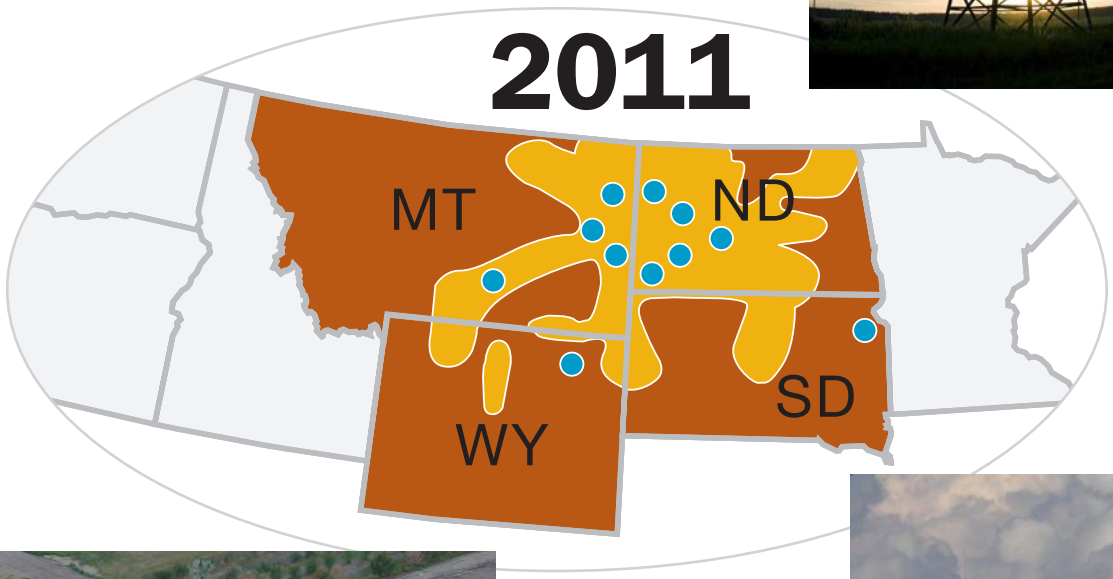
Integrated Resource Plan

2011



Submitted to the
Montana Public Service Commission
August 15, 2011

Volume III: Attachment B

Montana-Dakota Utilities Co.
2011 Integrated Resource Plan

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Volume III

Attachment B

MONTANA-DAKOTA
UTILITIES CO.
A Division of MDU Resources Group, Inc.

Attachment B

DEMAND-SIDE ANALYSIS DOCUMENTATION

Demand-Side Analysis

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DEMAND-SIDE ANALYSIS

Overview

Montana-Dakota recognizes the value that Demand-Side Management (DSM) can add in meeting its customer's future energy requirements with the growing demand for electricity and the need for additional supply-side resources. However, the implementation of DSM programs cannot be done without cost consideration to the customers and the Company's shareholders. Interests need to be balanced to achieve results at an affordable cost to both the utility and its customers. Montana-Dakota has focused on a proven list of DSM programs that are best suited for the Company's load shape.

In the past IRPs Montana-Dakota performed all DSM analysis on an Integrated System approach, as supply-side resources are approached in this manner. However, due to the complexities of offering DSM programs across multiple jurisdictions, this IRP includes DSM analysis for each state (Montana, North Dakota, and South Dakota) and in total for the Integrated System. The true value of DSM can only be achieved as an integrated resource implemented across all jurisdictions; however, cost recovery is necessary in each jurisdiction in order for full implementation to occur. In some cases, particularly in the case of demand response programs, the cost of infrastructure is such that if full system implementation is not achieved, the program may not be feasible.

The implementation plan as discussed in this Attachment is forecasted to cost a total of approximately $3.8 million for the 2011-2013 program years. Approximately $865,000 will be dedicated to energy efficiency programs, and $2.9 million is associated with demand response programs. Forecasted total lifetime cost is $0.053 per kWh, and total capacity cost is $155 per kW in 2013. Complete forecasted program costs for each state and in total for the Integrated System is shown in Appendix B to this Attachment.

Provided in this Attachment is a detailed discussion of Montana-Dakota's demand-side analysis and approach. In order to fully implement any of the described programs, Montana-Dakota will seek, and must have, regulatory approval and cost recovery.

DSM Energy Savings Goals

At this time Montana-Dakota has not defined the achievable potential for energy efficiency for its Integrated System. However, as discussed later in this report, Montana-Dakota will commission an Energy Efficiency Potential and Market Assessment Study for Montana customers to serve as a guide to refining energy efficiency goals and programs throughout its integrated system. The study is expected to be completed in mid-2012.

In the interim, Montana-Dakota has set a goal of achieving an annual energy reduction of 0.18 percent of annual energy sales by 2013 and 0.25 percent for 2014 through 2030. As shown in Table B-1, this will result in an annual average reduction of 0.23 percent through 2030.

DSM Energy Savings Goal
2011-2030
Table B-1

Year	Total kWh Sales	DSM Goal kWh	DSM Goal % of Sales
2011	2,540,830,000	1,000,000	0.04%
2012	2,638,517,000	2,700,000	0.10%
2013	2,778,978,000	5,000,000	0.18%
2014	2,833,174,000	7,086,866	0.25%
2015	2,924,681,000	7,315,666	0.25%
2016	2,975,811,000	7,443,430	0.25%
2017	3,026,203,000	7,569,508	0.25%
2018	3,077,460,000	7,697,719	0.25%
2019	3,129,538,000	7,827,812	0.25%
2020	3,180,299,000	7,954,831	0.25%
2021	3,231,928,000	8,083,954	0.25%
2022	3,284,383,000	8,215,173	0.25%
2023	3,337,691,000	8,348,547	0.25%
2024	3,391,856,000	8,484,029	0.25%
2025	3,446,900,000	8,621,751	0.25%
2026	3,502,842,000	8,761,694	0.25%
2027	3,559,712,000	8,903,982	0.25%
2028	3,617,535,000	9,048,627	0.25%
2029	3,676,345,000	9,195,752	0.25%
2030	3,736,137,000	9,345,340	0.25%
Totals	**63,927,211,900**	**148,604,679**	**0.23%**

Montana-Dakota understands that these goals are lower than national averages for achievable potential; however, based on historical participation, the small rural customer base, and low customer growth in the area, these goals are appropriate in the interim and will be adjusted if the potential is determined to be different in the future.

DSM Peak Demand Savings Goals

As discussed later in this Attachment, Montana-Dakota will pursue a demand response portfolio that will include a Residential Air Conditioning Cycling program, a Commercial Demand Response Program, and adjustments to the Company's current Interruptible Demand Response rate. Two of these programs will be implemented beginning in 2012 with total program goals expected to be achieved by 2015.

The demand response goal from the three programs is 48 MW or 8.3 percent of the total forecasted Integrated System peak demand in 2015. In addition, 1.5 MW of additional capacity savings is expected from the energy efficiency programs, bringing the total to 49.5 MW. The expected DSM demand savings from demand response and energy efficiency by year and in total are shown in Table B-2. The shown savings will replace the anticipated savings developed in the 2009 IRP and reflected in the load forecast described in Chapter 2 and Attachment A, and are not additive to those estimated savings.

DSM Demand Savings Goals
2011-2030
Table B-2

Year	Total Summer Peak MW	IT Rate Summer Peak MW	Com DR Summer Peak MW	Res AC DR Summer Peak MW	DR Goal Summer Peak MW	Total DR Program MW	Total DR Program %	Total EE Goal Summer Peak MW	Total EE & DR Summer Peak MW	Total EE & DR Program %
2011	513.1	6.6	0.0	0.0	6.6	6.6	1.3%	0.7	7.3	1.4%
2012	532.5	4.0	5.0	0.0	9.0	15.6	2.9%	0.9	16.5	3.1%
2013	552.9	1.2	10.0	4.0	15.2	30.8	5.6%	1.3	32.1	5.8%
2014	561.9	1.2	10.0	6.0	17.2	48.0	8.5%	1.5	49.5	8.8%
2015	577.6	0.0	0.0	0.0	0.0	48.0	8.3%	1.5	49.5	8.6%
2016	586.4	0.0	0.0	0.0	0.0	48.0	8.2%	1.5	49.5	8.4%
2017	595.1	0.0	0.0	0.0	0.0	48.0	8.1%	1.5	49.5	8.3%
2018	603.9	0.0	0.0	0.0	0.0	48.0	7.9%	1.5	49.5	8.2%
2019	612.9	0.0	0.0	0.0	0.0	48.0	7.8%	1.5	49.5	8.1%
2020	621.8	0.0	0.0	0.0	0.0	48.0	7.7%	1.5	49.5	8.0%
2021	630.8	0.0	0.0	0.0	0.0	48.0	7.6%	1.5	49.5	7.8%
2022	640.0	0.0	0.0	0.0	0.0	48.0	7.5%	1.5	49.5	7.7%
2023	649.3	0.0	0.0	0.0	0.0	48.0	7.4%	1.5	49.5	7.6%
2024	658.7	0.0	0.0	0.0	0.0	48.0	7.3%	1.5	49.5	7.5%
2025	668.3	0.0	0.0	0.0	0.0	48.0	7.2%	1.5	49.5	7.4%
2026	678.0	0.0	0.0	0.0	0.0	48.0	7.1%	1.5	49.5	7.3%
2027	687.8	0.0	0.0	0.0	0.0	48.0	7.0%	1.5	49.5	7.2%
2028	697.8	0.0	0.0	0.0	0.0	48.0	6.9%	1.5	49.5	7.1%
2029	708.0	0.0	0.0	0.0	0.0	48.0	6.8%	1.5	49.5	7.0%
2030	718.3	0.0	0.0	0.0	0.0	48.0	6.7%	1.5	49.5	6.9%

DSM Methodology

In order to balance all interests and achieve cost-effective DSM for customers and utility shareholders, a cost-benefit analysis from different perspectives was performed on potential DSM measures. The perspectives or "tests" are not intended to be used individually or in isolation, rather they must be compared to each other. This multi-perspective approach will allow consideration of tradeoffs between the various tests. However, the impacts measured from the Total Resource Cost Test will necessarily determine if a program is economically feasible. Once a program is determined feasible, all other test results are considered to determine if a program is to be implemented. Therefore, even if a program is feasible it may not be implemented due to tradeoffs with other tests and other identified factors.

Benefit/Cost Analysis

Montana-Dakota used a Microsoft Excel© spreadsheet-based model (Montana-Dakota DSM Model) to run benefit/cost analyses for each considered DSM program. The basic function of this evaluation tool is to calculate each DSM program's benefits and costs over its projected life on a discounted cash flow basis and determine its cost effectiveness on a stand-alone basis. The programs were evaluated using five different cost-effectiveness tests:

- *Participant Test* considers the economic impact of a program on the participating customers;
- *Utility Test* considers the impact on the utility;
- *Societal Cost Test* includes environmental externalities and considers the impact on the "society" (both the participating and non-participating customers);
- *Ratepayer Test* includes quantifiable benefits and costs of a given program and considers its impact on ratepayers; and
- *Total Resource Cost Test (TRC)* reflects the total benefits and costs to all customers (both the participants and non-participants).

For each test, the merits of the DSM program are evaluated based on the net present value (NPV) of the annual benefits and costs over the analysis horizon. The NPV calculation is based on the discount rate associated with each test and assumes the cash flows occur at the

end of the year. The following section explains the process of evaluating the programs from each of the five perspectives.

Participant Test

The Participant Test is a measure of the quantifiable benefits and costs brought about by a customer's participation in a DSM program. For purposes of evaluating the merits of a particular DSM program, quantifiable benefits include any incentives received by a participant and the reduction in a participant's electric bill through reduced energy use and/or demand. Quantifiable costs include any costs the customer incurs in order to participate in a DSM program, such as increased appliance costs or the availability of a back-up fuel source. The NPV calculation is based on the participant discount rate. The participant net benefit is calculated by the following equation:

Net Benefit = Total Annual Benefits – Total Annual Costs

where

Total Annual Benefits = Energy Savings (kWh)
+ Demand Savings (kW)
+ Incentive
+ Other Savings
Total Annual Costs = Direct Costs + Other Costs

A benefit/cost ratio greater than one for the Participant Test indicates the DSM program will result in savings to the participant over the life of the program.

Ratepayer Test

The Ratepayer Test is a measure of the quantifiable benefits and costs the utility incurs as a result of customer participation in a DSM program. For purposes of evaluating the merits of a particular DSM program, quantifiable benefits include any reduction in purchased power costs due to decreased customer energy and demand, along with a reduction in variable operation and maintenance costs. Quantifiable costs to the utility include incentive and administrative costs, along with the loss of electric margin due to reduced sales. The NPV calculation is based on the utility discount rate. The utility net benefit is calculated by the following equation:

Net Benefit = Annual Cost of Energy Saved – Annual Project Costs

where

*Annual Cost of Energy Saved = Energy Savings (kWh)**
*+ Peak Demand Savings (kW)**
+ O&M Savings
Annual Project Costs = Total Project Costs + Lost Margin

**kWh and kW savings include losses and reserve requirement savings.*

A benefit/cost ratio greater than one for the Ratepayer Test indicates the DSM program will reduce overall rates.

Societal Cost Test

The Societal Cost Test measures the net costs of a DSM program as a resource option based on the total costs of the program (both the participants' costs and the utility's costs). This test also includes a factor for environmental externalities, which for the purpose of this analysis is based a $30/ton cost of carbon dioxide (CO_2). This test is a summation of the benefit and cost terms in the Participant Test and the Ratepayer Test. The NPV calculation is based on the societal discount rate. The total cost net benefit is calculated by the following equation:

Net Benefit = Annual Cost of Energy Saved – Annual Project Costs

where

*Annual Cost of Energy Saved = Energy Savings (kWh)**
*+ Demand Savings (kW)**
+ O&M Savings
+ Avoided Environmental Damage
Annual Project Costs = Total Project Costs

**kWh and kW savings include losses and reserve requirement savings.*

A benefit/cost ratio greater than one for the Societal Cost Test indicates the DSM program is cost effective to both the utility and its ratepayers on a societal cost basis.

Utility Test

The Utility Test is a measure of the quantifiable benefits and costs placed on ratepayers due to changes in the utility's revenues and operating costs as a result of the DSM program. The Utility test includes the same benefits and costs as the Ratepayer Test, except the quantifiable costs exclude lost margin. The NPV calculation is based on the utility discount rate. The ratepayer net benefit is calculated by the following equation:

Net Benefit = Annual Cost of Energy Saved – Annual Project Costs

where

*Annual Cost of Energy Saved = Energy Savings (kWh)**
*+ Demand Savings (kW)**
+ O&M Savings
Annual Project Costs = Total Project

**kWh and kW savings include losses and reserve requirement savings.*

A benefit/cost ratio greater than one for the Utility Test indicates the cost of energy saved is greater than the cost of saving the energy.

Total Resource Cost Test (TRC)

The Total Resource Cost Test (TRC) reflects the total benefits and costs to all customers (participants and non-participants) in the utility service territory. The key difference between the TRC and utility test is that the TRC does not include program incentives, which are considered zero net transfers from a regional perspective. Instead, the TRC includes the net measures costs and net avoided costs. The NPV calculation is based on the utility discount rate. The total cost net benefit is calculated by the following equation:

Net Benefit = Annual Cost of Energy Saved – Annual Project Costs

where

*Annual Cost of Energy Saved = Energy Savings (kWh)**
*+ Demand Savings (kW)**
+ O&M Savings
Annual Project Costs = Total Project Costs net of incentive costs

**kWh and kW savings include losses and reserve requirement savings.*

A benefit/cost ratio greater than one for the TRC Test indicates the DSM program is cost effective to all customers, both participating and non-participating.

Montana-Dakota evaluated each program's feasibility based on the results of the TRC Test. If the benefit/cost ratio for the TRC Tests were greater than one, the DSM program(s) are considered feasible and will be further evaluated.

DSM Model Input Data

Montana-Dakota's DSM Model is dependent on the input data to determine the cost-benefit of each program. Recent Company operational and financial data is used for the general model

data inputs, and estimated supply cost avoidance is used based on marginal energy costs and capacity costs of adding the next supply resource including reserve requirements and losses. Program specific data is also used for each program being evaluated. The operational, financial, and program data inputs used for each program model run are provided in Appendix A to this Attachment, and sources of the data are shown in Table B-3.

Also shown in Table B-3 are the inputs for avoided system energy costs and capacity costs applicable to the DSM measures. Avoided energy costs are based on the system marginal energy cost that is projected for the next 10 years and escalated by 0.06 percent annually thereafter. The avoided capacity costs are based on the estimated levelized cost of a combustion turbine. These costs are the same across all three states in Montana-Dakota's Integrated System. The retail energy rate and demand costs vary across the states and are based on the average cost for the majority of the rate class to which the DSM measure is applicable.

Montana-Dakota Utilities Co.
Input Data Summary
Electric Conservation Model

Table B-3

Input No.	Input Data Description	Information Source	Montana Residential	Montana Commercial	North Dakota Residential	North Dakota Commercial	South Dakota Residential	South Dakota Commercial
1	Retail Rate (Summer)	System average retail rate for customer class based	$0.08183	$0.05379	$0.07214	$0.04072	$0.08258	$0.05772
	Retail Rate (Winter)	System average retail rate for customer class based	$0.06708	0.03977	$0.05757	0.03719	$0.07878	0.05759
	Retail Escalation Rate		4.93%	4.93%	4.93%	4.93%	4.93%	4.93%
1a	Fuel Cost Adjustment	Average fuel cost adjustment for customer class base to be effective January 1, 2011	$0.00115	$0.00115	$0.00830	$0.00830	$0.00328	$0.00328
	Fuel Escalation Rate		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
2	System Marginal Energy Costs	Actual costs for years 1 through 10						
	Escalation Rate (after Yr. 10)	Escalation factor applied after year 10	0.05799%	0.05799%	0.05799%	0.05799%	0.05799%	0.05799%
3	Retail Summer Demand Cost ($/kW/season)	Seasonal demand cost based on program availability	$0.00	$25.00	$0.00	$45.00	$0.00	$20.00
3a	Retail Winter Demand Cost ($/kW/season)	Seasonal demand cost based on program availability	$0.00	$41.00	$0.00	$66.00	$0.00	$40.00
	Escalation Rate		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
4	Electric Margin ($/KWh)	Average margin applicable to customer class	$0.04991	$0.02199	$0.04140	$0.01735	$0.05979	$0.03732
	Escalation Rate		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
5	Avoided Capacity Costs ($/kW/yr.)	Demand cost based on estimated levelized cost of combustion turbine	$84.67	$84.67	$84.67	$84.67	$84.67	$84.67
	Reserve Capacity	Based on MISO Non-Coincident Peak	12.06%	12.06%	12.06%	12.06%	12.06%	12.06%
	Escalation Rate		4.00%	4.00%	4.00%	4.00%	4.00%	4.00%

Table B-3 Continued

Input No.	Input Data Description	Information Source	Montana Residential	Montana Commercial	North Dakota Residential	North Dakota Commercial	South Dakota Residential	South Dakota Commercial
6	Variable O&M	Montana-Dakota's historical information	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Escalation Rate		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7	Environmental Damage Factor	$30 / ton Carbon Cost	30.7%	30.7%	30.7%	30.7%	30.7%	30.7%
	Escalation Rate		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
8	Participation Discount Rate	Federal Reserve Consumer Credit Interest rate 12 Months ended September 30, 2010	10.94%	10.94%	10.94%	10.94%	10.94%	10.94%
9	Utility Discount Rate	Montana-Dakota's authorized average cost of capital	9.610%	9.610%	9.610%	9.610%	9.610%	9.610%
10	Societal Discount Rate	Equal to the 30 year T-Bill rate average for 2010	4.24%	4.24%	4.24%	4.24%	4.24%	4.24%
11	General Input Data Year	2010	2010	2010	2010	2010	2010	2010
12	Project Analysis Yr. 1	Year(s) program will be implemented	2011	2011	2011	2011	2011	2011
	Yr. 2		2012	2012	2012	2012	2012	2012
	Yr. 3		2013	2013	2013	2013	2013	2013
13	Utility Project Costs	Total direct cost to the utility caused by implementing the program(s)						
	Admin Costs	Administration costs						
	Promo Costs	Promotional costs						
14	Direct Participant Project Costs ($/Part.)	Direct costs that the participant is required to pay to participate in the DSM program						
	Escalation Rate Yr. 1	Consumer Price Index based on 3 yr. average	2.11%	2.11%	2.11%	2.11%	2.11%	2.11%
	Yr. 2	Consumer Price Index based on 3 yr. average	2.11%	2.11%	2.11%	2.11%	2.11%	2.11%
	Yr. 3	Consumer Price Index based on 3 yr. average	2.11%	2.11%	2.11%	2.11%	2.11%	2.11%

Table B-3 continued

Input No.	Input Data Description	Information Source	Montana Residential	Montana Commercial	North Dakota Residential	North Dakota Commercial	South Dakota Residential	South Dakota Commercial
15	Project Life	Based on the estimated useful life of the energy saving equipment						
16	Avg. Summer Demand Reduction	Avg demand reduction (kW) caused by the DSM program						
16a	Avg. Winter Demand Reduction	Avg demand reduction (kW) caused by the DSM program						
17	Avg. Winter Energy Reduction	Avg energy reduction (kWh) caused by the DSM program						
17a	Avg. Summer Energy Reduction	Avg energy reduction (kWh) caused by the DSM program						
18a	System Demand Line Loss Factor Yr. 1	Historical demand line loss factor	11.650%	11.650%	11.650%	11.650%	11.650%	11.650%
	Yr. 2		11.650%	11.650%	11.650%	11.650%	11.650%	11.650%
	Yr. 3		11.650%	11.650%	11.650%	11.650%	11.650%	11.650%
18b	System Energy Line Loss Factor Yr. 1	Historical energy line loss factor	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%
	Yr. 2		7.4750%	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%
	Yr. 3		7.4750%	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%
19	Number of Participants	Total projected participation by customers, kW load target, or equipment saturation						
20	Incentive/Participant	Incentive provided to the participant						
21	Effective Tax Rate	Effective tax rate	39.3875%	39.3875%	39.16%	39.16%	37.60%	37.60%
22	Total Annual Summer kWh Saved	Total kWh saved from the program in the year implemented						
	Total Annual Winter kWh Saved	Total kWh saved from the program in the year implemented						
23	Total Annual Summer kW Saved	Total KW saved from the program in the year implemented						
	Total Annual Winter KW Saved	Total KW saved from the program in the year implemented						

Deemed Database

The underlying demand-side resource program designs and evaluation criteria, cost information, and other assumptions that are particular to the programs studied vary by program. The majority of the information is derived from the Minnesota deemed database that was developed for the state by NEXANT, an independent third party, and is used by utilities in Minnesota as part of their Conservation Improvement Programs. The Minnesota deemed database was adjusted to reflect weather data specific to Montana-Dakota's service territory. Utilizing the deemed database allows Montana-Dakota to use a deemed savings approach to evaluation, measurement, and verification (EM&V) for prescriptive measures. The deemed savings approach to EM&V allows Montana-Dakota to keep administration costs low while providing an appropriate level of verification for prescriptive measures.

This deemed database uses generally accepted engineering algorithms, along with developed operating data to determine the savings of each DSM measure. Along with the calculations, other program parameters are defined. The parameters include baseline efficiency standards, high-efficiency standards, incremental costs, and peak demand factors.

A summary description of the key variables for each DSM measure and a summary list of sources for participant cost, equipment life, and peak load factors for each DSM program are provided in Appendix C to this Attachment.

DSM Model Results

Based on the methodology and data inputs discussed above, a portfolio of programs was developed for Montana, North Dakota, and South Dakota. The complete DSM Model runs for each state and each program are provided in Appendix A to this Attachment, and a summary by state of the cost-benefit ratios is shown in Tables B-4 (Montana), B-5 (North Dakota), and B-6 (South Dakota).

Montana Electric DSM Program Summary
Table B-4

Benefit/Cost Ratios						
DSM Program	**Customer Class**	**RIM**	**Utility**	**Societal**	**Participant**	**Total Resource Cost**
Total Portfolio		5.29	7.39	4.06	3.63	2.52
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	1.62	2.69	3.27	2.04	1.72
Central Air Conditioning Tier 2 (16 SEER) - Replacement	Residential	0.97	1.36	1.65	1.45	0.87
Central Air Conditioning Tier 2 - New	Residential	0.94	1.08	1.31	0.90	0.69
Window AC Units	Residential	1.50	1.82	2.17	1.16	1.31
AC Tune-up	Residential	1.39	1.75	2.60	1.91	1.75
New Construction Bundle	Residential	0.70	0.90	1.25	1.34	0.66
Thermal Storage with ASHP	Residential	5.12	7.48	8.17	1.24	4.30
Residential Lighting	Residential	1.25	3.11	4.66	5.89	3.11
Demand Response						
Residential AC Cycling	Residential	1.24	1.24	3.85	--	2.09
Commercial Programs						
Commercial Lighting	Commercial	2.29	3.96	5.33	2.85	2.54
Commercial Motors - Replacement	Commercial	2.84	7.27	4.83	2.44	2.27
Commercial Motors - New / on Failure	Commercial	2.77	6.76	7.92	4.19	3.73
Variable Speed Drives - VFD'S	Commercial	4.98	19.99	13.53	5.50	6.94
Commercial AC - Split Systems	Commercial	3.03	5.12	7.64	3.53	3.92
Commercial AC - Packaged Systems	Commercial	3.53	4.44	5.66	1.94	2.90
Commercial AC - Water Cooled Chillers	Commercial	2.39	2.88	7.40	3.30	3.44
Commercial AC - Centrifugal Chillers	Commercial	4.88	5.53	4.69	0.97	2.18
Commercial Partnership Program (Custom)	Commercial	2.45	4.48	4.26	2.79	2.48
Demand Response						
Commercial Demand Response Program	Commercial	2.50	2.50	3.47	--	2.50

North Dakota Electric DSM Program Summary
Table B-5

Benefit/Cost Ratios						
DSM Program	**Customer Class**	**RIM**	**Utility**	**Societal**	**Participant**	**Total Resource Cost**
Total Portfolio		5.74	7.29	3.86	4.06	2.38
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	2.09	3.50	3.95	1.89	2.08
Central Air Conditioning Tier 2 (16 SEER) - Replacement	Residential	1.16	1.63	1.84	1.36	0.97
Central Air Conditioning Tier 2 - New	Residential	1.09	1.43	1.43	0.86	0.75
Window AC Units	Residential	1.68	2.11	2.39	1.20	1.44
AC Tune-up	Residential	1.67	2.12	3.15	1.82	2.12
New Construction Bundle	Residential	0.90	1.13	1.47	1.15	0.77
Thermal Storage with ASHP	Residential	6.14	8.96	9.01	1.13	4.74
Demand Response						
Residential AC Cycling	Residential	1.33	1.33	4.50	--	2.36
Commercial Programs						
Commercial Lighting	Commercial	4.11	6.86	8.77	3.44	4.18
Commercial Motors - Replacement	Commercial	3.40	8.26	4.96	2.33	2.33
Commercial Motors - New / on Failure	Commercial	3.35	7.76	8.53	4.00	4.00
Variable Speed Drives - VFD'S	Commercial	6.16	23.13	14.20	5.63	7.28
Commercial AC - Split Systems	Commercial	3.63	5.91	8.51	3.62	4.37
Commercial AC - Packaged Systems	Commercial	4.12	5.08	6.13	2.13	3.14
Commercial AC - Water Cooled Chillers	Commercial	2.74	3.26	8.64	3.43	4.02
Commercial AC - Centrifugal Chillers	Commercial	5.64	6.33	4.90	1.22	2.27
Commercial Partnership Program (Custom)	Commercial	2.95	5.17	4.59	2.69	2.68
Demand Response						
Commercial Demand Response Program	Commercial	2.34	2.34	3.26	--	2.34

South Dakota Electric DSM Program Summary
Table B-6

Benefit/Cost Ratios						
DSM Program	**Customer Class**	**RIM**	**Utility**	**Societal**	**Participant**	**Total Resource Cost**
Total Portfolio		5.38	9.53	4.07	4.00	2.54
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	1.80	3.57	4.03	2.09	2.11
Central Air Conditioning Tier 2 (16 SEER)	Residential	1.05	1.68	1.89	1.48	1.00
Central Air Conditioning Tier 2 - New	Residential	1.08	1.33	1.49	0.91	0.79
Window AC Units	Residential	1.61	2.21	2.50	1.28	1.50
AC Tune-up	Residential	1.55	2.15	3.19	1.94	2.15
New Construction Bundle	Residential	0.81	1.09	1.42	1.28	0.75
Demand Response						
Residential AC Cycling	Residential	1.33	1.33	4.54	--	2.38
Commercial Programs						
Commercial Lighting	Commercial	2.84	6.98	8.88	3.82	4.23
Commercial Motors - Replacement	Commercial	2.04	8.38	4.96	3.02	2.34
Commercial Motors - New / on Failure	Commercial	2.19	8.47	9.33	5.32	4.34
Variable Speed Drives - VFD'S	Commercial	3.38	23.65	14.39	6.65	7.39
Commercial AC - Split Systems	Commercial	3.10	4.49	6.46	2.09	3.31
Commercial AC - Packaged Systems	Commercial	3.42	5.16	6.18	1.90	3.17
Commercial AC - Water Cooled Chillers	Commercial	2.40	3.39	9.00	3.28	4.18
Commercial AC - Centrifugal Chillers	Commercial	5.14	6.50	4.99	0.92	2.31
Commercial Partnership Program (Custom)	Commercial	1.96	5.19	4.56	3.19	2.67
Demand Response						
Commercial Demand Response Program	Commercial	2.33	2.33	3.24	--	2.33

2010 DSM Activity Summary

Montana-Dakota currently offers DSM Programs in Montana and North Dakota. The following is a summary of the currently offered programs in each state. A summary of the 2010 program activity is presented in Table B-7.

Montana Programs

The Montana DSM Programs are funded through Universal Systems Benefit Charge and, with the exception of the Commercial Cooling and Motor Programs, have been offered for the last several years. The following is a summary of the current programs.

Montana Residential Programs

- ENERGY STAR® Central Air Conditioners – Montana residential electric customers who replace an existing central air conditioning system (with a 10 SEER rating or less) with a new central air conditioning system (with a 15 SEER/12.5 EER rating or greater) will qualify for a rebate of $175/ton.
- ENERGY STAR® Refrigerators – Montana residential electric customers who purchase an ENERGY STAR® rated refrigerator will qualify for a rebate of $10. This rebate is limited to one refrigerator per residential electric account.
- ENERGY STAR® Freezers – Montana residential electric customers who purchase an ENERGY STAR® rated freezer will qualify for a rebate of $10. This rebate is limited to one freezer per residential electric account.

Montana Commercial Programs

- Commercial Cooling – This program was implemented on October 1, 2010. Montana commercial electric customers who purchase and install the following cooling equipment will qualify for a rebate as listed below:

    - Central A/C System with 14.5 SEER/12 EER or greater — $100/ton
    - Central A/C System with 16 SEER/13EER or greater — $200/ton
    - Split System with the following ratings: — $100/ton

- 11.2 EER or greater rating for units up to 10 tons
- 10.2 EER or greater rating for units from 11-20 tons
- 9.9 EER or greater rating for units from 21-63 tons
- 9.6 EER or greater rating for units over 63 tons

  - Packages/Rooftop Units with the following rating: $100/ton
    - 13.1 EER or greater rating for units up to 5 tons
    - 11.5 EER or greater rating for units from 6-20 tons
    - 10.5 EER or greater rating for units from 21-63 tons
    - 9.4 EER or greater rating for units over 63 tons

- Commercial Motors – This program was implemented on October 1, 2010. Montana-Dakota commercial electric customers who purchase and install high efficient motors and/or variable speed drive fans and pumps will qualify for the following rebates:
  - NEMA Premium® Motor - New $ 4/HP
  - NEMA Premium® Motor – Replacement $15/HP
  - Variable Speed Drive Fans and Pumps $30/HP
- Commercial Lighting – Montana-Dakota commercial electric customers who replace less efficient lighting products with new high-efficient technologies will qualify for a rebate of $0.20/watt saved. The Commercial Lighting Program is divided into a standard project and a custom project option. The standard project is applicable to customers replacing an existing fixture with the same type of fixture but more energy-efficient technology. The custom project is applicable to participants re-configuring lighting systems, changing fixture types, and possibly de-lamping.

North Dakota Programs

In May of 2010, Montana-Dakota was awarded a grant from the North Dakota Department of Commerce to offer energy efficiency programs to North Dakota electric and natural gas

customers. The total grant award was $2.6 million and is to be spent no later than December 31, 2011.

In June 2010, Montana-Dakota implemented the electric and natural gas programs that were awarded under the grant. The following is a summary of programs currently offered to North Dakota customers.

North Dakota Residential Programs

- Residential Central Air Conditioners – North Dakota residential electric customers who purchase and install an electric central air conditioning system qualify for the following rebates:
    - Central A/C System with 14.5 SEER/12EER or greater $100/ton
    - Central A/C System with 16 SEER/13 EER or greater $200/ton
- Residential Thermal Storage with New Air Source Heat Pump - Montana-Dakota residential electric customers who purchase and install a brick electric thermal storage unit with a new high-efficiency air source heat pump qualify for a rebate of $60/kW. The maximum capacity of the thermal storage unit is limited to 38.4 kW, and the air source heat pump must have an 8.2 HSPF/13 SEER/ 12 EER or greater rating.

North Dakota Commercial Programs

- Commercial Cooling – Montana-Dakota commercial electric customers who purchase and install a high-efficiency electric cooling system qualify for the following rebates:
    - Split A/C System with 14.5 SEER/12EER or greater rating $100/ton
    - Split A/C System with 16 SEER/13 EER or greater rating $200/ton
    - Packaged A/C System with 14 SEER/11 EER or greater rating $100/ton
    - Packaged A/C System with 14 SEER/12 EER or greater rating $200/ton

- Commercial Motors – Montana-Dakota commercial electric customers who purchase and install high-efficiency motors and/or variable speed drive fans and pumps qualify for the following rebates:

    - NEMA Premium® New Motor $ 4/HP
    - NEMA Premium® Replacement Motor $15/HP
    - Variable Speed Drive Fans and Pumps $30/HP

- Commercial Lighting - Montana-Dakota commercial electric customers who replace lighting products with new high-efficiency technologies qualify for a rebate of $0.40/watt saved. The Commercial Lighting Program is divided into a standard project and a custom project option. The standard project is applicable to customers replacing an existing fixture with the same type of fixture but more energy-efficient. The custom project is applicable to participants re-configuring lighting systems, changing fixture types, and possibly de-lamping.

2010 Electric Conservation Programs
Summary
Table B-7

	Participation	Rebate	kWh Saved	kW Saved	Admin. Costs	Advertising Costs
MT Residential A/C	1	$350.00	714			
MT Residential Refrigerators	2	$20.00	148			
MT Residential Freezers	0	$0.00	0			$847.80
MT Commercial Cooling	0	$0.00	0	0		
MT Commercial Motors	0	$0.00	0	0		
MT Commercial Lighting	4	$8,523.40	88,416	40.4	$124.44	
Total Montana		**$8,893.40**	**89,278**	**40.4**	**$124.44**	**$847.80**
ND Residential Air Conditioning	147	$68,800.00	131,394	71.5		
ND Residential Thermal Storage	0	$0.00	0	0.0		$3,979.38
ND Commercial Cooling	1	$700.00	118	0.1		
ND Commercial Motors	1	$12,750.00	97,465	162.0		
ND Commercial Lighting	8	$19,534.40	157,563	48.7	$6,935.89	$0.00
Total North Dakota		**$101,784.40**	**386,540**	**282.3**	**$6,935.89**	**$3,979.00**

Summary of 2010 Conservation Program Marketing Activities

The purpose of Montana-Dakota's conservation program marketing is to maximize customer awareness and participation in the most economical manner. The program marketing activities strive to balance the cost of the advertising/promotional costs with the expected results. Montana-Dakota engaged in the following conservation marketing promotions in 2010:

North Dakota Programs

- Website updates in June 2010 (program launch);
- Contractor and homebuilder materials were mailed in June 2010 (program launch);
- Additional contractor and homebuilder communication provided through key account representatives;
- Bill inserts promoting the North Dakota residential electric conservation programs were mailed in August and December 2010;
- A general conservation programs billboard was run in Bismarck, Dickinson, and Williston in June, July, November, and December 2010; and
- A newspaper insert promoting the North Dakota residential electric conservation programs was run in Bismarck, Dickinson, and Williston in September 2010.

Montana Programs

- Website updates in January and October 2010;
- Contractor and dealer postcards were mailed in January of 2010;
- Additional contractor and dealer communication provided through key account representatives;
- A bill insert promoting the Montana residential electric conservation programs was mailed in April 2010;
- A general conservation programs billboard was run in the Miles City-Glendive markets in June, July, November, and December 2010; and
- Participation in various public informational meetings held through the service territory.

Implementation Plan

Montana-Dakota intends to work towards implementation of the identified feasible DSM programs over the 2011-2013 program years with specific program implementation varying by state, depending on State approval of the programs. In addition, Montana Dakota has identified the need to commission an Energy Efficiency Potential and Market Assessment Study and will start this process with the State of Montana and determine if appropriate on a broader basis.

The following is a discussion by state of the proposed DSM programs, marketing plans, the Energy Efficiency Potential and Market Assessment Study, and other areas identified for future study. Summaries of the DSM analysis and results based on the implementation plan are provided in Appendix B to this Attachment. The total program costs and cost-benefit ratios are slightly different than the model results provided in Appendix A. This insignificant difference is caused by a reallocation of administrative costs to only the program included in the implementation plan.

North Dakota

Montana-Dakota will continue existing programs offered in North Dakota under the ARRA (American Recovery and Reinvestment Act) grant for the remainder of 2011. Montana-Dakota will submit a new request for approval from the North Dakota Public Service Commission to implement a portfolio of programs. Assuming the appropriate cost recovery is obtained, the approved portfolio of programs will be implemented in 2012 and/or 2013. In addition, Montana-Dakota will implement the Commercial Demand Response program in 2012 and the Residential Air Conditioning Cycling program in 2013. The planned DSM activity in North Dakota for the 2011-2013 program years is shown in Table B-8.

Montana

Montana-Dakota will continue the existing programs offered in Montana for the remainder of 2011 and implement new feasible programs authorized by the Montana Public Service Commission in 2012 and/or 2013. In addition, Montana-Dakota will evaluate the use of a third party to provide the program delivery function within its service territory. This third party will

work with Montana residential and commercial customers, area contractors, and other trade allies to promote and deliver the program in Montana. The planned DSM activity in Montana for the 2011-2013 program years is shown in Table B-8.

South Dakota

Montana-Dakota's South Dakota electric service territory represents approximately six percent of the Integrated System demand with a customer base of approximately 8,600 customers. Montana-Dakota intends to implement only programs that are offered in the other two states, which will allow for the allocation of administrative costs for South Dakota that will make those programs cost effective. Montana-Dakota will seek appropriate cost recovery from the South Dakota Public Utilities Commission and, assuming cost recovery is approved, will implement all feasible programs in 2012 and 2013. The planned DSM activity in South Dakota for 2011-2013 is shown in Table B-8.

Summary of 2011-2013 Portfolio of Programs

Table B-8

	Montana	North Dakota	South Dakota
Residential Programs			
Central Air Conditioner Tier 1 (14.5 SEER)	$100/ton		$100/ton
Central Air Conditioner Tier 2 (16 SEER) - Replacement	$200/ton		$200/ton
Central Air Conditioner Tier 2 - New	$200/ton		$200/ton
Window Air Conditioner Units	$50		$50
Air Conditioner Tune-up	$45		$45
Thermal Storage with Air-Source Heat Pump	$60/kW	$60/kW	
Residential Lighting	$2/bulb		
Residential Air Conditioner Cycling	$50/year	$50/year	$50/year
Commercial Programs			
Commercial Lighting	$0.40/watt	$0.40/watt	$0.40/watt
Commercial Motors - Replacement	$15/HP		$15/HP
Commercial Motors - New/On Failure of Exist. Equip.	$4/HP		$4/HP
Variable Speed Drives - VFD	$30/HP		$30/HP
Commercial Air Conditioner - Split Systems	$75/ton		$75/ton
Commercial Air Conditioner - Packaged Systems	$75/ton		$75/ton
Commercial Air Conditioner - Water Cooled Chillers	$25/ton		$25/ton
Commercial Air Conditioner - Centrifugal Chillers	$25/ton		$25/ton
Commercial Partnership Program (Custom)	Project-Specific		Project-Specific
Commercial Demand Response Program	Customer-Specific	Customer-Specific	Customer-Specific
Interruptible Rate Demand Response Program	$2.50/kW	$2.50/kW	

The implementation plan as discussed is forecasted to cost a total of approximately $3.8 million for the 2011-2013 program years. Approximately $865,000 will be dedicated to energy efficiency programs, and $2.9 million is associated with demand response programs. Forecasted total lifetime cost is $0.053 per kWh, and total capacity cost is $155 per kW in 2013. Complete forecasted program costs for each state and in total for the Integrated System is shown in Appendix B to this Attachment.

Program Portfolio Overview

The following is an overview of program details associated with each residential and commercial DSM measure that will be implemented in the 2011-2013 program years, dependent on Commission approval. The overview provides a description of the program, applicable states, DSM measures included in the program, incentive levels, and marketing and promotion plan.

Residential Cooling Program

This program offers rebates to Montana-Dakota residential customers installing high-efficiency central air conditioning equipment in single family dwellings. This program is available to residential electric customers in Montana and South Dakota and is applicable to high-efficiency central air conditioners and window air conditioners. Heat pump systems do not qualify for this program. The residential cooling program includes:

- Tier 1 Central Air Conditioner Program: This program is applicable to existing residential electric customers who are replacing a central air conditioning unit. The new central air conditioning unit must have a minimum 14.5 SEER rating in order to qualify for the rebate.

- Tier 2 Central Air Conditioner Program: This program is applicable to new construction and existing residential electric customers. The new central air conditioning unit must have a minimum 16 SEER rating in order to qualify for the rebate.

- Window Air Conditioning Program: The program is applicable to residential electric customers who purchase an ENERGY STAR®-rated window air conditioning unit. Qualifying equipment is eligible for a rebate.

- The air conditioner tune-up program will be applicable only to existing residential electric customers. The air conditioner tune-up will be performed by a contractor, and the tune-up will include computer diagnostics, refrigerant check, and air flow corrections. Customers who participate in this program will be eligible for a rebate.

Program Incentives:

Measure	Incentive Level
Tier 1 Central Air Conditioner – 14.5 SEER or greater	$100/ton
Tier 2 Central Air Conditioner – 16 SEER or greater	$200/ton
Window Air Conditioner	$50
Air Conditioner Tune-Up	$45

Montana-Dakota will effectively market the program through following:

- Website,
- Bill Inserts,
- Pamphlets and Brochures,
- Radio Advertisements,
- Newspaper Inserts,
- Direct Mail,
- Co-op Advertising, and
- HVAC contractor relationships and promotion.

Residential Thermal Storage with an Air Source Heat Pump (ASHP)

This program offers rebates to Montana-Dakota residential electric customers when they purchase and install a brick electric thermal storage unit with a high-efficiency air-source heat pump (ASHP). This program is available to residential electric customers in Montana and North Dakota.

The program applies to the purchase and installation of a brick electric thermal storage unit with a new high-efficiency air source heat pump. The maximum capacity for the thermal storage unit is limited to 38.4 kW with an ASHP that must have a minimum efficiency rating of 8.2 HSPF/13 SEER/ 12 EER.

Program Incentive:

Measure	Incentive Level
Thermal Storage and ASHP Program	$60/kW

Montana-Dakota will effectively market the program through the following:

- Website,
- Bill Inserts,
- Pamphlets and Brochures,
- Direct Mail,
- Radio Advertisements,
- Newspaper Inserts,
- Co-op Advertising, and
- HVAC contractor and builder relationships and promotion.

Residential CFL Lighting Program

This program offers rebates to Montana-Dakota residential customers when they install high-efficiency compact fluorescent lighting (CFL) in single family dwellings. This program is available to residential electric customers in Montana and provides a rebate on a per bulb basis.

The residential CFL lighting program applies to residential electric customers who purchase and utilize high-efficiency CFL light bulbs in their home. The rebate applies to the number of bulbs purchased, with a maximum of 15 bulbs. This will be mail-in rebate with proof of purchase required.

Program Incentive:

Measure	Incentive Level
Residential CFL Lighting Program	$2/bulb

Montana-Dakota will effectively market the program through the following:

- Website,
- Bill Inserts,
- Pamphlets and Brochures,
- Direct Mail,
- Radio Advertisements,
- Newspaper Inserts,
- Co-op Advertising, and
- HVAC contractor and builder relationships and promotion.

Residential Air Conditioner Cycling Program

This program offers residential electric customers an annual incentive to participate in an Air Conditioner Cycling program. A switch will be installed on the customers' air conditioning system to allow Montana-Dakota to cycle the air conditioner off and on during the system peak load conditions. This program will be available to electric customers in Montana, North Dakota, and South Dakota.

The residential air conditioner cycling program applies to residential electric customers who agree to have the equipment installed to allow Montana-Dakota to cycle their air conditioner using various control strategies for three to four hours per day from June 1 to September 30. The program would have a maximum of 40 hours of interruptions per year, and the Company would expect to offer customers a maximum number of opt out periods during the year. The customer will receive an annual rebate for participating in this program. The program will be implemented by a third-party vendor for the initial implementation period of two years, and Montana-Dakota's personnel will maintain the program after the implementation period.

Program Incentive:

Measure	Incentive Level
Residential Air Conditioner Cycling Program	$50/year

Montana-Dakota and the selected third party vendor will effectively market the program through the following:

- Website,
- Bill Inserts,
- Pamphlets and Brochures,
- Direct Mail, and
- Trade shows and public awareness events.

Commercial Prescriptive Programs

This program offers prescriptive rebates to Montana-Dakota commercial industrial customers when they install high-efficiency lighting, cooling, and motor systems. This program will be available to Montana-Dakota's commercial customers in Montana and South Dakota that are served under a commercial electric tariff. Only the commercial lighting program is proposed to be implemented in North Dakota. The commercial prescriptive programs include:

- The Commercial Lighting program is designed to incentivize customers to replace fluorescent lighting systems with more efficient technology and lighting systems. Through 2012 the baseline equipment will be T-12 technology and T-8 technology will be considered high efficiency. Beyond 2012, T-8 technology will become the standard and T-5 technology or better will be considered high efficiency. The lighting rebate will cover a variety of fixtures with the exception of CFL lighting and outdoor lighting. The rebate will be based on $/watt saved and will be offered as a standard prescriptive rebate for one replacement of standard fixtures. The program will also offer a custom project feature to capture savings due to changes in fixture type and de-lamping.

- The Commercial Cooling program is designed to cover the most common types of cooling equipment and includes prescriptive rebates for split systems, packaged systems, and chillers. The rebates are based on a prescriptive $/ton for each type of cooling equipment.

- The Commercial Motor program is designed to cover new motors installed by customers as replacement of existing motors. The new motor must be a National Electrical Manufactures Association (NEMA) Premium Motor® to qualify for a rebate. Variable Speed Drive rebates will also be offered under the motor program. Rebates will be based on a prescriptive $/hp.

Program Incentives:

Measure	Incentive Level
Commercial Lighting Program	$0.40 per watt
Commercial Cooling Split Systems	$75 per ton
Commercial Cooling Packaged Systems	$75 per ton
Commercial Cooling Centrifugal Chillers	$25 per ton
Commercial Cooling Water Cooled Chillers	$25 per ton
Commercial Motors - Replacement	$15 per HP
Commercial Motors – New or replace on failure	$4 per HP
Variable Speed Drives	$30 per HP

Montana-Dakota will effectively market the program through the following:

- Website,
- Key Account Representatives,
- Pamphlets and Brochures,
- Radio Advertisements,
- Newspaper Inserts,
- Co-op Advertising, and
- HVAC contractor relationships and promotion.

Commercial Partnership Program

This program offers rebates to Montana-Dakota's commercial and industrial customers installing energy conservation measures that are not provided for in the prescriptive rebates due to the variability in the energy savings and cost of the project. Rebates will be based on the amount of energy savings, and the project must pass the Total Resource Cost Test (TRC) with a Benefit/Cost ratio greater than one. This program will be available to Montana-Dakota's general service customers in Montana and South Dakota.

The commercial partnership program is designed to lower the initial cost of a variety of energy-efficient upgrades that are not available for any of the prescriptive rebates. While the incentive levels for this program will be project specific, other criteria under this program are:

- Equipment installed must be more efficient than the industry standard;
- Simple payback must be greater than 18 months;
- Rebate cannot exceed 50 percent of the incremental cost of the equipment;
- Rebate will be based on the amount of energy and demand saved;
- Weatherization is not eligible for a rebate;
- Distributed renewable generation such as solar and wind under 50 kW will be considered under a net metering arrangement;
- Additional measurement and verification of the energy savings maybe required; and
- Rebate is also available to new construction.

The incentive levels for this program will be project specific. Montana-Dakota will effectively market the program through the following:

- Website,
- Key Account Representatives,
- Pamphlets and Brochures, and
- HVAC contractor relationships and promotion.

Commercial Demand Response Program

The Commercial Demand Response Program will be offered to commercial and industrial electric customers, with a priority focused on customers with loads of 150 kW or higher. This program will be administered by a third-party demand response aggregator under contract with Montana-Dakota. The third-party aggregator will be responsible for customer enrollment, settlement, and administration of the program on behalf of Montana-Dakota. This program will be available to commercial and industrial electric customers in Montana, North Dakota, and South Dakota.

The program applies to commercial and industrial electric customers who agree to shed non-critical load during a demand response event initiated by Montana-Dakota. The program will

provide for a one-hour notification of an event, with a four-hour maximum event period, and for up to 50 hours per year.

The customer will receive a capacity and energy payment for participating in the program, and payment amounts will be pursuant to a negotiated contract between the customer and the third-party aggregator, who will market and promote the program on behalf of Montana-Dakota.

Montana-Dakota with support the third-party aggregator's marketing and promotion efforts through the following:

- Key Account Representatives,
- Website,
- Bill Inserts, and
- Trade shows and public awareness events.

Marketing Plan

The goal of Montana-Dakota's conservation program marketing plan is to maximize customer awareness and participation in the most economical manner. The marketing plan strives to balance the cost of the advertising/promotional measure with the expected results, and will be dependent upon Commission approval of the programs and funding. Montana-Dakota's marketing plan for the Montana, North Dakota and South Dakota energy conservation programs will focus on three areas: (1) advertising and promotion, (2) dealer and builder market transformation meetings, and (3) customer education and outreach.

Advertising and Promotion

- Newspaper Inserts: Montana-Dakota plans to advertise the conservation rebate programs available to residential customers by developing a promotional brochure and inserting this brochure in the local newspapers two times per year, in the spring and the fall. In order to cover Montana-Dakota's Montana, North Dakota and South Dakota service territory, promotion placement will be planned to provide the maximum coverage for the associated cost. The target market for the newspaper inserts will be Montana-Dakota's residential electric customers.
- Radio Advertising: Montana-Dakota plans to advertise the conservation rebate programs available to residential customers by producing 30-second radio spots and

placing campaigns in the spring and the fall. The radio purchase will be placed by a media buyer in order to maximize the coverage in Montana-Dakota's Montana, North Dakota and South Dakota service territory. The radio spots will primarily focus on raising awareness of programs available and will reinforce information provided in the newspaper insets.

- Billboard Advertising Campaign: Montana-Dakota plans to secure a one-year billboard contract for the major markets in the Montana, North Dakota, and South Dakota service territories. The billboards will focus on the overall message that rebates are available and mix in messages regarding specific programs. The target market for the billboard campaign is the residential customers, and it will focus on raising awareness and provide additional reinforcement of the overall conservation rebate message.
- Direct Mail: Montana-Dakota plans to develop a direct mail piece that incorporates information about the conservation rebate programs available as well as energy conservation tips. This piece will be mailed directly to the residential customers once per year.
- Bill Inserts: Montana-Dakota plans to insert information regarding the conservation rebate programs in customers' bills a minimum of two times per year. If space is available, the conservation rebate insert will be utilized more than two times per year. This insert will target the residential customers and reinforce awareness of the programs and augment the other forms of advertising.
- Co-op Advertising with Dealers: Past experience has shown that one of the best advertisers for Montana-Dakota's conservation rebate programs are the dealers and contractors in the service territory. Montana-Dakota plans to offer co-op advertising dollars to dealers who also promote the conservation rebate programs.

Dealer and Builder Market Transformation Meetings

- Dealer and Builder Meetings: Montana-Dakota plans to hold dealer and builder meetings within its Montana, North Dakota, and South Dakota service territory. The purpose of these meetings is to provide the dealers and builders with information about the programs available to Montana-Dakota's customers and to give them the information to carry to the end-use customers, both residential and commercial.

Customer Education and Outreach

- Trade Shows/Energy Awareness Events: Montana-Dakota plans to participate in trade shows, county fairs, and energy awareness events in order to promote conservation education and information regarding rebate programs to customers.
- Energy Audits: Residential customers are continually interested in how they can reduce their home's energy use. Montana-Dakota plans to provide a program to supplement the customer's cost for a home energy audit. Montana-Dakota will also work to secure third-party contractors who would conduct the energy audits.

DSM Integration

As discussed in Chapter 2, the load forecasting section of this IRP, the DSM programs planned in the 2009 IRP are accounted for in the current load forecast whereby the resulting reduction in energy and peak demand is reflected. Therefore, based on energy and demand savings goals, an incremental DSM level needs to be integrated with the supply-side resources in the integration analysis (Chapter 5). The incremental change that is modeled in the integration analysis is based on the implementation plan discussed above less the adjusted 2009 IRP forecasted amounts reflected in the load forecast.

The incremental DSM package modeled in the integration analysis reflects an average cost of $50/kW year for capacity reductions and $0.038/kWh for the conservation or energy reduction programs. The average cost for energy was based on the total costs and lifetime energy savings from the portfolio of DSM measures planned for implementation.

A total of 8.7 MW of new DSM was integrated in the integration analysis beginning in 2014 and beyond. The kWh values were adjusted based on amounts already included in the load forecast and are based on the annual energy savings goal of 0.25 percent of annual energy sales. Tables B-9 and B-10 show the net amounts of energy and demand savings modeled in the integration analysis as a new DSM Package.

DSM Net Energy Savings for Integration 2011-2030 Table B-9					
Year	**Total kWh**	**DSM Goal kWh**	**DSM Goal % of Sales**	**In Load Forecast Conservation kWh**	**Net New DSM kWh**
2011	2,540,830,000	1,000,000	0.04%	3,132,259	(2,132,259)
2012	2,638,517,000	2,700,000	0.10%	6,517,884	(3,817,884)
2013	2,778,978,000	5,000,000	0.18%	6,517,884	(1,517,884)
2014	2,833,174,000	7,086,866	0.25%	6,517,884	568,982
2015	2,924,681,000	7,315,666	0.25%	6,517,884	797,782
2016	2,975,811,000	7,443,430	0.25%	6,517,884	925,546
2017	3,026,203,000	7,569,508	0.25%	6,517,884	1,051,624
2018	3,077,460,000	7,697,719	0.25%	6,517,884	1,179,835
2019	3,129,538,000	7,827,812	0.25%	6,517,884	1,309,928
2020	3,180,299,000	7,954,831	0.25%	6,517,884	1,436,947
2021	3,231,928,000	8,083,954	0.25%	6,517,884	1,566,070
2022	3,284,383,000	8,215,173	0.25%	6,517,884	1,697,289
2023	3,337,691,000	8,348,547	0.25%	6,517,884	1,830,663
2024	3,391,856,000	8,484,029	0.25%	6,517,884	1,966,145
2025	3,446,900,000	8,621,751	0.25%	6,517,884	2,103,867
2026	3,502,842,000	8,761,694	0.25%	6,517,884	2,243,810
2027	3,559,712,000	8,903,982	0.25%	6,517,884	2,386,098
2028	3,617,535,000	9,048,627	0.25%	6,517,884	2,530,743
2029	3,676,345,000	9,195,752	0.25%	6,517,884	2,677,868
2030	3,736,137,000	9,345,340	0.25%	6,517,884	2,827,456
Totals	**63,927,211,900**	**148,604,679**	**0.23%**		

DSM Net Demand Savings for Integration
2011-2030
Table B-10

Year	DR Goal Summer Peak MW	Total DR Program MW	Total EE Goal Summer Peak MW	Total EE & DR Summer Peak MW	In Model Com DR MW	In Load Forecast Int. Rate MW	In Load Forecast Conservation MW	In Load Forecast DR MW	Net New DSM MW
2011	6.6	6.6	0.7	7.3	0	7.6	4.2	1.3	(5.8)
2012	9.0	15.6	0.9	16.5	5	10.3	4.2	1.3	(4.3)
2013	15.2	30.8	1.3	32.1	15	10.3	4.2	1.3	1.3
2014	17.2	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2015	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2016	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2017	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2018	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2019	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2020	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2021	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2022	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2023	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2024	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2025	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2026	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2027	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2028	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2029	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7
2030	0.0	48.0	1.5	49.5	25	10.3	4.2	1.3	8.7

Future Action Plan

In addition to the implemented DSM programs, Montana-Dakota will focus on areas of additional study in the 2011-2013 program years: the Energy Efficiency Potential and Market Assessment Study and the completion of an Irrigation Study. These areas of study will focus on quantifying the magnitude of available energy efficiency and additional areas of possible programs and initiatives.

Energy Efficiency Potential and Market Assessment Study

Energy efficiency is increasingly being considered as an alternative to supply-side investment in generation. In cases where parties wish to understand the relative magnitude of the cost-effective efficiency potential and whether it can defer alternative investments, a study can help answer that question. Study results will provide input for the design of portfolios and programs aimed at increasing the penetration of efficiency, including:

- Setting attainable energy savings targets;
- Detailed efficiency program design and planning;
- Quantifying the energy efficiency resource for system planning;
- Determining a funding level for delivering energy efficiency programs;
- Designing programs to achieve the long-term potential; and
- Reassessing energy efficiency opportunities as conditions change.

Montana-Dakota is committed to investing in cost-effective conservation; however, the Company is unsure how much is available within its service territory. Therefore, in order to quantify the achievable potential of energy conservation and set attainable DSM goals, Montana-Dakota will move forward with commissioning a third party to perform an Energy Efficiency Potential and Market Assessment Study for Montana customers.

The Montana service territory was selected as a starting point due to the additional barriers that are inherent with a small rural customer base with a limited contractor network. The information derived in the Montana Potential Study will be evaluated to determine if adequate to extrapolate the obtained results to the areas served by the Montana-Dakota in North Dakota

and South Dakota and if necessary to commission another study specific to North Dakota.

Montana-Dakota expects the Potential Study will take nine to twelve months to complete. Montana-Dakota will issue an RFP in early 2011, with vendor selection and contract award complete by mid-2011. The study will be expected to be complete in mid- to late-2012.

Completion of an Irrigation Study

In the 2009 IRP, Montana-Dakota considered an Irrigation Demand Response program; however, due to uncertainty of the load profile, it was concluded that more study needed to be done to determine the cost-effectiveness of this program. Montana-Dakota did perform the study over the summer of 2010 using data available from the existing Automatic Meter Reading (AMR) system and specifically in those areas where readings are obtained through a network system. The results of this study are inconclusive and will require further evaluation, as the irrigation customers located in the network areas are primarily irrigation systems used for golf course watering and are not representative for the entire irrigation population.

Montana-Dakota will expand this study to incorporate a larger and more diverse set of irrigation customers. This expanded study will incorporate at least an additional 12 irrigation customers, which would be about 15 percent of Montana-Dakota's 174 irrigation customers. The additional study will also include a more diverse set of participants by utilizing data gathered with data recorders. This additional diversity in the study participants will increase the likelihood that the load profile developed in the study will mirror the load profile for Montana-Dakota's entire Integrated System.

Appendix A

DSM Analysis Results

Montana-Dakota Utilities Co.
Montana Electric DSM Program Summary
Table B-4

Benefit/Cost Ratios

DSM Program	Customer Class	RIM	Utility	Societal	Participant	Total Resource Cost
Total Portfolio		5.29	7.39	4.06	3.63	2.52
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	1.62	2.69	3.27	2.04	1.72
Central Air Conditioning Tier 2 (16 SEER) - Replacement	Residential	0.97	1.36	1.65	1.45	0.87
Central Air Conditioning Tier 2 - New	Residential	0.94	1.08	1.31	0.90	0.69
Window AC Units	Residential	1.50	1.82	2.17	1.16	1.31
AC Tune-up	Residential	1.39	1.75	2.60	1.91	1.75
New Construction Bundle	Residential	0.70	0.90	1.25	1.34	0.66
Thermal Storage with ASHP	Residential	5.12	7.48	8.17	1.24	4.30
Residential Lighting	Residential	1.25	3.11	4.66	5.89	3.11
Demand Response						
Residential AC Cycling	Residential	1.24	1.24	3.85		2.09
Commercial Programs						
Commerical Lighting	Commerical	2.29	3.96	5.33	2.85	2.54
Commercial Motors - Replacement	Commerical	2.84	7.27	4.83	2.44	2.27
Commerical Motors - New / on Failure	Commerical	2.77	6.76	7.92	4.19	3.73
Variable Speed Drives - VFD'S	Commerical	4.98	19.99	13.53	5.50	6.94
Commercial AC - Split Systems	Commerical	3.03	5.12	7.64	3.53	3.92
Commerical AC - Packaged Systems	Commerical	3.53	4.44	5.66	1.94	2.90
Commerical AC - Water Cooled Chillers	Commerical	2.39	2.88	7.40	3.30	3.44
Commercial AC - Centrifugal Chillers	Commerical	4.88	5.53	4.69	0.97	2.18
Commercial Partnership Program (Custom)	Commerical	2.45	4.48	4.26	2.79	2.48
Demand Response						
Commercial Demand Response Program	Commercial	2.50	2.50	3.47		2.50

Montana-Dakota Utilities Co.
North Dakota Electric DSM Program Summary
Table B-5

Benefit/Cost Ratios						
DSM Program	**Customer Class**	**RIM**	**Utility**	**Societal**	**Participant**	**Total Resource Cost**
Total Portfolio		5.74	7.29	3.86	4.06	2.38
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	2.09	3.50	3.95	1.89	2.08
Central Air Conditioning Tier 2 (16 SEER) - Replacement	Residential	1.16	1.63	1.84	1.36	0.97
Central Air Conditioning Tier 2 - New	Residential	1.09	1.43	1.43	0.86	0.75
Window AC Units	Residential	1.68	2.11	2.39	1.20	1.44
AC Tune-up	Residential	1.67	2.12	3.15	1.82	2.12
New Construction Bundle	Residential	0.90	1.13	1.47	1.15	0.77
Thermal Storage with ASHP	Residential	6.14	8.96	9.01	1.13	4.74
Demand Response						
Residential AC Cycling	Residential	1.33	1.33	4.50		2.36
Commercial Programs						
Commerical Lighting	Commerical	4.11	6.86	8.77	3.44	4.18
Commercial Motors - Replacement	Commerical	3.40	8.26	4.96	2.33	2.33
Commerical Motors - New / on Failure	Commerical	3.35	7.76	8.53	4.00	4.00
Variable Speed Drives - VFD'S	Commerical	6.16	23.13	14.20	5.63	7.28
Commercial AC - Split Systems	Commerical	3.63	5.91	8.51	3.62	4.37
Commerical AC - Packaged Systems	Commerical	4.12	5.08	6.13	2.13	3.14
Commerical AC - Water Cooled Chillers	Commerical	2.74	3.26	8.64	3.43	4.02
Commercial AC - Centrifugal Chillers	Commerical	5.64	6.33	4.90	1.22	2.27
Commercial Partnership Program (Custom)	Commercial	2.95	5.17	4.59	2.69	2.68
Demand Response						
Commercial Demand Response Program	Commercial	2.34	2.34	3.26		2.34

Montana-Dakota Utilities Co.
South Dakota Electric DSM Program Summary
Table B-6

Benefit/Cost Ratios						
DSM Program	**Customer Class**	**RIM**	**Utility**	**Societal**	**Participant**	**Total Resource Cost**
Total Portfolio		5.38	9.53	4.07	4.00	2.54
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	1.80	3.57	4.03	2.09	2.11
Central Air Conditioning Tier 2 (16 SEER)	Residential	1.05	1.68	1.89	1.48	1.00
Central Air Conditioning Tier 2 - New	Residential	1.08	1.33	1.49	0.91	0.79
Window AC Units	Residential	1.61	2.21	2.50	1.28	1.50
AC Tune-up	Residential	1.55	2.15	3.19	1.94	2.15
New Construction Bundle	Residential	0.81	1.09	1.42	1.28	0.75
Demand Response						
Residential AC Cycling	Residential	1.33	1.33	4.54		2.38
Commercial Programs						
Commerical Lighting	Commerical	2.84	6.98	8.88	3.82	4.23
Commercial Motors - Replacement	Commerical	2.04	8.38	4.96	3.02	2.34
Commerical Motors - New / on Failure	Commerical	2.19	8.47	9.33	5.32	4.34
Variable Speed Drives - VFD'S	Commerical	3.38	23.65	14.39	6.65	7.39
Commercial AC - Split Systems	Commerical	3.10	4.49	6.46	2.09	3.31
Commerical AC - Packaged Systems	Commerical	3.42	5.16	6.18	1.90	3.17
Commerical AC - Water Cooled Chillers	Commerical	2.40	3.39	9.00	3.28	4.18
Commercial AC - Centrifugal Chillers	Commerical	5.14	6.50	4.99	0.92	2.31
Commercial Partnership Program (Custom)	Commercial	1.96	5.19	4.56	3.19	2.67
Demand Response						
Commercial Demand Response Program	Commercial	2.33	2.33	3.24		2.33

Montana-Dakota Utilities Co.
Electric Utility - Montana
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	35	467,124	24	$13,554	$0.029	$564.75
Central Air Conditioning Tier 2 (16 SEER) - Replacement	35	564,550	22	27,108	0.048	1,232.18
Central Air Conditioning Tier 2 - New	15	92,988	10	11,517	0.124	1,151.70
Window AC Units	15	8,998	2	960	0.107	480.00
AC Tune-up	100	59,110	18	5,793	0.098	321.83
New Construction Bundle	10	175,740	6	11,589	0.066	1,931.50
Thermal Storage with ASHP	12	856,211	234	35,647	0.042	152.34
Residential Lighting	300	45,140	2	774	0.017	387.00
Total	522	2,269,861	318	$106,942	$0.047	$336.30
Demand Response						
Residential AC Cycling	800	0	893	$448,057	NA	$501.74
Total Residential	1,322	2,269,861	1,211	$554,999	$0.245	$458.30
Commercial Programs						
Commerical Lighting	20	7,157,842	116	$73,492	$0.010	$633.55
Commercial Motors - Replacement	30	2,944,294	32	13,966	0.005	436.44
Commerical Motors - New / on Failure	30	723,427	8	3,724	0.005	465.50
Variable Speed Drives - VFD'S	20	6,842,506	196	18,621	0.003	95.01
Commercial AC - Split Systems	20	1,565,383	54	18,621	0.012	344.83
Commerical AC - Packaged Systems	17	494,955	53	15,828	0.032	298.64
Commerical AC - Water Cooled Chillers	3	264,347	17	9,312	0.035	547.76
Commercial AC - Centrifugal Chillers	3	169,195	38	9,312	0.055	245.05
Commercial Partnership Program (Custom)	10	10,747,502	334	124,144	0.012	371.69
Total Commercial	153	30,909,451	848	$287,020	$0.009	$338.47
Demand Response						
Commercial Demand Response Program	8	859,801	3,573	$172,620	$0.201	$48.31
	8	859,801	3,573	$172,620	$0.201	$48.31
Total Commercial	161	31,769,252	4,421	$459,640	$0.014	$103.97
Education and Outreach				$56,600		
Total Programs without DR	675	33,179,312	1,166	$450,562	$0.014	$386.42
Total Demand Response	808	859,801	4,466	$620,677	$0.722	$138.98
Total Programs	1,483	34,039,113	5,632	$1,071,239	$0.031	$190.21

Montana-Dakota Utilities Co.
Electric Utility - North Dakota
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	70	956,354	54	$22,529	$0.024	$417.20
Central Air Conditioning Tier 2 (16 SEER) - Replacement	260	4,295,480	165	167,285	0.039	1,013.85
Central Air Conditioning Tier 2 - New	370	2,349,355	234	238,147	0.101	1,017.72
Window AC Units	155	113,947	19	8,322	0.073	438.00
AC Tune-up	225	136,629	41	10,867	0.080	265.05
New Construction Bundle	225	3,348,225	158	217,346	0.065	1,375.61
Thermal Storage with ASHP	35	2,497,265	684	86,509	0.035	126.48
Total	1,340	13,697,255	1,355	$751,005	$0.055	$554.25
Demand Response						
Residential AC Cycling	3,000	0	3,350	$1,494,000	NA	$445.97
Total Residential	4,340	13,697,255	4,705	$2,245,005	$0.164	$477.15
Commercial Programs						
Commerical Lighting	60	21,473,512	696	$190,555	$0.009	$273.79
Commercial Motors - Replacement	45	4,442,746	46	18,112	0.004	393.74
Commerical Motors - New / on Failure	45	1,091,609	12	4,830	0.004	402.50
Variable Speed Drives - VFD'S	45	15,395,627	442	36,224	0.002	81.95
Commercial AC - Split Systems	35	2,739,406	95	28,160	0.010	296.42
Commerical AC - Packaged Systems	45	1,310,175	140	36,224	0.028	258.74
Commerical AC - Water Cooled Chillers	6	528,675	33	16,078	0.030	487.21
Commercial AC - Centrifugal Chillers	6	338,409	75	16,078	0.048	214.37
Commercial Partnership Program (Custom)	22	23,644,502	736	236,137	0.010	320.84
Total Commercial	309	70,964,661	2,275	$582,398	$0.008	$256.00
Demand Response						
Commercial Demand Response Program	27	2,901,830	12,058	$621,432	$0.214	$51.54
	27	2,901,830	12,058	$621,432	$0.214	$51.54
Total Commercial	336	73,866,491	14,333	$1,203,830	$0.016	$83.99
Education and Outreach				$172,000		
Total Programs without DR	1,649	84,661,916	3,630	$1,505,403	$0.018	$414.71
Total Demand Response	3,027	2,901,830	15,408	$2,115,432	$0.729	$137.29
Total Programs	4,676	87,563,746	19,038	$3,620,835	$0.041	$190.19

Montana-Dakota Utilities Co.
Electric Utility - South Dakota
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	17	232,260	13	$5,422	$0.023	$417.08
Central Air Conditioning Tier 2 (16 SEER)	17	280,855	11	10,843	0.039	985.73
Central Air Conditioning Tier 2 - New	6	38,094	4	3,807	0.100	951.75
Window AC Units	6	4,410	1	317	0.072	317.00
AC Tune-up	45	27,325	8	2,146	0.079	268.25
New Construction Bundle	6	89,292	4	5,710	0.064	1,427.50
Total	214	672,236	41	$28,245	$0.042	$688.90
Demand Response						
Residential AC Cycling	200	0	223	$110,282	NA	$494.54
Total Residential	414	672,236	264	$138,527	$0.206	$524.72
Commercial Programs						
Commerical Lighting	10	3,578,921	116	$31,403	$0.009	$270.72
Commercial Motors - Replacement	6	588,860	6	2,388	0.004	398.00
Commerical Motors - New / on Failure	6	144,686	2	636	0.004	318.00
Variable Speed Drives - VFD'S	5	1,710,630	50	3,975	0.002	79.50
Commercial AC - Split Systems	10	256,814	27	7,957	0.031	294.70
Commerical AC - Packaged Systems	6	174,690	19	4,758	0.027	250.42
Commerical AC - Water Cooled Chillers	3	264,347	17	7,930	0.030	466.47
Commercial AC - Centrifugal Chillers	3	169,195	38	7,930	0.047	208.68
Commercial Partnership Program (Custom)	3	3,224,260	100	31,719	0.010	317.19
Total Commercial	52	10,112,403	375	$98,696	$0.010	$263.19
Demand Response						
Commercial Demand Response Program	3	322,430	1,340	$69,048	$0.214	$51.53
	3	322,430	1,340	$69,048	$0.214	$51.53
Total Commercial	55	10,434,833	1,715	$167,744	$0.016	$97.81
Education and Outreach				$34,850		
Total Programs without DR	266	10,784,639	416	$161,791	$0.015	$388.92
Total Demand Response	203	322,430	1,563	$179,330	$0.556	$114.73
Total Programs	469	11,107,069	1,979	$341,121	$0.031	$172.37

Montana-Dakota Utilities Co.
Electric Utility - Integrated System Total
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	122	1,655,738	91	$41,505	$0.025	$456.10
Central Air Conditioning Tier 2 (16 SEER) - Replacement	312	5,140,885	198	205,236	0.040	1,036.55
Central Air Conditioning Tier 2 - New	391	2,480,437	248	253,471	0.102	1,022.06
Window AC Units	176	127,355	22	9,599	0.075	436.32
AC Tune-up	370	223,064	67	18,806	0.084	280.69
New Construction Bundle	241	3,613,257	168	234,645	0.065	1,396.70
Thermal Storage with ASHP	164	3,353,476	918	122,156	0.036	133.07
Residential Lighting	300	45,140	2	774	0.017	387.00
Total	2,076	16,639,352	1,714	$886,192	$0.053	$517.03
Demand Response						
Residential AC Cycling	4,000	0	4,466	$2,052,339	NA	$459.55
Total Residential	6,076	16,639,352	6,180	$2,938,531	$0.177	$475.49
Commercial Programs						
Commerical Lighting	90	32,210,275	928	$295,450	$0.009	$318.37
Commercial Motors - Replacement	81	7,975,900	84	34,466	0.004	410.31
Commerical Motors - New / on Failure	81	1,959,722	22	9,190	0.005	417.73
Variable Speed Drives - VFD'S	70	23,948,763	688	58,820	0.002	85.49
Commercial AC - Split Systems	65	4,561,603	176	54,738	0.012	311.01
Commerical AC - Packaged Systems	68	1,979,820	212	56,810	0.029	267.97
Commerical AC - Water Cooled Chillers	12	1,057,369	67	33,320	0.032	497.31
Commercial AC - Centrifugal Chillers	12	676,799	151	33,320	0.049	220.66
Commercial Partnership Program (Custom)	35	37,616,264	1,170	392,000	0.010	335.04
Total Commercial	514	111,986,515	3,498	$968,114	$0.009	$276.76
Demand Response						
Commercial Demand Response Program	38	4,084,061	16,971	$863,100	$0.211	$50.86
	38	4,084,061	16,971	$863,100	$0.211	$50.86
Total Commercial	552	116,070,576	20,469	$1,831,214	$0.016	$89.46
Education and Outreach				$263,450		
Total Programs without DR	2,590	128,625,867	5,212	$2,117,756	$0.016	$406.32
Total Demand Response	4,038	4,084,061	21,437	$2,915,439	$0.714	$136.00
Total Programs	6,628	132,709,928	26,649	$5,033,195	$0.038	$188.87

Montana-Dakota Utilities Co.
Input Data Summary
Electric Conservation Model
Table B-3

Input No.	Input Data Description	Information Source	Montana Residential	Montana Commercial	North Dakota Residential	North Dakota Commercial	South Dakota Residential	South Dakota Commercial
1	Retail Rate (Summer)	System average retail rate for customer class based	$0.08183	$0.05379	$0.07214	$0.04072	$0.08258	$0.05772
	Retail Rate (Winter)	System average retail rate for customer class based	$0.06708	0.03977	$0.05757	0.03719	$0.07878	0.05759
	Retail Escalation Rate		4.93%	4.93%	4.93%	4.93%	4.93%	4.93%
1a	Fuel Cost Adjustment	Average fuel cost adjustment for customer class base to be effective January 1, 2011	$0.00115	$0.00115	$0.00830	$0.00830	$0.00328	$0.00328
	Fuel Escalation Rate		1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
2	System Marginal Energy Costs	Actual costs for years 1 through 10						
	Escalation Rate (after Yr. 10)	Escalation factor applied after year 10	0.05799%	0.05799%	0.05799%	0.05799%	0.05799%	0.05799%
3	Retail Summer Demand Cost ($/kW/season)	Seasonal demand cost based on program availability	$0.00	$25.00	$0.00	$45.00	$0.00	$20.00
3a	Retail Winter Demand Cost ($/kW/season)	Seasonal demand cost based on program availability	$0.00	$41.00	$0.00	$66.00	$0.00	$40.00
	Escalation Rate		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
4	Electric Margin ($/KWh)	Average margin applicable to customer class	$0.04991	$0.02199	$0.04140	$0.01735	$0.05979	$0.03732
	Escalation Rate		2.00%	2.00%	2.00%	2.00%	2.00%	2.00%
5	Avoided Capacity Costs ($/kW/yr.)	Demand cost based on estimated levalized cost of combustion turbine	$84.67	$84.67	$84.67	$84.67	$84.67	$84.67
	Reserve Capacity	Based on MISO Non-Coincident Peak	12.06%	12.06%	12.06%	12.06%	12.06%	12.06%
	Escalation Rate		4.00%	4.00%	4.00%	4.00%	4.00%	4.00%
6	Variable O&M	Montana-Dakota's historical information	$0.00	$0.00		$0.00	$0.00	$0.00
	Escalation Rate		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7	Environmental Damage Factor	$30 / ton Carbon Cost	30.7%	30.7%	30.7%	30.7%	30.7%	30.7%
	Escalation Rate		3.00%	3.00%	3.00%	3.00%	3.00%	3.00%
8	Participation Discount Rate	Federal Reserve Consumer Credit Interest rate 12 Months ended September 30, 2010	10.94%	10.94%	10.94%	10.94%	10.94%	10.94%
9	Utility Discount Rate	Montana-Dakota's authorized average cost of capital	9.610%	9.610%	9.610%	9.610%	9.610%	9.610%
10	Societal Discount Rate	Equal to the 30 year T-Bill rate average for 2010	4.24%	4.24%	4.24%	4.24%	4.24%	4.24%

Montana-Dakota Utilities Co.
Input Data Summary
Electric Conservation Model
Table B-3

Input No.	Input Data Description	Information Source	Montana Residential	Montana Commercial	North Dakota Residential	North Dakota Commercial	South Dakota Residential	South Dakota Commercial
11	General Input Data Year	2010	2010	2010	2010	2010	2010	2010
12	Project Analysis Yr. 1	Year(s) program will be implemented	2011	2011	2011	2011	2011	2011
	Yr. 2		2012	2012	2012	2012	2012	2012
	Yr. 3		2013	2013	2013	2013	2013	2013
13	Utility Project Costs	Total direct cost to the utility caused by implementing the program(s)						
	Admin Costs	Administration costs						
	Promo Costs	Promotional costs						
14	Direct Participant Project Costs ($/Part.)	Direct costs that the participant is required to pay to participate in the DSM program						
	Escalation Rate Yr. 1	Consumer Price Index based on 3 yr. average	2.11%	2.11%	2.11%	2.11%	2.11%	2.11%
	Yr. 2	Consumer Price Index based on 3 yr. average	2.11%	2.11%	2.11%	2.11%	2.11%	2.11%
	Yr. 3	Consumer Price Index based on 3 yr. average	2.11%	2.11%	2.11%	2.11%	2.11%	2.11%
14a	Other Participant Costs (Annual $/Part.) Yr. 1		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Yr. 2		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Yr. 3		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Escalation Rate Yr. 1		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Yr. 2		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Yr. 3		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
14b	Other Participant Savings (Annual $/Part.) Yr. 1		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Yr. 2		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Yr. 3		$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
	Escalation Rate Yr. 1		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Yr. 2		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Yr. 3		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15	Project Life	Based on the estimated useful life of the energy saving equipment						
16	Avg. Summer Demand Reduction	Avg demand reduction (kW) caused by the DSM program						

Montana-Dakota Utilities Co.
Input Data Summary
Electric Conservation Model
Table B-3

Input No.	Input Data Description	Information Source	Montana Residential	Montana Commercial	North Dakota Residential	North Dakota Commercial	South Dakota Residential	South Dakota Commercial
16a	Avg. Winter Demand Reduction	Avg demand reduction (kW) caused by the DSM program						
17	Avg. Winter Energy Reduction	Avg energy reduction (kWh) caused by the DSM program						
17a	Avg. Summer Energy Reduction	Avg energy reduction (kWh) caused by the DSM program						
18a	System Demand Line Loss Factor Yr. 1	Historical demand line loss factor	11.650%	11.650%	11.650%	11.650%	11.650%	11.650%
	Yr. 2		11.650%	11.650%	11.650%	11.650%	11.650%	11.650%
	Yr. 3		11.650%	11.650%	11.650%	11.650%	11.650%	11.650%
18b	System Energy Line Loss Factor Yr. 1	Historical energy line loss factor	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%
	Yr. 2		7.4750%	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%
	Yr. 3		7.4750%	7.4750%	7.4750%	7.4750%	7.4750%	7.4750%
19	Number of Participants	Total projected participation by customers, kW load target, or equipment saturation						
20	Incentive/Participant	Incentive provided to the participant						
21	Effective Tax Rate	Effective tax rate	39.3875%	39.3875%	39.16%	39.16%	37.60%	37.60%
22	Total Annual Summer Kwh Saved	Total Kwh saved from the program in the year implemented						
	Total Annual Winter Kwh Saved	Total Kwh saved from the program in the year implemented						
23	Total Annual Summer Kw Saved	Total Kw saved from the program in the year implemented						
	Total Annual Winter Kw Saved	Total Kw saved from the program in the year implemented						

Montana Electric DSM Programs
Technical Assumptions

		Participation Assumptions			Technical Assumptions				
2011 - 2013 Program Years	**Customer Class**	**Number of Participants Year 1**	**Number of Participants Year 2**	**Number of Participants Year 3**	**Project Life**	**Baseline Efficiency**	**Average High Efficiency**	**Average Summer kWh Saved / part**	**Average Winter kWh Saved / part**
Residential Programs									
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	5	10	20	14	10.0	14.50	887	0
Central Air Conditioning Tier 2 (16 SEER) - Replacement	Residential	5	10	20	14	10.0	16.00	1,072	0
Central Air Conditioning Tier 2 - New	Residential	5	5	5	14	13.0	16.00	412	0
Window AC Units	Residential	5	5	5	9	9.8	10.80	62	0
AC Tune-up	Residential	20	30	50	5	NA	NA	110	0
New Construction Bundle	Residential	2	3	5	14	13.0	16.00	664	504
Thermal Storage with ASHP	Residential	2	5	5	14	1.3	1.74	0	4,742
Residential Lighting	Residential	50	100	150	5	60.0	15.00	13	15
Demand Response									
Residential AC Cycling	Residential	0	0	800	15	NA	NA	0	0
Commercial Programs									
Commerical Lighting	Commerical	5	10	5	18	T-12	T-8	6,167	12,333
Commercial Motors - Replacement	Commerical	5	10	15	20	88.9	93.60	1,630	3,262
Commerical Motors - New / on Failure	Commerical	5	10	15	20	92.4	93.60	401	801
Variable Speed Drives - VFD'S	Commerical	5	5	10	15	NA	NA	7,074	14,148
Commercial AC - Split Systems	Commerical	5	5	10	15	8.9	11.20	1,593	0
Commerical AC - Packaged Systems	Commerical	2	5	10	15	8.9	11.60	1,806	0
Commerical AC - Water Cooled Chillers	Commerical	1	1	1	20	1.3	1.15	4,315	0
Commercial AC - Centrifugal Chillers	Commerical	1	1	1	20	0.6	0.53	2,762	0
Commercial Partnership Program (Custom)	Commerical	2	3	5	10	NA	NA	50,000	50,000
Demand Response									
Commercial Demand Response Program	Commercial	0	3	5	10	NA	NA	10,000	0
Totals		**1,483**	**125**	**221**	**1,137**				
Total Less Demand Response		125	218	332					

Montana Electric DSM Programs
Technical Assumptions - Continued

2011 - 2013 Program Years	Average Summer kW Saved / part	Average Winter kW Saved / part	Average Peak Load Factor of Measure	coincident Summer Peak Avg kW Saved / Part	coincident Winter Peak Avg kW Saved / Part	Average Non-Energy Benefits / Part	Cost Std Equip	Cost High Eff Equip	incremental Cost	Average Incentive / Part
	Tech Assumptions Continued						Cost Assumptions			
Residential Programs										
Central Air Conditioning Tier 1 (14.5 SEER)	0.6900	0.0000	0.9000	0.6210	0.0000	0.00	NA	NA	$520	$300
Central Air Conditioning Tier 2 (16 SEER) - Replacement	0.6300	0.0000	0.9000	0.5700	0.0000	0.00	NA	NA	1,037	600
Central Air Conditioning Tier 2 - New	0.6300	0.0000	0.9000	0.5700	0.0000	0.00	NA	NA	1,037	600
Window AC Units	0.1000	0.0000	0.9000	0.0900	0.0000	0.00	NA	NA	75	50
AC Tune-up	0.1800	0.0000	0.9000	0.1600	0.0000	0.00	NA	NA	45	45
New Construction Bundle	0.6900	0.1500	NA	0.5800	0.0000	0.00	NA	NA	1,337	900
Thermal Storage with ASHP	0.0000	35.0000	0.5000	0.0000	17.5000	0.00	NA	NA	4,500	2,304
Residential Lighting	0.0036	0.0036	0.0800	0.0029	0.0029	0.00	NA	NA	2	2
Demand Response										
Residential AC Cycling	3.6000	0.0000	0.2800	1.0000	0.0000	0.00	NA	NA	0	50
Commercial Programs										
Commerical Lighting	7.4000	7.4000	0.7000	5.2000	5.2000	0.00	NA	NA	5,000	2,960
Commercial Motors - Replacement	0.6200	0.6200	0.7500	0.4650	0.4650	0.00	NA	NA	1,400	375
Commerical Motors - New / on Failure	0.15	0.1500	0.7500	0.1125	0.1125	0.00	NA	NA	201	100
Variable Speed Drives - VFD'S	5.8600	5.8600	0.7500	4.4000	4.4000	0.00	NA	NA	2,500	750
Commercial AC - Split Systems	2.7000	0.0000	0.9000	2.4300	0.0000	0.00	NA	NA	1,035	750
Commerical AC - Packaged Systems	3.1000	0.0000	0.9000	2.7900	0.0000	0.00	NA	NA	1,246	750
Commerical AC - Water Cooled Chillers	5.5000	0.0000	0.9000	4.9500	0.0000	0.00	NA	NA	1,997	2,500
Commercial AC - Centrifugal Chillers	12.3800	0.0000	0.9000	11.2500	0.0000	0.00	NA	NA	7,276	2,500
Commercial Partnership Program (Custom)	20.0000	20.0000	0.7500	15.0000	15.0000	0.00	NA	NA	20,000	10,000
Demand Response										
Commercial Demand Response Program	400.0000	0.0000	1.0000	400.0000	0.0000	0.00	NA	NA	0	0

Additional Technical Notes

*Average kW savings per season is base on total kW saved & allocated to season based on normal usage patterns of the technology. (i.e. AC summer only, motors 4 months summer & 8 months winter)

**Air Conditioning tune-up, consisting of computerized diagnostic and refrigerant charge / air flow corrections

North Dakota Electric DSM Programs
Technical Assumptions

		Participation Assumptions			Technical Assumptions				
2011 - 2013 Program Years	**Customer Class**	**Number of Participants Year 1**	**Number of Participants Year 2**	**Number of Participants Year 3**	**Project Life**	**Baseline Efficiency**	**Average High Efficiency**	**Average Summer kWh Saved / part**	**Average Winter kWh Saved / part**
Residential Programs									
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	20	20	30	14	10.0	14.50	908	0
Central Air Conditioning Tier 2 (16 SEER) - Replacement	Residential	80	80	100	14	10.0	16.00	1,098	0
Central Air Conditioning Tier 2 - New	Residential	100	120	150	14	13.0	16.00	422	0
Window AC Units	Residential	30	50	75	9	9.8	10.80	76	0
AC Tune-up	Residential	50	75	100	5	NA	NA	113	0
New Construction Bundle	Residential	50	75	100	14	13.0	16.00	485	504
Thermal Storage with ASHP	Residential	10	10	15	14	1.3	1.74	0	4,742
Demand Response									
Residential AC Cycling	Residential	0	0	3,000	15	NA	NA	0	0
Commercial Programs									
Commerical Lighting	Commerical	15	20	25	18	T-12	T-8	6,167	12,333
Commercial Motors - Replacement	Commerical	10	15	20	20	88.9	93.60	1,630	3,262
Commerical Motors - New / on Failure	Commerical	10	15	20	20	92.4	93.60	401	801
Variable Speed Drives - VFD'S	Commerical	10	15	20	15	NA	NA	7,074	14,148
Commercial AC - Split Systems	Commerical	10	10	15	15	8.9	11.20	1,593	0
Commerical AC - Packaged Systems	Commerical	10	15	20	15	8.9	11.60	1,806	0
Commerical AC - Water Cooled Chillers	Commerical	2	2	2	20	1.3	1.15	4,315	0
Commercial AC - Centrifugal Chillers	Commerical	2	2	2	20	0.6	0.53	2,762	0
Commercial Partnership Program (Custom)	Commercial	5	7	10	10	NA	NA	50,000	50,000
Demand Response									
Commercial Demand Response Program	Commercial	0	9	18	10	NA	NA	10,000	0
Totals	**4,676**	**414**	**540**	**3,722**					
Total Less Demand Response		414	531	704					

North Dakota Electric DSM Programs
Technical Assumptions - Continued

	Technical Assumptions - Continued						Cost Assumptions			
2011 - 2013 Program Years	**Average Summer kW Saved / part**	**Average Winter kW Saved / part**	**Average Peak Load Factor of Measure**	**coincident Summer Peak Avg kW Saved / Part**	**coincident Winter Peak Avg kW Saved / Part**	**Average Non-Energy Benefits / Part**	**Cost Std Equip**	**Cost High Eff Equip**	**incremental Cost**	**Average Incentive / Part**
Residential Programs										
Central Air Conditioning Tier 1 (14.5 SEER)	0.46	0.00	0.90	0.69	0.00	0.00	NA	NA	$520	$300
Central Air Conditioning Tier 2 (16 SEER) - Replacement	0.63	0.00	0.90	0.57	0.00	0.00	NA	NA	1,037	600
Central Air Conditioning Tier 2 - New	0.63	0.00	0.90	0.57	0.00	0.00	NA	NA	1,037	600
Window AC Units	0.12	0.00	0.90	0.11	0.00	0.00	NA	NA	75	50
AC Tune-up	0.18	0.00	0.90	0.16	0.00	0.00	NA	NA	45	45
New Construction Bundle	0.76	0.03	NA	0.63	0.00	0.00	NA	NA	1,337	900
Thermal Storage with ASHP	0.00	35.00	0.50	0.00	17.50	0.00	NA	NA	4,500	2,304
Demand Response										
Residential AC Cycling	3.60	0.00	0.28	1.00	0.00	0.00	NA	NA	0	50
Commercial Programs										
Commerical Lighting	7.40	7.40	0.70	5.20	5.20	0.00	NA	NA	5,000	2,960
Commercial Motors - Replacement	0.62	0.62	0.75	0.47	0.47	0.00	NA	NA	1,400	375
Commerical Motors - New / on Failure	0.15	0.15	0.75	0.11	0.11	0.00	NA	NA	201	100
Variable Speed Drives - VFD'S	5.86	5.86	0.75	4.40	4.40	0.00	NA	NA	2,500	750
Commercial AC - Split Systems	2.70	0.00	0.90	2.43	0.00	0.00	NA	NA	1,035	750
Commerical AC - Packaged Systems	3.10	0.00	0.90	2.79	0.00	0.00	NA	NA	1,246	750
Commerical AC - Water Cooled Chillers	5.50	0.00	0.90	4.95	0.00	0.00	NA	NA	1,997	2,500
Commercial AC - Centrifugal Chillers	12.38	0.00	0.90	11.25	0.00	0.00	NA	NA	7,276	2,500
Commercial Partnership Program (Custom)	20.00	20.00	0.75	15.00	15.00	0.00	NA	NA	20,000	10,000
Demand Response										
Commercial Demand Response Program	400.00	0.00	1.00	400.00	0.00	0.00	NA	NA	0	0

Additional Technical Notes

*Average kW savings per season is base on total kW saved & allocated to season based on normal usage patterns of the technology. (i.e. AC summer only, motors 4 months summer & 8 months winter)

**Air Conditioning tune-up, consisting of computerized diagnostic and refrigerant charge / air flow corrections

South Dakota Electric DSM Programs
Technical Assumptions

		Participation Assumptions			Technical Assumptions				
2011 - 2013 Program Years	**Customer Class**	**Number of Participants Year 1**	**Number of Participants Year 2**	**Number of Participants Year 3**	**Project Life**	**Baseline Efficiency**	**Average High Efficiency**	**Average Summer kWh Saved / part**	**Average Winter kWh Saved / part**
Residential Programs									
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	2	5	10	14	10.0	14.50	908	0
Central Air Conditioning Tier 2 (16 SEER)	Residential	2	5	10	14	10.0	16.00	1,098	0
Central Air Conditioning Tier 2 - New	Residential	2	2	2	14	13.0	16.00	422	0
Window AC Units	Residential	2	2	2	9	9.8	10.80	76	0
AC Tune-up	Residential	10	15	20	5	NA	NA	113	0
New Construction Bundle	Residential	2	2	2	14	13.0	16.00	485	504
Demand Response									
Residential AC Cycling	Residential	0	0	200	15	NA	NA	0	0
Commercial Programs									
Commerical Lighting	Commerical	2	3	5	18	T-12	T-8	6,167	12,333
Commercial Motors - Replacement	Commerical	1	2	3	20	88.9	93.60	1,630	3,262
Commerical Motors - New / on Failure	Commerical	1	2	3	20	92.4	93.60	401	801
Variable Speed Drives - VFD'S	Commerical	1	2	2	15	NA	NA	7,074	14,148
Commercial AC - Split Systems	Commerical	2	3	5	15	8.9	11.20	1,593	0
Commerical AC - Packaged Systems	Commerical	2	2	2	15	8.9	11.60	1,806	0
Commerical AC - Water Cooled Chillers	Commerical	1	1	1	20	1.3	1.15	4,315	0
Commercial AC - Centrifugal Chillers	Commerical	1	1	1	20	0.6	0.53	2,762	0
Commercial Partnership Program (Custom)	Commercial	1	1	1	10	NA	NA	50,000	50,000
Demand Response									
Commercial Demand Response Program	Commercial	0	1	2	10	NA	NA	10,000	0
Totals	**352**	**32**	**49**	**271**					
Total Less Demand Response		32	48	69					

South Dakota Electric DSM Programs
Technical Assumptions - Continued

	Technical Assumptions - Continued						Cost Assumptions			
2011 - 2013 Program Years	**Average Summer kW Saved / part**	**Average Winter kW Saved / part**	**Average Peak Load Factor of Measure**	**coincident Summer Peak Avg kW Saved / Part**	**coincident Winter Peak Avg kW Saved / Part**	**Average Non-Energy Benefits / Part**	**Cost Std Equip**	**Cost High Eff Equip**	**incremental Cost**	**Average Incentive / Part**
Residential Programs										
Central Air Conditioning Tier 1 (14.5 SEER)	0.46	0.00	0.90	0.69	0.00	0.00	NA	NA	$520	$300
Central Air Conditioning Tier 2 (16 SEER)	0.63	0.00	0.90	0.57	0.00	0.00	NA	NA	1,037	600
Central Air Conditioning Tier 2 - New	0.63	0.00	0.90	0.57	0.00	0.00	NA	NA	1,037	600
Window AC Units	0.12	0.00	0.90	0.11	0.00	0.00	NA	NA	75	50
AC Tune-up	0.18	0.00	0.90	0.16	0.00	0.00	NA	NA	45	45
New Construction Bundle	0.76	0.03	NA	0.63	0.00	0.00	NA	NA	1,337	900
Demand Response										
Residential AC Cycling	3.60	0.00	0.28	1.00	0.00	0.00	NA	NA	0	50
Commercial Programs										
Commerical Lighting	7.40	7.40	0.70	5.20	5.20	0.00	NA	NA	5,000	2,960
Commercial Motors - Replacement	0.62	0.62	0.75	0.47	0.47	0.00	NA	NA	1,400	375
Commerical Motors - New / on Failure	0.15	0.15	0.75	0.11	0.11	0.00	NA	NA	201	100
Variable Speed Drives - VFD'S	5.86	5.86	0.75	4.40	4.40	0.00	NA	NA	2,500	750
Commercial AC - Split Systems	2.70	0.00	0.90	2.43	0.00	0.00	NA	NA	1,035	750
Commerical AC - Packaged Systems	3.10	0.00	0.90	2.79	0.00	0.00	NA	NA	1,246	750
Commerical AC - Water Cooled Chillers	5.50	0.00	0.90	4.95	0.00	0.00	NA	NA	1,997	2,500
Commercial AC - Centrifugal Chillers	12.38	0.00	0.90	11.25	0.00	0.00	NA	NA	7,276	2,500
Commercial Partnership Program (Custom)	20.00	20.00	0.75	15.00	15.00	0.00	NA	NA	20,000	10,000
Demand Response										
Commercial Demand Response Program	400.00	0.00	1.00	400.00	0.00	0.00	NA	NA	0	0

Additional Technical Notes

*Average kW savings per season is base on total kW saved & allocated to season based on normal usage patterns of the technology. (i.e. AC summer only, motors 4 months summer & 8 months winter)

**Air Conditioning tune-up, consisting of computerized diagnostic and refrigerant charge / air flow corrections

Commercial Demand Response Program

This program will be marketed and aggreated by Constellation Energy (Cpower) of behalf of Montana-Dakota. Commercial customers with loads in excess of 150 kW will be targeted. All load will be shed during events and load with back-up generation will not be allowed to particpate. Baseline methodology and E&MW is still under development.

Program kW Goals - Integrated System

Summer 2011	0
Summer 2012	5,000
Summer 2013	10,000
Summer 2014	10,000
	25,000

	Lg Ind Customers	Sm ind Customers	Lg Comm Customers	Total Customers	2012 Participation Goal	2012 kW Goal	2012 Capacity Cost	2012 Energy Cost	2012 kWh Saved
Montana	41	95	227	363	3	1,000	$ 50,040	$ 7,500	25,000
North Dakota	49	102	668	819	9	3,600	$ 180,144	$ 27,000	90,000
South Dakota	6	19	99	124	1	400	$ 20,016	$ 3,000	10,000
Total	**96**	**216**	**994**	**1,306**	**13**	**5,000**	**$ 250,200**	**$ 37,500**	**125,000**

Assumptions

Resource on average needed for:		25	hrs/yr
Capacity Cost	$	4.17	kW/month
Average Load Factor		100%	
Energy Cost	$	0.30	kWh
Average kW per customer		400	kW
Avg kWh Savings		10,000	

Customers are all large commercial & small / large industrial customers by state as of 12/31/2010

	2013 Participation Goal	2013 kW Goal	2013 Capacity Cost	2013 Energy Cost	2013 kWh Saved
Montana	5	2,000	$ 100,080	$ 15,000	50,000
North Dakota	18	7,200	$ 360,288	$ 54,000	180,000
South Dakota	2	800	$ 40,032	$ 6,000	20,000
Total	**25**	**10,000**	**$ 500,400**	**$ 75,000**	**250,000**

	2014 Participation Goal	2014 kW Goal	2014 Capacity Cost	2014 Energy Cost	2014 kWh Saved
Montana	5	2,000	$ 100,080	$ 15,000	50,000
North Dakota		7,200	$ 360,288	$ 54,000	180,000
South Dakota	2	800	$ 40,032	$ 6,000	20,000
Total	**25**	**10,000**	**$ 500,400**	**$ 75,000**	**250,000**

	Total Program Participation Goal	Total Program kW Goal	Total Program Capacity Cost	Total Program Energy Cost	Total Program kWh Saved
Montana	13	5,000	250,200	37,500	125,000
North Dakota	45	18,000	900,720	135,000	450,000
South Dakota	5	2,000	100,080	15,000	50,000
Total	**63**	**25,000**	**$ 1,251,000**	**$ 187,500**	**625,000**

Air Conditioning Cycling Program

Prgogram will be a 100% switched based program for central AC with residential and small commercial customers.
Incentive will be provided as an annual payment typically in the fall after performance for the summer peak season.
Prices are estimated based on costs obtained in 2006 RFP and April 2 2010 update
Montana-Dakota intends re-issue RFP in early 2012 and begin marketing in fall of 2012

Program kW Goals - Integrated System

Summer 2011	-
Summer 2012	-
Summer 2013	4,000
Summer 2014	6,000
	10,000

	Residential Customers	Sm Commercial Customers	AC Saturation	Total Available	2012 Participation Goal	2012 kW Goal	2012 Installed Cost	2012 Incentive Cost
Montana	18,805	4,767	50%	11,786	-	-	$ -	$ -
North Dakota	64,468	10,237	50%	37,353	-	-	$ -	$ -
South Dakota	6,597	1,783	50%	4,190	-	-	$ -	$ -
Total	**89,870**	**16,787**	**2**	**53,329**		**-**	**$ -**	**$ -**

Assumptions

Resource on average needed for:	25	hrs/yr
Cost per kW	$ 498.00	kW
Annual Incentive	$ 50.00	per yr

Overall Saturation **18.8%**

Customers are all large commercial & small / large industrial customers by state as of 12/31/2010

		2013 Participation Goal	2013 kW Goal	2013 Installed Cost	2013 Incentive Cost
7%	Montana	800	800	$ 398,400	$ 40,000
8%	North Dakota	3,000	3,000	$ 1,494,000	$ 150,000
5%	South Dakota	200	200	$ 99,600	$ 10,000
	Total	**4,000**	**4,000**	**$ 1,992,000**	**$ 200,000**

		2014 Participation	2014 kW Goal	2014 Installed Cost	2014 Incentive Cost
10%	Montana	1,200	1,200	$ 597,600	$ 60,000
12%	North Dakota	4,500	4,500	$ 2,241,000	$ 225,000
7%	South Dakota	300	300	$ 149,400	$ 15,000
	Total	**6,000**	**6,000**	**$ 2,988,000**	**$ 300,000**

		Total Program Participation Goal	Total Program kW Goal	Total Program Installed Cost	Total Program Incentive Cost
17%	Montana	2,000	2,000	996,000	100,000
20%	North Dakota	7,500	7,500	3,735,000	375,000
12%	South Dakota	500	500	249,000	25,000
	Total	**10,000**	**10,000**	**$ 4,980,000**	**$ 500,000**

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	
Retail Rate Winter ($/kWh) =	
Retail Escalation Rate =	
1a) Power Supply Cost Adjustment	
Fuel Escalation Rate =	
2) Avg. System Marginal Energy Cost ($/kWh) =	
Escalation Rate =	
3) Retail Summer Demand Rate ($/kW/season) =	
3a) Retail Winter Demand Rate ($/kW/season) =	
Escalation Rate =	
4) Electric Margin ($/kWh) =	
Escalation Rate =	
5) System Peak Shaving Demand Cost ($/kW/yr)	
Reserve Capacity=	
Escalation Rate =	
6) System Variable O&M ($/kWh) =	
Escalation Rate =	
7) Environmental Damage Factor =	
Escalation Rate =	
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$16,015	$27,809	$45,597
Incentive Costs =	66,333	108,620	179,245
Total Utility Project Costs =	$82,348	$136,429	$224,842
14) Direct Participant Costs ($/Part.) =			
Escalation Rate =			
14a) Other Participant Costs (Annual $/Part.) =			
Escalation Rate =			
14b) Other Participant Savings (Annual $/Part.) =			
Escalation Rate =			
15) Project Life (Years) =			
16) Avg Summer kW/part. Saved =			
16a) Avg Winter kW/part Saved =			
17) Avg. Summer kWh/Part. Saved =			
17a) Avg. Winter kWh/Part. Saved =			
18a) System Demand Line Loss Factor			
18b) System Energy Line Loss Factor			
19) Number of Participants =	125	221	1,137
20) Incentive/Participant =			
21) Effective Federal & State Income Tax Rate =			
22) Annual Summer Kwh Saved	211,357	349,974	525,427
Annual Winter Kwh Saved	280,272	427,732	575,190
23) Annual Summer KW Saved	128	1,389	3,059
Annual Winter KW Saved	90	161	216

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$4,226,715	5.29
Utility Cost Test	$4,506,178	7.39
Societal Test	$7,717,921	4.06
Participant Test	$1,482,654	3.63
Total Resource Cost Test	$3,144,553	2.52

Table 1
Ratepayer Impact Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

		Benefits												Costs					Annual
t	Year	Summer kWh Requirements Reduction (A1)	Winter kWh Requirements Reduction (A2)	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Total Energy Reduction (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Project Costs (O)	Benefits Less Costs (P)
1	2011	227,156	301,221	528,377		$15,114		$0	246		$24,277	$39,391		491,629	$7,163	$16,015	$66,333	$89,511	($50,120)
2	2012	603,293	760,927	1,364,220		40,763		0	1,976		202,779	243,542		1,269,335	19,063	27,809	108,620	155,492	88,050
3	2013	1,167,995	1,379,113	2,547,108		81,379		0	5,632		601,102	682,481		2,369,952	36,466	45,597	179,245	261,308	421,173
4	2014	1,167,995	1,379,113	2,547,108		85,278		0	5,632		625,152	710,430		2,369,952	37,187	9,657	40,000	86,844	623,586
5	2015	1,167,995	1,379,113	2,547,108		93,938		0	5,632		650,159	744,097		2,369,952	37,935	9,657	40,000	87,592	656,505
6	2016	1,164,932	1,378,307	2,543,239		94,608		0	5,628		675,644	770,252		2,366,352	38,566	9,657	40,000	88,223	682,029
7	2017	1,159,988	1,376,695	2,536,683		99,210		0	5,623		702,091	801,301		2,360,252	39,130	9,657	40,000	88,787	712,514
8	2018	1,151,981	1,374,277	2,526,258		107,391		0	5,612		728,719	836,110		2,350,552	39,560	9,657	40,000	89,217	746,893
9	2019	1,151,981	1,374,277	2,526,258		112,570		0	5,612		757,903	870,473		2,350,552	40,359	9,657	40,000	90,016	780,457
10	2020	1,151,647	1,374,277	2,525,924		120,463		0	5,611		788,065	908,528		2,350,242	41,162	9,657	40,000	90,819	817,709
11	2021	1,043,839	1,266,802	2,310,641		110,912		0	5,545		809,960	920,872		2,149,932	38,651	9,657	40,000	88,308	832,564
12	2022	850,052	1,105,590	1,955,642		94,536		0	4,104		623,438	717,974		1,819,622	33,836	9,657	40,000	83,493	634,481
13	2023	527,626	836,902	1,364,528		66,466		0	1,703		269,041	335,507		1,269,622	25,030	9,657	40,000	74,687	260,820
14	2024	527,626	836,902	1,364,528		67,009		0	1,703		279,803	346,812		1,269,622	25,533	9,657	40,000	75,190	271,622
15	2025	513,457	825,625	1,339,082		66,338		0	1,653		282,464	348,802		1,245,947	25,078	9,657	40,000	74,735	274,067
16	2026	437,591	704,960	1,142,551		57,128		0	1,471		261,411	318,539		1,063,086	21,101	9,657	40,000	70,758	247,781
17	2027	333,421	583,213	916,634		46,290		0	1,260		232,872	279,162		852,881	15,918	9,657	40,000	65,575	213,587
18	2028	220,862	396,099	616,961		31,483		0	211		40,557	72,040		574,051	10,929	0	0	10,929	61,111
19	2029	187,722	329,824	517,546		26,705		0	182		36,381	63,086		481,551	9,351	0	0	9,351	53,735
20	2030	121,442	197,275	318,717		16,637		0	124		25,779	42,416		296,551	5,873	0	0	5,873	36,543
Total =				34,039,113					65,160			$10,051,815		31,671,635				$1,686,708	$8,365,107
											NPV =	$5,211,196						$984,481	4,226,715

Total NPV = $4,226,715
Benefit/Cost Ratio = 5.29

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated

(K = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M = Program Admin Costs (13)
(N = Incentive/Participant (20) x Number of Participants (19)
(O = (L) + (M) + (N)
(P = (I) - (O)

Table 2
Utility Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$15,114	$0	$24,277	$39,391	$82,348	$82,348	($42,957)
2012	40,763	0	202,779	243,542	136,429	136,429	107,113
2013	81,379	0	601,102	682,481	224,842	224,842	457,639
2014	85,278	0	625,152	710,430	49,657	49,657	660,773
2015	93,938	0	650,159	744,097	49,657	49,657	694,440
2016	94,608	0	675,644	770,252	49,657	49,657	720,595
2017	99,210	0	702,091	801,301	49,657	49,657	751,644
2018	107,391	0	728,719	836,110	49,657	49,657	786,453
2019	112,570	0	757,903	870,473	49,657	49,657	820,816
2020	120,463	0	788,065	908,528	49,657	49,657	858,871
2021	110,912	0	809,960	920,872	49,657	49,657	871,215
2022	94,536	0	623,438	717,974	49,657	49,657	668,317
2023	66,466	0	269,041	335,507	49,657	49,657	285,850
2024	67,009	0	279,803	346,812	49,657	49,657	297,155
2025	66,338	0	282,464	348,802	49,657	49,657	299,145
2026	57,128	0	261,411	318,539	49,657	49,657	268,882
2027	46,290	0	232,872	279,162	49,657	49,657	229,505
2028	31,483	0	40,557	72,040	0	0	72,040
2029	26,705	0	36,381	63,086	0	0	63,086
2030	16,637	0	25,779	42,416	0	0	42,416
Total =				$10,051,815		$1,138,817	$8,912,998
			NPV =	$5,211,196		$705,018	4,506,178

Total NPV =	$4,506,178
Benefit/Cost Ratio =	7.39

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$15,114	$0	$24,277	$12,457	$51,848	$82,348	$62,131	$144,479	($92,631)
2012	40,763	0	202,779	79,320	322,862	194,385	99,759	294,144	28,718
2013	81,379	0	601,102	228,950	911,431	796,994	95,288	892,282	19,149
2014	85,278	0	625,152	245,471	955,901	223,431	(40,000)	183,431	772,470
2015	93,938	0	650,159	264,822	1,008,919	223,454	(40,000)	183,454	825,465
2016	94,608	0	675,644	282,357	1,052,609	223,478	(40,000)	183,478	869,131
2017	99,210	0	702,091	302,549	1,103,850	223,502	(40,000)	183,502	920,348
2018	107,391	0	728,719	325,162	1,161,272	223,526	(40,000)	183,526	977,746
2019	112,570	0	757,903	348,680	1,219,153	223,551	(40,000)	183,551	1,035,602
2020	120,463	0	788,065	374,841	1,283,369	223,577	(40,000)	183,577	1,099,792
2021	110,912	0	809,960	391,335	1,312,207	223,603	(40,000)	183,603	1,128,604
2022	94,536	0	623,438	314,262	1,032,236	223,122	(28,000)	195,122	837,114
2023	66,466	0	269,041	151,260	486,767	49,657	(40,000)	9,657	477,110
2024	67,009	0	279,803	161,048	507,860	49,657	(40,000)	9,657	498,203
2025	66,338	0	282,464	166,831	515,633	49,657	(40,000)	9,657	505,976
2026	57,128	0	261,411	156,926	475,465	49,657	(40,000)	9,657	465,808
2027	46,290	0	232,872	141,654	420,816	49,657	(40,000)	9,657	411,159
2028	31,483	0	40,557	37,652	109,692	0	0	0	109,692
2029	26,705	0	36,381	33,960	97,046	0	0	0	97,046
2030	16,637	0	25,779	23,518	65,934	0	0	0	65,934
Total =					$14,094,870			$3,042,434	$11,052,436
				NPV =	$10,242,243			$2,524,322	7,717,921

Total NPV = $7,717,921
Benefit/Cost Ratio = 4.06

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits												Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$66,333			491,629	$24,430	128	90			$5,234	$0	$95,997	$131,175	$0	$131,175	($35,178)
2012	108,620			1,269,335	66,779	1,519	251			44,032	0	219,431	217,267	0	217,267	2,164
2013	179,245			2,369,952	131,750	4,579	466			109,362	0	420,357	292,279	0	292,279	128,078
2014	0			2,369,952	138,234	4,579	466			111,550	0	249,784	0	0	0	249,784
2015	0			2,369,952	145,060	4,579	466			113,779	0	258,839	0	0	0	258,839
2016	0			2,366,352	151,836	4,576	466			116,057	0	267,893	0	0	0	267,893
2017	0			2,360,252	158,643	4,570	465			118,377	0	277,020	0	0	0	277,020
2018	0			2,350,552	165,359	4,562	465			120,743	0	286,102	0	0	0	286,102
2019	0			2,350,552	173,503	4,562	465			123,158	0	296,661	0	0	0	296,661
2020	0			2,350,242	182,023	4,562	465			125,622	0	307,645	0	0	0	307,645
2021	0			2,149,932	175,072	4,531	435			125,672	0	300,744	0	0	0	300,744
2022	0			1,819,622	155,774	3,286	390			86,374	0	242,148	0	0	0	242,148
2023	0			1,269,622	114,697	1,211	315			17,017	0	131,714	0	0	0	131,714
2024	0			1,269,622	120,353	1,211	315			17,358	0	137,711	0	0	0	137,711
2025	0			1,245,947	122,621	1,201	280			17,705	0	140,326	0	0	0	140,326
2026	0			1,063,086	107,900	1,143	171			15,448	0	123,348	0	0	0	123,348
2027	0			852,881	86,739	1,066	61			12,813	0	99,552	0	0	0	99,552
2028	0			574,051	61,150	170	17			7,066	0	68,216	0	0	0	68,216
2029	0			481,551	53,906	144	17			6,259	0	60,165	0	0	0	60,165
2030	0			296,551	35,031	92	17			4,453	0	39,484	0	0	0	39,484
Total =						52,271	6,083					$4,023,137			$640,721	$3,382,416
											NPV =	$2,047,148			$564,494	1,482,654

Total NPV = $1,482,654
Benefit/Cost Ratio = 3.63

Worksheet Calculations	
(A) = Table 1 (N)	(I) = Retail Winter Demand Rate, escalated.
(B) = Retail Summer Rate, escalated.	(J) = (A) + (D) + (I) + (J)
(C) = Retail Winter Rate, escalated.	(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(D) = Table 1 (K)	(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(E) = [Retail Rate (B) or (C)] x (D)	(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)	(O) = (L) + (M)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)	(P) = (K) - (N)
(H) = Retail Summer Demand Rate, escalated.	

Table 5
Total Resource Cost Test

Company: **Total Program with Demand Response**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$15,114	$24,277	$39,391	$82,348	$62,131	$144,479	($105,088)
2012	40,763	202,779	243,542	194,385	99,759	294,144	(50,602)
2013	81,379	601,102	682,481	796,994	95,288	892,282	(209,801)
2014	85,278	625,152	710,430	223,431	(40,000)	183,431	526,999
2015	93,938	650,159	744,097	223,454	(40,000)	183,454	560,643
2016	94,608	675,644	770,252	223,478	(40,000)	183,478	586,774
2017	99,210	702,091	801,301	223,502	(40,000)	183,502	617,799
2018	107,391	728,719	836,110	223,526	(40,000)	183,526	652,584
2019	112,570	757,903	870,473	223,551	(40,000)	183,551	686,922
2020	120,463	788,065	908,528	223,577	(40,000)	183,577	724,951
2021	110,912	809,960	920,872	223,603	(40,000)	183,603	737,269
2022	94,536	623,438	717,974	223,122	(28,000)	195,122	522,852
2023	66,466	269,041	335,507	49,657	(40,000)	9,657	325,850
2024	67,009	279,803	346,812	49,657	(40,000)	9,657	337,155
2025	66,338	282,464	348,802	49,657	(40,000)	9,657	339,145
2026	57,128	261,411	318,539	49,657	(40,000)	9,657	308,882
2027	46,290	232,872	279,162	49,657	(40,000)	9,657	269,505
2028	31,483	40,557	72,040	0	0	0	72,040
2029	26,705	36,381	63,086	0	0	0	63,086
2030	16,637	25,779	42,416	0	0	0	42,416
		Total =	$10,051,815			$3,042,434	$7,009,381
		NPV =	$5,211,196			$2,066,643	3,144,553

Total NPV = $3,144,553
Benefit/Cost Ratio = 2.52

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	
Retail Rate Winter ($/kWh) =	
Retail Escalation Rate =	
1a) Power Supply Cost Adjustment	
Fuel Escalation Rate =	
2) Avg. System Marginal Energy Cost ($/kWh) =	
Escalation Rate =	
3) Retail Summer Demand Rate ($/kW/season) =	
3a) Retail Winter Demand Rate ($/kW/season) =	
Escalation Rate =	
4) Electric Margin ($/kWh) =	
Escalation Rate =	
5) System Peak Shaving Demand Cost ($/kW/yr)	
Reserve Capacity=	
Escalation Rate =	
6) System Variable O&M ($/kWh) =	
Escalation Rate =	
7) Environmental Damage Factor =	
Escalation Rate =	
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2,010
12) Project Analysis Year 1 =	2,011
Project Analysis Year 2 =	2,012
Project Analysis Year 3 =	2,013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$16,015	$27,809	$35,940
Incentive Costs =	$66,333	$108,620	$139,245
Total Utility Project Costs =	$82,348	$136,429	$175,185
14) Direct Participant Costs ($/Part.) =			
Escalation Rate =			
14a) Other Participant Costs (Annual $/Part.) =			
Escalation Rate =			
14b) Other Participant Savings (Annual $/Part.) =			
Escalation Rate =			
15) Project Life (Years) =			
16) Avg Summer kW/part. Saved =			
16a) Avg Winter kW/part Saved =			
17) Avg. Summer kWh/Part. Saved =			
17a) Avg. Winter kWh/Part. Saved =			
18a) System Demand Line Loss Factor			
18b) System Energy Line Loss Factor			
19) Number of Participants =	125	218	332
20) Incentive/Participant =			
21) Effective Federal & State Income Tax Rate =			
22) Annual Summer Kwh Saved	211,357	319,974	475,427
Annual Winter Kwh Saved	280,272	427,732	575,190
23) Annual Summer KW Saved	128	189	259
Annual Winter KW Saved	90	161	216

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$1,135,768	2.82
Utility Cost Test	$1,408,077	4.99
Societal Test	$2,918,218	5.44
Participant Test	$915,130	2.62
Total Resource Cost Test	$1,142,328	2.85

Table 1
Ratepayer Impact Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

		Benefits															Costs						Annual
t	Year	Summer kWh Requirements Reduction (A1)	Winter kWh Requirements Reduction (A2)	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Total Energy Reduction (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Project Costs (O)	Benefits Less Costs (P)
1	2011	$227,156	$301,221	528,377		$15,114		$0	$145	$101	246		$24,277	$39,391		$211,357	$280,272	491,629	$7,163	$16,015	$66,333	$89,511	($50,120)
2	2012	571,050	760,927	1,331,977		39,800		0	355	281	636		65,268	105,068		531,331	708,004	1,239,335	18,647	27,809	108,620	155,076	(50,008)
3	2013	1,082,015	1,379,113	2,461,128		78,632		0	646	520	1,166		124,446	203,078		1,006,758	1,283,194	2,289,952	35,334	35,940	139,245	210,519	(7,441)
4	2014	1,082,015	1,379,113	2,461,128		82,399		0	646	520	1,166		129,426	211,825		1,006,758	1,283,194	2,289,952	36,033	0	0	36,033	175,792
5	2015	1,082,015	1,379,113	2,461,128		90,767		0	646	520	1,166		134,604	225,371		1,006,758	1,283,194	2,289,952	36,758	0	0	36,758	188,613
6	2016	1,078,952	1,378,307	2,457,259		91,410		0	642	520	1,162		139,500	230,910		1,003,908	1,282,444	2,286,352	37,365	0	0	37,365	193,545
7	2017	1,074,008	1,376,695	2,450,703		95,847		0	637	520	1,157		144,466	240,313		999,308	1,280,944	2,280,252	37,905	0	0	37,905	202,408
8	2018	1,066,001	1,374,277	2,440,278		103,736		0	627	519	1,146		148,809	252,545		991,858	1,278,694	2,270,552	38,311	0	0	38,311	214,234
9	2019	1,066,001	1,374,277	2,440,278		108,739		0	627	519	1,146		154,769	263,508		991,858	1,278,694	2,270,552	39,085	0	0	39,085	224,423
10	2020	1,065,667	1,374,277	2,439,944		116,363		0	626	519	1,145		160,815	277,178		991,548	1,278,694	2,270,242	39,862	0	0	39,862	237,316
11	2021	957,859	1,266,802	2,224,661		106,785		0	593	486	1,079		157,611	264,396		891,238	1,178,694	2,069,932	37,325	0	0	37,325	227,071
12	2022	796,314	1,105,590	1,901,904		91,938		0	542	436	978		148,567	240,505		740,928	1,028,694	1,769,622	32,991	0	0	32,991	207,514
13	2023	527,626	836,902	1,364,528		66,466		0	458	352	810		127,965	194,431		490,928	778,694	1,269,622	25,030	0	0	25,030	169,401
14	2024	527,626	836,902	1,364,528		67,009		0	458	352	810		133,083	200,092		490,928	778,694	1,269,622	25,533	0	0	25,533	174,559
15	2025	513,457	825,625	1,339,082		66,338		0	447	313	760		129,868	196,206		477,745	768,202	1,245,947	25,078	0	0	25,078	171,128
16	2026	437,591	704,960	1,142,551		57,128		0	386	192	578		102,716	159,844		407,156	655,930	1,063,086	21,101	0	0	21,101	138,743
17	2027	333,421	583,213	916,634		46,290		0	298	69	367		67,828	114,118		310,231	542,650	852,881	15,918	0	0	15,918	98,200
18	2028	220,862	396,099	616,961		31,483		0	191	20	211		40,557	72,040		205,501	368,550	574,051	10,929	0	0	10,929	61,111
19	2029	187,722	329,824	517,546		26,705		0	162	20	182		36,381	63,086		174,666	306,885	481,551	9,351	0	0	9,351	53,735
20	2030	121,442	197,275	318,717		16,637		0	104	20	124		25,779	42,416		112,996	183,555	296,551	5,873	0	0	5,873	36,543
Total =				33,179,312							16,035			$3,596,321				30,871,635				$929,554	$2,666,767
													NPV =	$1,760,706								$624,938	1,135,768

Total NPV = $1,135,768
Benefit/Cost Ratio = 2.82

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated

(K = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M = Program Admin Costs (13)
(N = Incentive/Participant (20) x Number of Participants (19)
(O = (L) + (M) + (N)
(P = (I) - (O)

Table 2
Utility Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$15,114	$0	$24,277	$39,391	$82,348	$82,348	($42,957)
2012	39,800	0	65,268	105,068	136,429	136,429	(31,361)
2013	78,632	0	124,446	203,078	175,185	175,185	27,893
2014	82,399	0	129,426	211,825	0	0	211,825
2015	90,767	0	134,604	225,371	0	0	225,371
2016	91,410	0	139,500	230,910	0	0	230,910
2017	95,847	0	144,466	240,313	0	0	240,313
2018	103,736	0	148,809	252,545	0	0	252,545
2019	108,739	0	154,769	263,508	0	0	263,508
2020	116,363	0	160,815	277,178	0	0	277,178
2021	106,785	0	157,611	264,396	0	0	264,396
2022	91,938	0	148,567	240,505	0	0	240,505
2023	66,466	0	127,965	194,431	0	0	194,431
2024	67,009	0	133,083	200,092	0	0	200,092
2025	66,338	0	129,868	196,206	0	0	196,206
2026	57,128	0	102,716	159,844	0	0	159,844
2027	46,290	0	67,828	114,118	0	0	114,118
2028	31,483	0	40,557	72,040	0	0	72,040
2029	26,705	0	36,381	63,086	0	0	63,086
2030	16,637	0	25,779	42,416	0	0	42,416
Total =				$3,596,321		$393,962	$3,202,359
			NPV =	$1,760,706		$352,629	1,408,077

Total NPV =	$1,408,077
Benefit/Cost Ratio =	4.99

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$15,114	$0	$24,277	$12,457	$51,848	$82,348	$62,131	$144,479	($92,631)
2012	39,800	0	65,268	34,220	139,288	136,429	99,759	236,188	(96,900)
2013	78,632	0	124,446	68,126	271,204	175,185	135,288	310,473	(39,269)
2014	82,399	0	129,426	73,188	285,013	0	0	0	285,013
2015	90,767	0	134,604	80,209	305,580	0	0	0	305,580
2016	91,410	0	139,500	84,648	315,558	0	0	0	315,558
2017	95,847	0	144,466	90,736	331,049	0	0	0	331,049
2018	103,736	0	148,809	98,215	350,760	0	0	0	350,760
2019	108,739	0	154,769	105,551	369,059	0	0	0	369,059
2020	116,363	0	160,815	114,357	391,535	0	0	0	391,535
2021	106,785	0	157,611	112,359	376,755	0	0	0	376,755
2022	91,938	0	148,567	105,270	345,775	0	0	0	345,775
2023	66,466	0	127,965	87,657	282,088	0	0	0	282,088
2024	67,009	0	133,083	92,916	293,008	0	0	0	293,008
2025	66,338	0	129,868	93,845	290,051	0	0	0	290,051
2026	57,128	0	102,716	78,746	238,590	0	0	0	238,590
2027	46,290	0	67,828	57,907	172,025	0	0	0	172,025
2028	31,483	0	40,557	37,652	109,692	0	0	0	109,692
2029	26,705	0	36,381	33,960	97,046	0	0	0	97,046
2030	16,637	0	25,779	23,518	65,934	0	0	0	65,934
Total =					$5,081,858			$691,140	$4,390,718
				NPV =	$3,575,007			$656,789	2,918,218

Total NPV =	$2,918,218
Benefit/Cost Ratio =	5.44

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits													Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$66,333			$211,357	$280,272	491,629	$24,430	128	90			$5,234	$0	$95,997	$131,175	$0	$131,175	($35,178)
2012	108,620			531,331	708,004	1,239,335	65,002	319	251			12,820	0	186,442	217,267	0	217,267	(30,825)
2013	139,245			1,006,758	1,283,194	2,289,952	126,778	579	466			24,466	0	290,489	292,279	0	292,279	(1,790)
2014	0			1,006,758	1,283,194	2,289,952	133,017	579	466			24,955	0	157,972	0	0	0	157,972
2015	0			1,006,758	1,283,194	2,289,952	139,586	579	466			25,453	0	165,039	0	0	0	165,039
2016	0			1,003,908	1,282,444	2,286,352	146,092	576	466			25,964	0	172,056	0	0	0	172,056
2017	0			999,308	1,280,944	2,280,252	152,616	570	465			26,483	0	179,099	0	0	0	179,099
2018	0			991,858	1,278,694	2,270,552	159,034	562	465			27,012	0	186,046	0	0	0	186,046
2019	0			991,858	1,278,694	2,270,552	166,867	562	465			27,552	0	194,419	0	0	0	194,419
2020	0			991,548	1,278,694	2,270,242	175,060	562	465			28,102	0	203,162	0	0	0	203,162
2021	0			891,238	1,178,694	2,069,932	167,765	531	435			26,203	0	193,968	0	0	0	193,968
2022	0			740,928	1,028,694	1,769,622	150,982	486	390			22,962	0	173,944	0	0	0	173,944
2023	0			490,928	778,694	1,269,622	114,697	411	315			17,017	0	131,714	0	0	0	131,714
2024	0			490,928	778,694	1,269,622	120,353	411	315			17,358	0	137,711	0	0	0	137,711
2025	0			477,745	768,202	1,245,947	122,621	401	280			17,705	0	140,326	0	0	0	140,326
2026	0			407,156	655,930	1,063,086	107,900	343	171			15,448	0	123,348	0	0	0	123,348
2027	0			310,231	542,650	852,881	86,739	266	61			12,813	0	99,552	0	0	0	99,552
2028	0			205,501	368,550	574,051	61,150	170	17			7,066	0	68,216	0	0	0	68,216
2029	0			174,666	306,885	481,551	53,906	144	17			6,259	0	60,165	0	0	0	60,165
2030	0			112,996	183,555	296,551	35,031	92	17			4,453	0	39,484	0	0	0	39,484
Total =				13,043,759	17,827,876			8,271	6,083					$2,999,149			$640,721	$2,358,428
													NPV =	$1,479,623			$564,494	915,130

Total NPV = $915,130
Benefit/Cost Ratio = 2.62

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Total Program without Demand Response**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$15,114	$24,277	$39,391	$82,348	$62,131	$144,479	($105,088)
2012	39,800	65,268	105,068	136,429	99,759	236,188	(131,120)
2013	78,632	124,446	203,078	175,185	135,288	310,473	(107,395)
2014	82,399	129,426	211,825	0	0	0	211,825
2015	90,767	134,604	225,371	0	0	0	225,371
2016	91,410	139,500	230,910	0	0	0	230,910
2017	95,847	144,466	240,313	0	0	0	240,313
2018	103,736	148,809	252,545	0	0	0	252,545
2019	108,739	154,769	263,508	0	0	0	263,508
2020	116,363	160,815	277,178	0	0	0	277,178
2021	106,785	157,611	264,396	0	0	0	264,396
2022	91,938	148,567	240,505	0	0	0	240,505
2023	66,466	127,965	194,431	0	0	0	194,431
2024	67,009	133,083	200,092	0	0	0	200,092
2025	66,338	129,868	196,206	0	0	0	196,206
2026	57,128	102,716	159,844	0	0	0	159,844
2027	46,290	67,828	114,118	0	0	0	114,118
2028	31,483	40,557	72,040	0	0	0	72,040
2029	26,705	36,381	63,086	0	0	0	63,086
2030	16,637	25,779	42,416	0	0	0	42,416
		Total =	$3,596,321			$691,140	$2,905,181
		NPV =	$1,760,706			$618,378	1,142,328

Total NPV =	$1,142,328
Benefit/Cost Ratio =	2.85

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$362	$894	$1,798
Incentive Costs =	1,500	3,000	6,000
Total Utility Project Costs =	$1,862	$3,894	$7,798
14) Direct Participant Costs ($/Part.) =	$520	$520	$520
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	NA
16) Avg Summer kW/part. Saved =	0.621	0.621	0.621
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	887	887	887
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	10	20
20) Incentive/Participant =	$300	$300	$300
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	4,435	8,870	17,740
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	3	6	12
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$12,219	1.62
Utility Cost Test	$20,135	2.69
Societal Test	$45,431	3.27
Participant Test	$17,170	2.04
Total Resource Cost Test	$13,365	1.72

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	4,767	$0.02860	$136	$0.00000	$0	3	0	3	$98.68	$296	$432	$0.05091	4,435	0	4,435	$137	$362	$1,500	$1,999	($1,567)
2	2012	14,300	0.02988	427	0.00000	0	10	0	10	102.62	1,026	1,453	0.05193	13,305	0	13,305	419	894	3,000	4,313	(2,860)
3	2013	33,366	0.03195	1,066	0.00000	0	24	0	24	106.73	2,562	3,628	0.05296	31,045	0	31,045	997	1,798	6,000	8,795	(5,167)
4	2014	33,366	0.03348	1,117	0.00000	0	24	0	24	111.00	2,664	3,781	0.05402	31,045	0	31,045	1,017	0	0	1,017	2,764
5	2015	33,366	0.03688	1,231	0.00000	0	24	0	24	115.44	2,771	4,002	0.05510	31,045	0	31,045	1,037	0	0	1,037	2,965
6	2016	33,366	0.03720	1,241	0.00000	0	24	0	24	120.05	2,881	4,122	0.05621	31,045	0	31,045	1,058	0	0	1,058	3,064
7	2017	33,366	0.03911	1,305	0.00000	0	24	0	24	124.86	2,997	4,302	0.05733	31,045	0	31,045	1,079	0	0	1,079	3,223
8	2018	33,366	0.04251	1,418	0.00000	0	24	0	24	129.85	3,116	4,534	0.05848	31,045	0	31,045	1,100	0	0	1,100	3,434
9	2019	33,366	0.04456	1,487	0.00000	0	24	0	24	135.05	3,241	4,728	0.05965	31,045	0	31,045	1,122	0	0	1,122	3,606
10	2020	33,366	0.04769	1,591	0.00000	0	24	0	24	140.45	3,371	4,962	0.06084	31,045	0	31,045	1,145	0	0	1,145	3,817
11	2021	33,366	0.04800	1,602	0.00000	0	24	0	24	146.07	3,506	5,108	0.06206	31,045	0	31,045	1,168	0	0	1,168	3,940
12	2022	33,366	0.04834	1,613	0.00000	0	24	0	24	151.91	3,646	5,259	0.06330	31,045	0	31,045	1,191	0	0	1,191	4,068
13	2023	33,366	0.04871	1,625	0.00000	0	24	0	24	157.98	3,792	5,417	0.06456	31,045	0	31,045	1,215	0	0	1,215	4,202
14	2024	33,366	0.04911	1,639	0.00000	0	24	0	24	164.30	3,943	5,582	0.06586	31,045	0	31,045	1,239	0	0	1,239	4,343
15	2025	28,599	0.04954	1,417	0.00000	0	21	0	21	170.88	3,588	5,005	0.06717	26,610	0	26,610	1,083	0	0	1,083	3,922
16	2026	19,066	0.05000	953	0.00000	0	14	0	14	177.71	2,488	3,441	0.06852	17,740	0	17,740	737	0	0	737	2,704
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		467,124							336			$65,756				434,630				$29,298	$36,458
											NPV =	$32,040								$19,821	12,219

Total NPV = $12,219
Benefit/Cost Ratio = 1.62

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$136	$0	$296	$432	$1,862	$1,862	($1,430)
2012	427	0	1,026	1,453	3,894	3,894	(2,441)
2013	1,066	0	2,562	3,628	7,798	7,798	(4,170)
2014	1,117	0	2,664	3,781	0	0	3,781
2015	1,231	0	2,771	4,002	0	0	4,002
2016	1,241	0	2,881	4,122	0	0	4,122
2017	1,305	0	2,997	4,302	0	0	4,302
2018	1,418	0	3,116	4,534	0	0	4,534
2019	1,487	0	3,241	4,728	0	0	4,728
2020	1,591	0	3,371	4,962	0	0	4,962
2021	1,602	0	3,506	5,108	0	0	5,108
2022	1,613	0	3,646	5,259	0	0	5,259
2023	1,625	0	3,792	5,417	0	0	5,417
2024	1,639	0	3,943	5,582	0	0	5,582
2025	1,417	0	3,588	5,005	0	0	5,005
2026	953	0	2,488	3,441	0	0	3,441
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$65,756		$13,554	$52,202
			NPV =	$32,040		$11,905	20,135

Total NPV =	$20,135
Benefit/Cost Ratio =	2.69

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$136	$0	$296	$137	$569	$1,862	$1,100	$2,962	($2,393)
2012	427	0	1,026	473	1,926	3,894	2,200	6,094	(4,168)
2013	1,066	0	2,562	1,217	4,845	7,798	4,400	12,198	(7,353)
2014	1,117	0	2,664	1,306	5,087	0	0	0	5,087
2015	1,231	0	2,771	1,424	5,426	0	0	0	5,426
2016	1,241	0	2,881	1,511	5,633	0	0	0	5,633
2017	1,305	0	2,997	1,624	5,926	0	0	0	5,926
2018	1,418	0	3,116	1,763	6,297	0	0	0	6,297
2019	1,487	0	3,241	1,894	6,622	0	0	0	6,622
2020	1,591	0	3,371	2,047	7,009	0	0	0	7,009
2021	1,602	0	3,506	2,171	7,279	0	0	0	7,279
2022	1,613	0	3,646	2,302	7,561	0	0	0	7,561
2023	1,625	0	3,792	2,442	7,859	0	0	0	7,859
2024	1,639	0	3,943	2,592	8,174	0	0	0	8,174
2025	1,417	0	3,588	2,394	7,399	0	0	0	7,399
2026	953	0	2,488	1,695	5,136	0	0	0	5,136
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$92,748			$21,254	$71,494
				NPV =	$65,465			$20,034	45,431

Total NPV = $45,431
Benefit/Cost Ratio = 3.27

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,500	$0.08587	$0.07039	4,435	0	4,435	$381	3	0	$0.000	$0.000	$0	$0	$1,881	$2,655	$0	$2,655	($774)
2012	3,000	0.09010	0.07386	13,305	0	13,305	1,199	9	0	0.000	0.000	0	0	4,199	5,422	0	5,422	(1,223)
2013	6,000	0.09454	0.07750	31,045	0	31,045	2,935	22	0	0.000	0.000	0	0	8,935	11,072	0	11,072	(2,137)
2014	0	0.09920	0.08132	31,045	0	31,045	3,080	22	0	0.000	0.000	0	0	3,080	0	0	0	3,080
2015	0	0.10410	0.08533	31,045	0	31,045	3,232	22	0	0.000	0.000	0	0	3,232	0	0	0	3,232
2016	0	0.10923	0.08954	31,045	0	31,045	3,391	22	0	0.000	0.000	0	0	3,391	0	0	0	3,391
2017	0	0.11461	0.09395	31,045	0	31,045	3,558	22	0	0.000	0.000	0	0	3,558	0	0	0	3,558
2018	0	0.12027	0.09859	31,045	0	31,045	3,734	22	0	0.000	0.000	0	0	3,734	0	0	0	3,734
2019	0	0.12620	0.10345	31,045	0	31,045	3,918	22	0	0.000	0.000	0	0	3,918	0	0	0	3,918
2020	0	0.13242	0.10855	31,045	0	31,045	4,111	22	0	0.000	0.000	0	0	4,111	0	0	0	4,111
2021	0	0.13895	0.11390	31,045	0	31,045	4,314	22	0	0.000	0.000	0	0	4,314	0	0	0	4,314
2022	0	0.14580	0.11952	31,045	0	31,045	4,526	22	0	0.000	0.000	0	0	4,526	0	0	0	4,526
2023	0	0.15299	0.12541	31,045	0	31,045	4,750	22	0	0.000	0.000	0	0	4,750	0	0	0	4,750
2024	0	0.16053	0.13160	31,045	0	31,045	4,984	22	0	0.000	0.000	0	0	4,984	0	0	0	4,984
2025	0	0.16845	0.13809	26,610	0	26,610	4,482	19	0	0.000	0.000	0	0	4,482	0	0	0	4,482
2026	0	0.17676	0.14490	17,740	0	17,740	3,136	12	0	0.000	0.000	0	0	3,136	0	0	0	3,136
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				434,630	0			307	0					$66,231			$19,149	$47,082
													NPV =	$33,709			$16,538	17,170

Total NPV = $17,170
Benefit/Cost Ratio = 2.04

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 1 (14.5 SEER)**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$136	$296	$432	$1,862	$1,100	$2,962	($2,530)
2012	427	1,026	1,453	3,894	2,200	6,094	(4,641)
2013	1,066	2,562	3,628	7,798	4,400	12,198	(8,570)
2014	1,117	2,664	3,781	0	0	0	3,781
2015	1,231	2,771	4,002	0	0	0	4,002
2016	1,241	2,881	4,122	0	0	0	4,122
2017	1,305	2,997	4,302	0	0	0	4,302
2018	1,418	3,116	4,534	0	0	0	4,534
2019	1,487	3,241	4,728	0	0	0	4,728
2020	1,591	3,371	4,962	0	0	0	4,962
2021	1,602	3,506	5,108	0	0	0	5,108
2022	1,613	3,646	5,259	0	0	0	5,259
2023	1,625	3,792	5,417	0	0	0	5,417
2024	1,639	3,943	5,582	0	0	0	5,582
2025	1,417	3,588	5,005	0	0	0	5,005
2026	953	2,488	3,441	0	0	0	3,441
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$65,756			$21,254	$44,502
		NPV =	$32,040			$18,675	13,365

Total NPV = $13,365
Benefit/Cost Ratio = 1.72

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$724	$1,788	$3,596
Incentive Costs =	3,000	6,000	12,000
Total Utility Project Costs =	$3,724	$7,788	$15,596
14) Direct Participant Costs ($/Part.) =	$1,037	$1,037	$1,037
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.570	0.570	0.570
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,072	1,072	1,072
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	10	20
20) Incentive/Participant =	$600	$600	$600
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	5,360	10,720	21,440
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	3	6	11
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	($1,074)	0.97
Utility Cost Test	$8,491	1.36
Societal Test	$25,953	1.65
Participant Test	$14,942	1.45
Total Resource Cost Test	($4,956)	0.87

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	5,761	$0.02860	$165	$0.00000	$0	3	0	3	$98.68	$296	$461	$0.05091	5,360	0	5,360	$165	$724	$3,000	$3,889	($3,428)
2	2012	17,282	0.02988	516	0.00000	0	10	0	10	102.62	1,026	1,542	0.05193	16,080	0	16,080	506	1,788	6,000	8,294	(6,752)
3	2013	40,325	0.03195	1,288	0.00000	0	22	0	22	106.73	2,348	3,636	0.05296	37,520	0	37,520	1,204	3,596	12,000	16,800	(13,164)
4	2014	40,325	0.03348	1,350	0.00000	0	22	0	22	111.00	2,442	3,792	0.05402	37,520	0	37,520	1,229	0	0	1,229	2,563
5	2015	40,325	0.03688	1,487	0.00000	0	22	0	22	115.44	2,540	4,027	0.05510	37,520	0	37,520	1,253	0	0	1,253	2,774
6	2016	40,325	0.03720	1,500	0.00000	0	22	0	22	120.05	2,641	4,141	0.05621	37,520	0	37,520	1,278	0	0	1,278	2,863
7	2017	40,325	0.03911	1,577	0.00000	0	22	0	22	124.86	2,747	4,324	0.05733	37,520	0	37,520	1,304	0	0	1,304	3,020
8	2018	40,325	0.04251	1,714	0.00000	0	22	0	22	129.85	2,857	4,571	0.05848	37,520	0	37,520	1,330	0	0	1,330	3,241
9	2019	40,325	0.04456	1,797	0.00000	0	22	0	22	135.05	2,971	4,768	0.05965	37,520	0	37,520	1,357	0	0	1,357	3,411
10	2020	40,325	0.04769	1,923	0.00000	0	22	0	22	140.45	3,090	5,013	0.06084	37,520	0	37,520	1,384	0	0	1,384	3,629
11	2021	40,325	0.04800	1,936	0.00000	0	22	0	22	146.07	3,214	5,150	0.06206	37,520	0	37,520	1,411	0	0	1,411	3,739
12	2022	40,325	0.04834	1,949	0.00000	0	22	0	22	151.91	3,342	5,291	0.06330	37,520	0	37,520	1,440	0	0	1,440	3,851
13	2023	40,325	0.04871	1,964	0.00000	0	22	0	22	157.98	3,476	5,440	0.06456	37,520	0	37,520	1,468	0	0	1,468	3,972
14	2024	40,325	0.04911	1,980	0.00000	0	22	0	22	164.30	3,615	5,595	0.06586	37,520	0	37,520	1,498	0	0	1,498	4,097
15	2025	34,564	0.04954	1,712	0.00000	0	19	0	19	170.88	3,247	4,959	0.06717	32,160	0	32,160	1,309	0	0	1,309	3,650
16	2026	23,043	0.05000	1,152	0.00000	0	13	0	13	177.71	2,310	3,462	0.06852	21,440	0	21,440	890	0	0	890	2,572
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		564,550							309			$66,172				525,280				$46,134	$20,038
											NPV =	$32,301								$33,375	(1,074)

Total NPV = ($1,074)
Benefit/Cost Ratio = 0.97

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$165	$0	$296	$461	$3,724	$3,724	($3,263)
2012	516	0	1,026	1,542	7,788	7,788	(6,246)
2013	1,288	0	2,348	3,636	15,596	15,596	(11,960)
2014	1,350	0	2,442	3,792	0	0	3,792
2015	1,487	0	2,540	4,027	0	0	4,027
2016	1,500	0	2,641	4,141	0	0	4,141
2017	1,577	0	2,747	4,324	0	0	4,324
2018	1,714	0	2,857	4,571	0	0	4,571
2019	1,797	0	2,971	4,768	0	0	4,768
2020	1,923	0	3,090	5,013	0	0	5,013
2021	1,936	0	3,214	5,150	0	0	5,150
2022	1,949	0	3,342	5,291	0	0	5,291
2023	1,964	0	3,476	5,440	0	0	5,440
2024	1,980	0	3,615	5,595	0	0	5,595
2025	1,712	0	3,247	4,959	0	0	4,959
2026	1,152	0	2,310	3,462	0	0	3,462
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$66,172		$27,108	$39,064
			NPV =	$32,301		$23,810	8,491

Total NPV =	$8,491
Benefit/Cost Ratio =	1.36

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$165	$0	$296	$146	$607	$3,724	$2,185	$5,909	($5,302)
2012	516	0	1,026	502	2,044	7,788	4,370	12,158	(10,114)
2013	1,288	0	2,348	1,220	4,856	15,596	8,740	24,336	(19,480)
2014	1,350	0	2,442	1,310	5,102	0	0	0	5,102
2015	1,487	0	2,540	1,433	5,460	0	0	0	5,460
2016	1,500	0	2,641	1,518	5,659	0	0	0	5,659
2017	1,577	0	2,747	1,633	5,957	0	0	0	5,957
2018	1,714	0	2,857	1,778	6,349	0	0	0	6,349
2019	1,797	0	2,971	1,910	6,678	0	0	0	6,678
2020	1,923	0	3,090	2,068	7,081	0	0	0	7,081
2021	1,936	0	3,214	2,189	7,339	0	0	0	7,339
2022	1,949	0	3,342	2,316	7,607	0	0	0	7,607
2023	1,964	0	3,476	2,453	7,893	0	0	0	7,893
2024	1,980	0	3,615	2,598	8,193	0	0	0	8,193
2025	1,712	0	3,247	2,372	7,331	0	0	0	7,331
2026	1,152	0	2,310	1,706	5,168	0	0	0	5,168
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$93,324			$42,403	$50,921
				NPV =	$65,922			$39,969	25,953

Total NPV = $25,953
Benefit/Cost Ratio = 1.65

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$3,000	$0.08587	$0.07039	5,360	0	5,360	$460	3	0	$0.000	$0.000	$0	$0	$3,460	$5,294	$0	$5,294	($1,834)
2012	6,000	0.09010	0.07386	16,080	0	16,080	1,449	9	0	0.000	0.000	0	0	7,449	10,812	0	10,812	(3,363)
2013	12,000	0.09454	0.07750	37,520	0	37,520	3,547	20	0	0.000	0.000	0	0	15,547	22,081	0	22,081	(6,534)
2014	0	0.09920	0.08132	37,520	0	37,520	3,722	20	0	0.000	0.000	0	0	3,722	0	0	0	3,722
2015	0	0.10410	0.08533	37,520	0	37,520	3,906	20	0	0.000	0.000	0	0	3,906	0	0	0	3,906
2016	0	0.10923	0.08954	37,520	0	37,520	4,098	20	0	0.000	0.000	0	0	4,098	0	0	0	4,098
2017	0	0.11461	0.09395	37,520	0	37,520	4,300	20	0	0.000	0.000	0	0	4,300	0	0	0	4,300
2018	0	0.12027	0.09859	37,520	0	37,520	4,513	20	0	0.000	0.000	0	0	4,513	0	0	0	4,513
2019	0	0.12620	0.10345	37,520	0	37,520	4,735	20	0	0.000	0.000	0	0	4,735	0	0	0	4,735
2020	0	0.13242	0.10855	37,520	0	37,520	4,968	20	0	0.000	0.000	0	0	4,968	0	0	0	4,968
2021	0	0.13895	0.11390	37,520	0	37,520	5,213	20	0	0.000	0.000	0	0	5,213	0	0	0	5,213
2022	0	0.14580	0.11952	37,520	0	37,520	5,470	20	0	0.000	0.000	0	0	5,470	0	0	0	5,470
2023	0	0.15299	0.12541	37,520	0	37,520	5,740	20	0	0.000	0.000	0	0	5,740	0	0	0	5,740
2024	0	0.16053	0.13160	37,520	0	37,520	6,023	20	0	0.000	0.000	0	0	6,023	0	0	0	6,023
2025	0	0.16845	0.13809	32,160	0	32,160	5,417	17	0	0.000	0.000	0	0	5,417	0	0	0	5,417
2026	0	0.17676	0.14490	21,440	0	21,440	3,790	11	0	0.000	0.000	0	0	3,790	0	0	0	3,790
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				525,280	0			280	0					$88,351			$38,187	$50,164
													NPV =	$47,923			$32,981	14,942

Total NPV =	$14,942
Benefit/Cost Ratio =	1.45

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$165	$296	$461	$3,724	$2,185	$5,909	($5,448)
2012	516	1,026	1,542	7,788	4,370	12,158	(10,616)
2013	1,288	2,348	3,636	15,596	8,740	24,336	(20,700)
2014	1,350	2,442	3,792	0	0	0	3,792
2015	1,487	2,540	4,027	0	0	0	4,027
2016	1,500	2,641	4,141	0	0	0	4,141
2017	1,577	2,747	4,324	0	0	0	4,324
2018	1,714	2,857	4,571	0	0	0	4,571
2019	1,797	2,971	4,768	0	0	0	4,768
2020	1,923	3,090	5,013	0	0	0	5,013
2021	1,936	3,214	5,150	0	0	0	5,150
2022	1,949	3,342	5,291	0	0	0	5,291
2023	1,964	3,476	5,440	0	0	0	5,440
2024	1,980	3,615	5,595	0	0	0	5,595
2025	1,712	3,247	4,959	0	0	0	4,959
2026	1,152	2,310	3,462	0	0	0	3,462
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$66,172			$42,403	$23,769
		NPV =	$32,301			$37,257	(4,956)

Total NPV = ($4,956)
Benefit/Cost Ratio = 0.87

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$724	$894	$899
Incentive Costs =	3,000	3,000	3,000
Total Utility Project Costs =	$3,724	$3,894	$3,899
14) Direct Participant Costs ($/Part.) =	$1,037	$1,037	$1,037
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	NA
16) Avg Summer kW/part. Saved =	0.570	0.570	0.570
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	412	412	412
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	5	5
20) Incentive/Participant =	$600	$600	$600
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	2,060	2,060	2,060
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	3	3	3
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	($780)	0.94
Utility Cost Test	$845	1.08
Societal Test	$5,296	1.31
Participant Test	($1,489)	0.90
Total Resource Cost Test	($5,152)	0.69

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,214	$0.02860	$63	$0.00000	$0	3	0	3	$98.68	$296	$359	$0.05091	2,060	0	2,060	$64	$724	$3,000	$3,788	($3,429)
2	2012	4,428	0.02988	132	0.00000	0	6	0	6	102.62	616	748	0.05193	4,120	0	4,120	130	894	3,000	4,024	(3,276)
3	2013	6,642	0.03195	212	0.00000	0	10	0	10	106.73	1,067	1,279	0.05296	6,180	0	6,180	198	899	3,000	4,097	(2,818)
4	2014	6,642	0.03348	222	0.00000	0	10	0	10	111.00	1,110	1,332	0.05402	6,180	0	6,180	202	0	0	202	1,130
5	2015	6,642	0.03688	245	0.00000	0	10	0	10	115.44	1,154	1,399	0.05510	6,180	0	6,180	206	0	0	206	1,193
6	2016	6,642	0.03720	247	0.00000	0	10	0	10	120.05	1,201	1,448	0.05621	6,180	0	6,180	211	0	0	211	1,237
7	2017	6,642	0.03911	260	0.00000	0	10	0	10	124.86	1,249	1,509	0.05733	6,180	0	6,180	215	0	0	215	1,294
8	2018	6,642	0.04251	282	0.00000	0	10	0	10	129.85	1,299	1,581	0.05848	6,180	0	6,180	219	0	0	219	1,362
9	2019	6,642	0.04456	296	0.00000	0	10	0	10	135.05	1,351	1,647	0.05965	6,180	0	6,180	223	0	0	223	1,424
10	2020	6,642	0.04769	317	0.00000	0	10	0	10	140.45	1,405	1,722	0.06084	6,180	0	6,180	228	0	0	228	1,494
11	2021	6,642	0.04800	319	0.00000	0	10	0	10	146.07	1,461	1,780	0.06206	6,180	0	6,180	232	0	0	232	1,548
12	2022	6,642	0.04834	321	0.00000	0	10	0	10	151.91	1,519	1,840	0.06330	6,180	0	6,180	237	0	0	237	1,603
13	2023	6,642	0.04871	324	0.00000	0	10	0	10	157.98	1,580	1,904	0.06456	6,180	0	6,180	242	0	0	242	1,662
14	2024	6,642	0.04911	326	0.00000	0	10	0	10	164.30	1,643	1,969	0.06586	6,180	0	6,180	247	0	0	247	1,722
15	2025	4,428	0.04954	219	0.00000	0	6	0	6	170.88	1,025	1,244	0.06717	4,120	0	4,120	168	0	0	168	1,076
16	2026	2,214	0.05000	111	0.00000	0	3	0	3	177.71	533	644	0.06852	2,060	0	2,060	86	0	0	86	558
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		92,988							138			$22,405				86,520				$14,625	$7,780
											NPV =	$11,367								$12,147	(780)

Total NPV = ($780)
Benefit/Cost Ratio = 0.94

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$63	$0	$296	$359	$3,724	$3,724	($3,365)
2012	132	0	616	748	3,894	3,894	(3,146)
2013	212	0	1,067	1,279	3,899	3,899	(2,620)
2014	222	0	1,110	1,332	0	0	1,332
2015	245	0	1,154	1,399	0	0	1,399
2016	247	0	1,201	1,448	0	0	1,448
2017	260	0	1,249	1,509	0	0	1,509
2018	282	0	1,299	1,581	0	0	1,581
2019	296	0	1,351	1,647	0	0	1,647
2020	317	0	1,405	1,722	0	0	1,722
2021	319	0	1,461	1,780	0	0	1,780
2022	321	0	1,519	1,840	0	0	1,840
2023	324	0	1,580	1,904	0	0	1,904
2024	326	0	1,643	1,969	0	0	1,969
2025	219	0	1,025	1,244	0	0	1,244
2026	111	0	533	644	0	0	644
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$22,405		$11,517	$10,888
			NPV =	$11,367		$10,522	845

Total NPV =	$845
Benefit/Cost Ratio =	1.08

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$63	$0	$296	$114	$473	$3,724	$2,185	$5,909	($5,436)
2012	132	0	616	244	992	3,894	2,185	6,079	(5,087)
2013	212	0	1,067	429	1,708	3,899	2,185	6,084	(4,376)
2014	222	0	1,110	460	1,792	0	0	0	1,792
2015	245	0	1,154	498	1,897	0	0	0	1,897
2016	247	0	1,201	531	1,979	0	0	0	1,979
2017	260	0	1,249	570	2,079	0	0	0	2,079
2018	282	0	1,299	615	2,196	0	0	0	2,196
2019	296	0	1,351	660	2,307	0	0	0	2,307
2020	317	0	1,405	710	2,432	0	0	0	2,432
2021	319	0	1,461	756	2,536	0	0	0	2,536
2022	321	0	1,519	805	2,645	0	0	0	2,645
2023	324	0	1,580	858	2,762	0	0	0	2,762
2024	326	0	1,643	914	2,883	0	0	0	2,883
2025	219	0	1,025	595	1,839	0	0	0	1,839
2026	111	0	533	317	961	0	0	0	961
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$31,481			$18,072	$13,409
				NPV =	$22,636			$17,340	5,296

Total NPV = $5,296
Benefit/Cost Ratio = 1.31

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits														Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$3,000	$0.08587	$0.07039	2,060	0	2,060	$177	3	0	$0.000	$0.000	$0	$0	$3,177	$5,294	$0	$5,294	($2,117)
2012	3,000	0.09010	0.07386	4,120	0	4,120	371	6	0	0.000	0.000	0	0	3,371	5,406	0	5,406	(2,035)
2013	3,000	0.09454	0.07750	6,180	0	6,180	584	9	0	0.000	0.000	0	0	3,584	5,520	0	5,520	(1,936)
2014	0	0.09920	0.08132	6,180	0	6,180	613	9	0	0.000	0.000	0	0	613	0	0	0	613
2015	0	0.10410	0.08533	6,180	0	6,180	643	9	0	0.000	0.000	0	0	643	0	0	0	643
2016	0	0.10923	0.08954	6,180	0	6,180	675	9	0	0.000	0.000	0	0	675	0	0	0	675
2017	0	0.11461	0.09395	6,180	0	6,180	708	9	0	0.000	0.000	0	0	708	0	0	0	708
2018	0	0.12027	0.09859	6,180	0	6,180	743	9	0	0.000	0.000	0	0	743	0	0	0	743
2019	0	0.12620	0.10345	6,180	0	6,180	780	9	0	0.000	0.000	0	0	780	0	0	0	780
2020	0	0.13242	0.10855	6,180	0	6,180	818	9	0	0.000	0.000	0	0	818	0	0	0	818
2021	0	0.13895	0.11390	6,180	0	6,180	859	9	0	0.000	0.000	0	0	859	0	0	0	859
2022	0	0.14580	0.11952	6,180	0	6,180	901	9	0	0.000	0.000	0	0	901	0	0	0	901
2023	0	0.15299	0.12541	6,180	0	6,180	945	9	0	0.000	0.000	0	0	945	0	0	0	945
2024	0	0.16053	0.13160	6,180	0	6,180	992	9	0	0.000	0.000	0	0	992	0	0	0	992
2025	0	0.16845	0.13809	4,120	0	4,120	694	6	0	0.000	0.000	0	0	694	0	0	0	694
2026	0	0.17676	0.14490	2,060	0	2,060	364	3	0	0.000	0.000	0	0	364	0	0	0	364
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				86,520	0			126	0					$19,867			$16,220	$3,647
													NPV =	$13,163			$14,652	(1,489)

Total NPV = ($1,489)
Benefit/Cost Ratio = 0.90

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 2 - New**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$63	$296	$359	$3,724	$2,185	$5,909	($5,550)
2012	132	616	748	3,894	2,185	6,079	(5,331)
2013	212	1,067	1,279	3,899	2,185	6,084	(4,805)
2014	222	1,110	1,332	0	0	0	1,332
2015	245	1,154	1,399	0	0	0	1,399
2016	247	1,201	1,448	0	0	0	1,448
2017	260	1,249	1,509	0	0	0	1,509
2018	282	1,299	1,581	0	0	0	1,581
2019	296	1,351	1,647	0	0	0	1,647
2020	317	1,405	1,722	0	0	0	1,722
2021	319	1,461	1,780	0	0	0	1,780
2022	321	1,519	1,840	0	0	0	1,840
2023	324	1,580	1,904	0	0	0	1,904
2024	326	1,643	1,969	0	0	0	1,969
2025	219	1,025	1,244	0	0	0	1,244
2026	111	533	644	0	0	0	644
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$22,405			$18,072	$4,333
		NPV =	$11,367			$16,519	(5,152)

Total NPV =	($5,152)
Benefit/Cost Ratio =	0.69

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Window AC Units**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$60	$75	$75
Incentive Costs =	250	250	250
Total Utility Project Costs =	$310	$325	$325
14) Direct Participant Costs ($/Part.) =	$75	$75	$75
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	9	9	9
16) Avg Summer kW/part. Saved =	0.090	0.090	0.090
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	62	62	62
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	5	5
20) Incentive/Participant =	$50	$50	$50
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	310	310	310
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	0	0
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$535	1.50
Utility Cost Test	$720	1.82
Societal Test	$1,499	2.17
Participant Test	$170	1.16
Total Resource Cost Test	$377	1.31

Table 1
Ratepayer Impact Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	333	$0.02860	$10	$0.00000	$0	1	0	1	$98.68	$99	$109	$0.05091	310	0	310	$10	$60	$250	$320	($211)
2	2012	666	0.02988	20	0.00000	0	1	0	1	102.62	103	123	0.05193	620	0	620	20	75	250	345	(222)
3	2013	1,000	0.03195	32	0.00000	0	2	0	2	106.73	213	245	0.05296	930	0	930	30	75	250	355	(110)
4	2014	1,000	0.03348	33	0.00000	0	2	0	2	111.00	222	255	0.05402	930	0	930	30	0	0	30	225
5	2015	1,000	0.03688	37	0.00000	0	2	0	2	115.44	231	268	0.05510	930	0	930	31	0	0	31	237
6	2016	1,000	0.03720	37	0.00000	0	2	0	2	120.05	240	277	0.05621	930	0	930	32	0	0	32	245
7	2017	1,000	0.03911	39	0.00000	0	2	0	2	124.86	250	289	0.05733	930	0	930	32	0	0	32	257
8	2018	1,000	0.04251	43	0.00000	0	2	0	2	129.85	260	303	0.05848	930	0	930	33	0	0	33	270
9	2019	1,000	0.04456	45	0.00000	0	2	0	2	135.05	270	315	0.05965	930	0	930	34	0	0	34	281
10	2020	666	0.04769	32	0.00000	0	1	0	1	140.45	140	172	0.06084	620	0	620	23	0	0	23	149
11	2021	333	0.04800	16	0.00000	0	1	0	1	146.07	146	162	0.06206	310	0	310	12	0	0	12	150
12	2022	0	0.04834	0	0.00000	0	0	0	0	151.91	0	0	0.06330	0	0	0	0	0	0	0	0
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.06456	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.06586	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.06717	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.06852	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		8,998							18			$2,518				8,370				$1,247	$1,271
											NPV =	$1,597								$1,062	535

Total NPV = $535
Benefit/Cost Ratio = 1.50

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$10	$0	$99	$109	$310	$310	($201)
2012	20	0	103	123	325	325	(202)
2013	32	0	213	245	325	325	(80)
2014	33	0	222	255	0	0	255
2015	37	0	231	268	0	0	268
2016	37	0	240	277	0	0	277
2017	39	0	250	289	0	0	289
2018	43	0	260	303	0	0	303
2019	45	0	270	315	0	0	315
2020	32	0	140	172	0	0	172
2021	16	0	146	162	0	0	162
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$2,518		$960	$1,558
			NPV =	$1,597		$877	720

Total NPV = $720
Benefit/Cost Ratio = 1.82

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$10	$0	$99	$34	$143	$310	$125	$435	($292)
2012	20	0	103	40	163	325	125	450	(287)
2013	32	0	213	82	327	325	125	450	(123)
2014	33	0	222	88	343	0	0	0	343
2015	37	0	231	95	363	0	0	0	363
2016	37	0	240	102	379	0	0	0	379
2017	39	0	250	109	398	0	0	0	398
2018	43	0	260	118	421	0	0	0	421
2019	45	0	270	126	441	0	0	0	441
2020	32	0	140	71	243	0	0	0	243
2021	16	0	146	69	231	0	0	0	231
2022	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$3,452			$1,335	$2,117
				NPV =	$2,780			$1,281	1,499

Total NPV = $1,499
Benefit/Cost Ratio = 2.17

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits														Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$250	$0.08587	$0.07039	310	0	310	$27	0	0	$0.000	$0.000	$0	$0	$277	$383	$0	$383	($106)
2012	250	0.09010	0.07386	620	0	620	56	1	0	0.000	0.000	0	0	306	391	0	391	(85)
2013	250	0.09454	0.07750	930	0	930	88	1	0	0.000	0.000	0	0	338	399	0	399	(61)
2014	0	0.09920	0.08132	930	0	930	92	1	0	0.000	0.000	0	0	92	0	0	0	92
2015	0	0.10410	0.08533	930	0	930	97	1	0	0.000	0.000	0	0	97	0	0	0	97
2016	0	0.10923	0.08954	930	0	930	102	1	0	0.000	0.000	0	0	102	0	0	0	102
2017	0	0.11461	0.09395	930	0	930	107	1	0	0.000	0.000	0	0	107	0	0	0	107
2018	0	0.12027	0.09859	930	0	930	112	1	0	0.000	0.000	0	0	112	0	0	0	112
2019	0	0.12620	0.10345	930	0	930	117	1	0	0.000	0.000	0	0	117	0	0	0	117
2020	0	0.13242	0.10855	620	0	620	82	1	0	0.000	0.000	0	0	82	0	0	0	82
2021	0	0.13895	0.11390	310	0	310	43	0	0	0.000	0.000	0	0	43	0	0	0	43
2022	0	0.14580	0.11952	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.15299	0.12541	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.16053	0.13160	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.16845	0.13809	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.17676	0.14490	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				8,370	0			9	0					$1,673			$1,173	$500
													NPV =	$1,230			$1,060	170

Total NPV = $170
Benefit/Cost Ratio = 1.16

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Window AC Units**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$10	$99	$109	$310	$125	$435	($326)
2012	20	103	123	325	125	450	(327)
2013	32	213	245	325	125	450	(205)
2014	33	222	255	0	0	0	255
2015	37	231	268	0	0	0	268
2016	37	240	277	0	0	0	277
2017	39	250	289	0	0	0	289
2018	43	260	303	0	0	0	303
2019	45	270	315	0	0	0	315
2020	32	140	172	0	0	0	172
2021	16	146	162	0	0	0	162
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$2,518			$1,335	$1,183
		NPV =	$1,597			$1,220	377

Total NPV =	$377
Benefit/Cost Ratio =	1.31

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **AC Tune-up**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$217	$402	$674
Incentive Costs =	900	1,350	2,250
Total Utility Project Costs =	$1,117	$1,752	$2,924
14) Direct Participant Costs ($/Part.) =	$45	$45	$45
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	5	5	5
16) Avg Summer kW/part. Saved =	0.160	0.160	0.160
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	110	110	110
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	20	30	50
20) Incentive/Participant =	$45	$45	$45
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	2,200	3,300	5,500
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	3	5	8
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$2,511	1.39
Utility Cost Test	$3,858	1.75
Societal Test	$8,789	2.60
Participant Test	$3,757	1.91
Total Resource Cost Test	$3,858	1.75

Table 1
Ratepayer Impact Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,364	$0.02860	$68	$0.00000	$0	4	0	4	$98.68	$395	$463	$0.05091	2,200	0	2,200	$68	$217	$900	$1,185	($722)
2	2012	5,911	0.02988	177	0.00000	0	9	0	9	102.62	924	1,101	0.05193	5,500	0	5,500	173	402	1,350	1,925	(824)
3	2013	11,822	0.03195	378	0.00000	0	18	0	18	106.73	1,921	2,299	0.05296	11,000	0	11,000	353	674	2,250	3,277	(978)
4	2014	11,822	0.03348	396	0.00000	0	18	0	18	111.00	1,998	2,394	0.05402	11,000	0	11,000	360	0	0	360	2,034
5	2015	11,822	0.03688	436	0.00000	0	18	0	18	115.44	2,078	2,514	0.05510	11,000	0	11,000	367	0	0	367	2,147
6	2016	9,458	0.03720	352	0.00000	0	14	0	14	120.05	1,681	2,033	0.05621	8,800	0	8,800	300	0	0	300	1,733
7	2017	5,911	0.03911	231	0.00000	0	9	0	9	124.86	1,124	1,355	0.05733	5,500	0	5,500	191	0	0	191	1,164
8	2018	0	0.04251	0	0.00000	0	0	0	0	129.85	0	0	0.05848	0	0	0	0	0	0	0	0
9	2019	0	0.04456	0	0.00000	0	0	0	0	135.05	0	0	0.05965	0	0	0	0	0	0	0	0
10	2020	0	0.04769	0	0.00000	0	0	0	0	140.45	0	0	0.06084	0	0	0	0	0	0	0	0
11	2021	0	0.04800	0	0.00000	0	0	0	0	146.07	0	0	0.06206	0	0	0	0	0	0	0	0
12	2022	0	0.04834	0	0.00000	0	0	0	0	151.91	0	0	0.06330	0	0	0	0	0	0	0	0
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.06456	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.06586	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.06717	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.06852	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		59,110							90			$12,159				55,000				$7,605	$4,554
											NPV =	$9,007								$6,496	2,511

Total NPV = $2,511
Benefit/Cost Ratio = 1.39

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$68	$0	$395	$463	$1,117	$1,117	($654)
2012	177	0	924	1,101	1,752	1,752	(651)
2013	378	0	1,921	2,299	2,924	2,924	(625)
2014	396	0	1,998	2,394	0	0	2,394
2015	436	0	2,078	2,514	0	0	2,514
2016	352	0	1,681	2,033	0	0	2,033
2017	231	0	1,124	1,355	0	0	1,355
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$12,159		$5,793	$6,366
			NPV =	$9,007		$5,149	3,858

Total NPV =	$3,858
Benefit/Cost Ratio =	1.75

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$68	$0	$395	$146	$609	$1,117	$0	$1,117	($508)
2012	177	0	924	359	1,460	1,752	0	1,752	(292)
2013	378	0	1,921	771	3,070	2,924	0	2,924	146
2014	396	0	1,998	827	3,221	0	0	0	3,221
2015	436	0	2,078	895	3,409	0	0	0	3,409
2016	352	0	1,681	745	2,778	0	0	0	2,778
2017	231	0	1,124	512	1,867	0	0	0	1,867
2018	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$16,414			$5,793	$10,621
				NPV =	$14,278			$5,489	8,789

Total NPV = $8,789
Benefit/Cost Ratio = 2.60

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$900	$0.08587	$0.07039	2,200	0	2,200	$189	3	0	$0.000	$0.000	$0	$0	$1,089	$919	$0	$919	$170
2012	1,350	0.09010	0.07386	5,500	0	5,500	496	8	0	0.000	0.000	0	0	1,846	1,408	0	1,408	438
2013	2,250	0.09454	0.07750	11,000	0	11,000	1,040	16	0	0.000	0.000	0	0	3,290	2,395	0	2,395	895
2014	0	0.09920	0.08132	11,000	0	11,000	1,091	16	0	0.000	0.000	0	0	1,091	0	0	0	1,091
2015	0	0.10410	0.08533	11,000	0	11,000	1,145	16	0	0.000	0.000	0	0	1,145	0	0	0	1,145
2016	0	0.10923	0.08954	8,800	0	8,800	961	13	0	0.000	0.000	0	0	961	0	0	0	961
2017	0	0.11461	0.09395	5,500	0	5,500	630	8	0	0.000	0.000	0	0	630	0	0	0	630
2018	0	0.12027	0.09859	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2019	0	0.12620	0.10345	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2020	0	0.13242	0.10855	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2021	0	0.13895	0.11390	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2022	0	0.14580	0.11952	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.15299	0.12541	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.16053	0.13160	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.16845	0.13809	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.17676	0.14490	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				55,000	0			80	0					$10,052			$4,722	$5,330
													NPV =	$7,891			$4,134	3,757

Total NPV = $3,757
Benefit/Cost Ratio = 1.91

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **AC Tune-up**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$68	$395	$463	$1,117	$0	$1,117	($654)
2012	177	924	1,101	1,752	0	1,752	(651)
2013	378	1,921	2,299	2,924	0	2,924	(625)
2014	396	1,998	2,394	0	0	0	2,394
2015	436	2,078	2,514	0	0	0	2,514
2016	352	1,681	2,033	0	0	0	2,033
2017	231	1,124	1,355	0	0	0	1,355
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$12,159			$5,793	$6,366
		NPV =	$9,007			$5,149	3,858

Total NPV = $3,858
Benefit/Cost Ratio = 1.75

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **New Construction Bundle**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$435	$805	$1,349
Incentive Costs =	1,800	2,700	4,500
Total Utility Project Costs =	$2,235	$3,505	$5,849
14) Direct Participant Costs ($/Part.) =	$1,337	$1,337	$1,337
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.580	0.580	0.580
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	664	664	664
17a) Avg. Winter kWh/Part. Saved =	504	504	504
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	3	5
20) Incentive/Participant =	$900	$900	$900
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	1,328	1,992	3,320
Annual Winter Kwh Saved	1,008	1,512	2,520
23) Annual Summer KW Saved	1	2	3
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	($4,011)	0.70
Utility Cost Test	($1,005)	0.90
Societal Test	$3,729	1.25
Participant Test	$4,215	1.34
Total Resource Cost Test	($4,894)	0.66

Table 1
Ratepayer Impact Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,510	$0.02860	$72	$0.00000	$0	1	0	1	$98.68	$99	$171	$0.05091	1,328	1,008	2,336	$72	$435	$1,800	$2,307	($2,136)
2	2012	6,276	0.02988	188	0.00000	0	3	0	3	102.62	308	496	0.05193	3,320	2,520	5,840	184	805	2,700	3,689	(3,193)
3	2013	12,553	0.03195	401	0.00000	0	6	0	6	106.73	640	1,041	0.05296	6,640	5,040	11,680	375	1,349	4,500	6,224	(5,183)
4	2014	12,553	0.03348	420	0.00000	0	6	0	6	111.00	666	1,086	0.05402	6,640	5,040	11,680	382	0	0	382	704
5	2015	12,553	0.03688	463	0.00000	0	6	0	6	115.44	693	1,156	0.05510	6,640	5,040	11,680	390	0	0	390	766
6	2016	12,553	0.03720	467	0.00000	0	6	0	6	120.05	720	1,187	0.05621	6,640	5,040	11,680	398	0	0	398	789
7	2017	12,553	0.03911	491	0.00000	0	6	0	6	124.86	749	1,240	0.05733	6,640	5,040	11,680	406	0	0	406	834
8	2018	12,553	0.04251	534	0.00000	0	6	0	6	129.85	779	1,313	0.05848	6,640	5,040	11,680	414	0	0	414	899
9	2019	12,553	0.04456	559	0.00000	0	6	0	6	135.05	810	1,369	0.05965	6,640	5,040	11,680	422	0	0	422	947
10	2020	12,553	0.04769	599	0.00000	0	6	0	6	140.45	843	1,442	0.06084	6,640	5,040	11,680	431	0	0	431	1,011
11	2021	12,553	0.04800	603	0.00000	0	6	0	6	146.07	876	1,479	0.06206	6,640	5,040	11,680	439	0	0	439	1,040
12	2022	12,553	0.04834	607	0.00000	0	6	0	6	151.91	911	1,518	0.06330	6,640	5,040	11,680	448	0	0	448	1,070
13	2023	12,553	0.04871	611	0.00000	0	6	0	6	157.98	948	1,559	0.06456	6,640	5,040	11,680	457	0	0	457	1,102
14	2024	12,553	0.04911	616	0.00000	0	6	0	6	164.30	986	1,602	0.06586	6,640	5,040	11,680	466	0	0	466	1,136
15	2025	10,042	0.04954	497	0.00000	0	5	0	5	170.88	854	1,351	0.06717	5,312	4,032	9,344	380	0	0	380	971
16	2026	6,276	0.05000	314	0.00000	0	3	0	3	177.71	533	847	0.06852	3,320	2,520	5,840	243	0	0	243	604
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		175,740							84			$18,857				163,520				$17,496	$1,361
											NPV =	$9,296								$13,307	(4,011)

Total NPV = ($4,011)
Benefit/Cost Ratio = 0.70

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$72	$0	$99	$171	$2,235	$2,235	($2,064)
2012	188	0	308	496	3,505	3,505	(3,009)
2013	401	0	640	1,041	5,849	5,849	(4,808)
2014	420	0	666	1,086	0	0	1,086
2015	463	0	693	1,156	0	0	1,156
2016	467	0	720	1,187	0	0	1,187
2017	491	0	749	1,240	0	0	1,240
2018	534	0	779	1,313	0	0	1,313
2019	559	0	810	1,369	0	0	1,369
2020	599	0	843	1,442	0	0	1,442
2021	603	0	876	1,479	0	0	1,479
2022	607	0	911	1,518	0	0	1,518
2023	611	0	948	1,559	0	0	1,559
2024	616	0	986	1,602	0	0	1,602
2025	497	0	854	1,351	0	0	1,351
2026	314	0	533	847	0	0	847
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$18,857		$11,589	$7,268
			NPV =	$9,296		$10,301	(1,005)

Total NPV = ($1,005)
Benefit/Cost Ratio = 0.90

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$72	$0	$99	$54	$225	$2,235	$874	$3,109	($2,884)
2012	188	0	308	162	658	3,505	1,311	4,816	(4,158)
2013	401	0	640	349	1,390	5,849	2,185	8,034	(6,644)
2014	420	0	666	375	1,461	0	0	0	1,461
2015	463	0	693	411	1,567	0	0	0	1,567
2016	467	0	720	435	1,622	0	0	0	1,622
2017	491	0	749	468	1,708	0	0	0	1,708
2018	534	0	779	511	1,824	0	0	0	1,824
2019	559	0	810	548	1,917	0	0	0	1,917
2020	599	0	843	595	2,037	0	0	0	2,037
2021	603	0	876	629	2,108	0	0	0	2,108
2022	607	0	911	664	2,182	0	0	0	2,182
2023	611	0	948	703	2,262	0	0	0	2,262
2024	616	0	986	744	2,346	0	0	0	2,346
2025	497	0	854	646	1,997	0	0	0	1,997
2026	314	0	533	417	1,264	0	0	0	1,264
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$26,568			$15,959	$10,609
				NPV =	$18,852			$15,123	3,729

Total NPV = $3,729
Benefit/Cost Ratio = 1.25

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,800	$0.08587	$0.07039	1,328	1,008	2,336	$185	1	0	$0.000	$0.000	$0	$0	$1,985	$2,730	$0	$2,730	($745)
2012	2,700	0.09010	0.07386	3,320	2,520	5,840	485	3	0	0.000	0.000	0	0	3,185	4,182	0	4,182	(997)
2013	4,500	0.09454	0.07750	6,640	5,040	11,680	1,018	6	0	0.000	0.000	0	0	5,518	7,117	0	7,117	(1,599)
2014	0	0.09920	0.08132	6,640	5,040	11,680	1,069	6	0	0.000	0.000	0	0	1,069	0	0	0	1,069
2015	0	0.10410	0.08533	6,640	5,040	11,680	1,121	6	0	0.000	0.000	0	0	1,121	0	0	0	1,121
2016	0	0.10923	0.08954	6,640	5,040	11,680	1,177	6	0	0.000	0.000	0	0	1,177	0	0	0	1,177
2017	0	0.11461	0.09395	6,640	5,040	11,680	1,235	6	0	0.000	0.000	0	0	1,235	0	0	0	1,235
2018	0	0.12027	0.09859	6,640	5,040	11,680	1,295	6	0	0.000	0.000	0	0	1,295	0	0	0	1,295
2019	0	0.12620	0.10345	6,640	5,040	11,680	1,359	6	0	0.000	0.000	0	0	1,359	0	0	0	1,359
2020	0	0.13242	0.10855	6,640	5,040	11,680	1,426	6	0	0.000	0.000	0	0	1,426	0	0	0	1,426
2021	0	0.13895	0.11390	6,640	5,040	11,680	1,497	6	0	0.000	0.000	0	0	1,497	0	0	0	1,497
2022	0	0.14580	0.11952	6,640	5,040	11,680	1,570	6	0	0.000	0.000	0	0	1,570	0	0	0	1,570
2023	0	0.15299	0.12541	6,640	5,040	11,680	1,648	6	0	0.000	0.000	0	0	1,648	0	0	0	1,648
2024	0	0.16053	0.13160	6,640	5,040	11,680	1,729	6	0	0.000	0.000	0	0	1,729	0	0	0	1,729
2025	0	0.16845	0.13809	5,312	4,032	9,344	1,452	5	0	0.000	0.000	0	0	1,452	0	0	0	1,452
2026	0	0.17676	0.14490	3,320	2,520	5,840	952	3	0	0.000	0.000	0	0	952	0	0	0	952
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				92,960	70,560			84	0					$28,218			$14,029	$14,189
													NPV =	$16,497			$12,282	4,215

Total NPV = $4,215
Benefit/Cost Ratio = 1.34

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **New Construction Bundle**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$72	$99	$171	$2,235	$874	$3,109	($2,938)
2012	188	308	496	3,505	1,311	4,816	(4,320)
2013	401	640	1,041	5,849	2,185	8,034	(6,993)
2014	420	666	1,086	0	0	0	1,086
2015	463	693	1,156	0	0	0	1,156
2016	467	720	1,187	0	0	0	1,187
2017	491	749	1,240	0	0	0	1,240
2018	534	779	1,313	0	0	0	1,313
2019	559	810	1,369	0	0	0	1,369
2020	599	843	1,442	0	0	0	1,442
2021	603	876	1,479	0	0	0	1,479
2022	607	911	1,518	0	0	0	1,518
2023	611	948	1,559	0	0	0	1,559
2024	616	986	1,602	0	0	0	1,602
2025	497	854	1,351	0	0	0	1,351
2026	314	533	847	0	0	0	847
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$18,857			$15,959	$2,898
		NPV =	$9,296			$14,190	(4,894)

Total NPV = ($4,894)
Benefit/Cost Ratio = 0.66

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$1,113	$3,433	$3,453
Incentive Costs =	4,608	11,520	11,520
Total Utility Project Costs =	$5,721	$14,953	$14,973
14) Direct Participant Costs ($/Part.) =	$4,500	$4,500	$4,500
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.000	0.000	0.000
16a) Avg Winter kW/part Saved =	17.500	17.500	17.500
17) Avg. Summer kWh/Part. Saved =	0	0	0
17a) Avg. Winter kWh/Part. Saved =	4,742	4,742	4,742
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	5	5
20) Incentive/Participant =	$2,304	$2,304	$2,304
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	0	0
Annual Winter Kwh Saved	9,484	23,710	23,710
23) Annual Summer KW Saved	0	0	0
Annual Winter KW Saved	35	88	88

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$191,662	5.12
Utility Cost Test	$206,356	7.48
Societal Test	$422,148	8.17
Participant Test	$11,927	1.24
Total Resource Cost Test	$182,808	4.30

Table 1
Ratepayer Impact Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	10,193	$0.02860	$292	$0.00000	$0	0	39	39	$98.68	$3,849	$4,141	$0.05091	0	9,484	9,484	$293	$1,113	$4,608	$6,014	($1,873)
2	2012	35,675	0.02988	1,066	0.00000	0	0	137	137	102.62	14,059	15,125	0.05193	0	33,194	33,194	1,045	3,433	11,520	15,998	(873)
3	2013	61,158	0.03195	1,954	0.00000	0	0	234	234	106.73	24,975	26,929	0.05296	0	56,904	56,904	1,827	3,453	11,520	16,800	10,129
4	2014	61,158	0.03348	2,048	0.00000	0	0	234	234	111.00	25,974	28,022	0.05402	0	56,904	56,904	1,863	0	0	1,863	26,159
5	2015	61,158	0.03688	2,256	0.00000	0	0	234	234	115.44	27,013	29,269	0.05510	0	56,904	56,904	1,900	0	0	1,900	27,369
6	2016	61,158	0.03720	2,275	0.00000	0	0	234	234	120.05	28,092	30,367	0.05621	0	56,904	56,904	1,939	0	0	1,939	28,428
7	2017	61,158	0.03911	2,392	0.00000	0	0	234	234	124.86	29,217	31,609	0.05733	0	56,904	56,904	1,977	0	0	1,977	29,632
8	2018	61,158	0.04251	2,600	0.00000	0	0	234	234	129.85	30,385	32,985	0.05848	0	56,904	56,904	2,017	0	0	2,017	30,968
9	2019	61,158	0.04456	2,725	0.00000	0	0	234	234	135.05	31,602	34,327	0.05965	0	56,904	56,904	2,057	0	0	2,057	32,270
10	2020	61,158	0.04769	2,917	0.00000	0	0	234	234	140.45	32,865	35,782	0.06084	0	56,904	56,904	2,098	0	0	2,098	33,684
11	2021	61,158	0.04800	2,936	0.00000	0	0	234	234	146.07	34,180	37,116	0.06206	0	56,904	56,904	2,141	0	0	2,141	34,975
12	2022	61,158	0.04834	2,956	0.00000	0	0	234	234	151.91	35,547	38,503	0.06330	0	56,904	56,904	2,183	0	0	2,183	36,320
13	2023	61,158	0.04871	2,979	0.00000	0	0	234	234	157.98	36,967	39,946	0.06456	0	56,904	56,904	2,227	0	0	2,227	37,719
14	2024	61,158	0.04911	3,003	0.00000	0	0	234	234	164.30	38,446	41,449	0.06586	0	56,904	56,904	2,272	0	0	2,272	39,177
15	2025	50,965	0.04954	2,525	0.00000	0	0	195	195	170.88	33,322	35,847	0.06717	0	47,420	47,420	1,931	0	0	1,931	33,916
16	2026	25,482	0.05000	1,274	0.00000	0	0	98	98	177.71	17,416	18,690	0.06852	0	23,710	23,710	985	0	0	985	17,705
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		856,211							3,277			$480,107				796,656				$64,402	$415,705
											NPV =	$238,182								$46,520	191,662

Total NPV = $191,662
Benefit/Cost Ratio = 5.12

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$292	$0	$3,849	$4,141	$5,721	$5,721	($1,580)
2012	1,066	0	14,059	15,125	14,953	14,953	172
2013	1,954	0	24,975	26,929	14,973	14,973	11,956
2014	2,048	0	25,974	28,022	0	0	28,022
2015	2,256	0	27,013	29,269	0	0	29,269
2016	2,275	0	28,092	30,367	0	0	30,367
2017	2,392	0	29,217	31,609	0	0	31,609
2018	2,600	0	30,385	32,985	0	0	32,985
2019	2,725	0	31,602	34,327	0	0	34,327
2020	2,917	0	32,865	35,782	0	0	35,782
2021	2,936	0	34,180	37,116	0	0	37,116
2022	2,956	0	35,547	38,503	0	0	38,503
2023	2,979	0	36,967	39,946	0	0	39,946
2024	3,003	0	38,446	41,449	0	0	41,449
2025	2,525	0	33,322	35,847	0	0	35,847
2026	1,274	0	17,416	18,690	0	0	18,690
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$480,107		$35,647	$444,460
			NPV =	$238,182		$31,826	206,356

Total NPV =	$206,356
Benefit/Cost Ratio =	7.48

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$292	$0	$3,849	$1,309	$5,450	$5,721	$4,392	$10,113	($4,663)
2012	1,066	0	14,059	4,926	20,051	14,953	10,980	25,933	(5,882)
2013	1,954	0	24,975	9,034	35,963	14,973	10,980	25,953	10,010
2014	2,048	0	25,974	9,682	37,704	0	0	0	37,704
2015	2,256	0	27,013	10,417	39,686	0	0	0	39,686
2016	2,275	0	28,092	11,132	41,499	0	0	0	41,499
2017	2,392	0	29,217	11,935	43,544	0	0	0	43,544
2018	2,600	0	30,385	12,828	45,813	0	0	0	45,813
2019	2,725	0	31,602	13,750	48,077	0	0	0	48,077
2020	2,917	0	32,865	14,763	50,545	0	0	0	50,545
2021	2,936	0	34,180	15,773	52,889	0	0	0	52,889
2022	2,956	0	35,547	16,853	55,356	0	0	0	55,356
2023	2,979	0	36,967	18,009	57,955	0	0	0	57,955
2024	3,003	0	38,446	19,247	60,696	0	0	0	60,696
2025	2,525	0	33,322	17,145	52,992	0	0	0	52,992
2026	1,274	0	17,416	9,208	27,898	0	0	0	27,898
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$676,118			$61,999	$614,119
				NPV =	$481,024			$58,876	422,148

Total NPV = $422,148
Benefit/Cost Ratio = 8.17

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$4,608	$0.08587	$0.07039	0	9,484	9,484	$668	0	35	$0.000	$0.000	$0	$0	$5,276	$9,190	$0	$9,190	($3,914)
2012	11,520	0.09010	0.07386	0	33,194	33,194	2,452	0	123	0.000	0.000	0	0	13,972	23,460	0	23,460	(9,488)
2013	11,520	0.09454	0.07750	0	56,904	56,904	4,410	0	210	0.000	0.000	0	0	15,930	23,955	0	23,955	(8,025)
2014	0	0.09920	0.08132	0	56,904	56,904	4,627	0	210	0.000	0.000	0	0	4,627	0	0	0	4,627
2015	0	0.10410	0.08533	0	56,904	56,904	4,856	0	210	0.000	0.000	0	0	4,856	0	0	0	4,856
2016	0	0.10923	0.08954	0	56,904	56,904	5,095	0	210	0.000	0.000	0	0	5,095	0	0	0	5,095
2017	0	0.11461	0.09395	0	56,904	56,904	5,346	0	210	0.000	0.000	0	0	5,346	0	0	0	5,346
2018	0	0.12027	0.09859	0	56,904	56,904	5,610	0	210	0.000	0.000	0	0	5,610	0	0	0	5,610
2019	0	0.12620	0.10345	0	56,904	56,904	5,887	0	210	0.000	0.000	0	0	5,887	0	0	0	5,887
2020	0	0.13242	0.10855	0	56,904	56,904	6,177	0	210	0.000	0.000	0	0	6,177	0	0	0	6,177
2021	0	0.13895	0.11390	0	56,904	56,904	6,481	0	210	0.000	0.000	0	0	6,481	0	0	0	6,481
2022	0	0.14580	0.11952	0	56,904	56,904	6,801	0	210	0.000	0.000	0	0	6,801	0	0	0	6,801
2023	0	0.15299	0.12541	0	56,904	56,904	7,136	0	210	0.000	0.000	0	0	7,136	0	0	0	7,136
2024	0	0.16053	0.13160	0	56,904	56,904	7,489	0	210	0.000	0.000	0	0	7,489	0	0	0	7,489
2025	0	0.16845	0.13809	0	47,420	47,420	6,548	0	175	0.000	0.000	0	0	6,548	0	0	0	6,548
2026	0	0.17676	0.14490	0	23,710	23,710	3,436	0	88	0.000	0.000	0	0	3,436	0	0	0	3,436
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				0	796,656			0	2,941					$110,667			$56,605	$54,062
													NPV =	$61,727			$49,800	11,927

Total NPV = $11,927
Benefit/Cost Ratio = 1.24

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Thermal Storage with ASHP**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$292	$3,849	$4,141	$5,721	$4,392	$10,113	($5,972)
2012	1,066	14,059	15,125	14,953	10,980	25,933	(10,808)
2013	1,954	24,975	26,929	14,973	10,980	25,953	976
2014	2,048	25,974	28,022	0	0	0	28,022
2015	2,256	27,013	29,269	0	0	0	29,269
2016	2,275	28,092	30,367	0	0	0	30,367
2017	2,392	29,217	31,609	0	0	0	31,609
2018	2,600	30,385	32,985	0	0	0	32,985
2019	2,725	31,602	34,327	0	0	0	34,327
2020	2,917	32,865	35,782	0	0	0	35,782
2021	2,936	34,180	37,116	0	0	0	37,116
2022	2,956	35,547	38,503	0	0	0	38,503
2023	2,979	36,967	39,946	0	0	0	39,946
2024	3,003	38,446	41,449	0	0	0	41,449
2025	2,525	33,322	35,847	0	0	0	35,847
2026	1,274	17,416	18,690	0	0	0	18,690
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$480,107			$61,999	$418,108
		NPV =	$238,182			$55,374	182,808

Total NPV = $182,808
Benefit/Cost Ratio = 4.30

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Residential Lighting**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$24	$60	$90
Incentive Costs =	100	200	300
Total Utility Project Costs =	$124	$260	$390
14) Direct Participant Costs ($/Part.) =	$2	$2	$2
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	5	5	5
16) Avg Summer kW/part. Saved =	0.003	0.003	0.003
16a) Avg Winter kW/part Saved =	0.003	0.003	0.003
17) Avg. Summer kWh/Part. Saved =	13	13	13
17a) Avg. Winter kWh/Part. Saved =	15	15	15
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	50	100	150
20) Incentive/Participant =	$2	$2	$2
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	650	1,300	1,950
Annual Winter Kwh Saved	750	1,500	2,250
23) Annual Summer KW Saved	0	0	0
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$422	1.25
Utility Cost Test	$1,448	3.11
Societal Test	$2,680	4.66
Participant Test	$2,692	5.89
Total Resource Cost Test	$1,448	3.11

Table 1
Ratepayer Impact Test

Project: **Residential Lighting**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	1,505	$0.02860	$43	$0.00000	$0	0	0	0	$98.68	$0	$43	$0.05091	650	750	1,400	$43	$24	$100	$167	($124)
2	2012	4,514	0.02988	135	0.00000	0	1	1	2	102.62	205	340	0.05193	1,950	2,250	4,200	132	60	200	392	(52)
3	2013	9,028	0.03195	288	0.00000	0	1	1	2	106.73	213	501	0.05296	3,900	4,500	8,400	270	90	300	660	(159)
4	2014	9,028	0.03348	302	0.00000	0	1	1	2	111.00	222	524	0.05402	3,900	4,500	8,400	275	0	0	275	249
5	2015	9,028	0.03688	333	0.00000	0	1	1	2	115.44	231	564	0.05510	3,900	4,500	8,400	281	0	0	281	283
6	2016	7,523	0.03720	280	0.00000	0	1	1	2	120.05	240	520	0.05621	3,250	3,750	7,000	238	0	0	238	282
7	2017	4,514	0.03911	177	0.00000	0	1	1	2	124.86	250	427	0.05733	1,950	2,250	4,200	146	0	0	146	281
8	2018	0	0.04251	0	0.00000	0	0	0	0	129.85	0	0	0.05848	0	0	0	0	0	0	0	0
9	2019	0	0.04456	0	0.00000	0	0	0	0	135.05	0	0	0.05965	0	0	0	0	0	0	0	0
10	2020	0	0.04769	0	0.00000	0	0	0	0	140.45	0	0	0.06084	0	0	0	0	0	0	0	0
11	2021	0	0.04800	0	0.00000	0	0	0	0	146.07	0	0	0.06206	0	0	0	0	0	0	0	0
12	2022	0	0.04834	0	0.00000	0	0	0	0	151.91	0	0	0.06330	0	0	0	0	0	0	0	0
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.06456	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.06586	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.06717	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.06852	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.06989	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0
Total =		45,140							12			$2,919				42,000				$2,159	$760
											NPV =	$2,134								$1,712	422

Total NPV = $422
Benefit/Cost Ratio = 1.25

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Residential Lighting**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$43	$0	$0	$43	$124	$124	($81)
2012	135	0	205	340	260	260	80
2013	288	0	213	501	390	390	111
2014	302	0	222	524	0	0	524
2015	333	0	231	564	0	0	564
2016	280	0	240	520	0	0	520
2017	177	0	250	427	0	0	427
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$2,919		$774	$2,145
			NPV =	$2,134		$686	1,448

Total NPV =	$1,448
Benefit/Cost Ratio =	3.11

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Residential Lighting**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$43	$0	$0	$14	$57	$124	$0	$124	($67)
2012	135	0	205	111	451	260	0	260	191
2013	288	0	213	168	669	390	0	390	279
2014	302	0	222	181	705	0	0	0	705
2015	333	0	231	201	765	0	0	0	765
2016	280	0	240	191	711	0	0	0	711
2017	177	0	250	161	588	0	0	0	588
2018	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$3,946			$774	$3,172
				NPV =	$3,412			$732	2,680

Total NPV =	$2,680
Benefit/Cost Ratio =	4.66

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Residential Lighting**
Program Years: **2011 - 2013**

	Benefits														Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$100	$0.08587	$0.07039	650	750	1,400	$109	0	0	$0.000	$0.000	$0	$0	$209	$102	$0	$102	$107
2012	200	0.09010	0.07386	1,950	2,250	4,200	342	0	0	0.000	0.000	0	0	542	209	0	209	333
2013	300	0.09454	0.07750	3,900	4,500	8,400	717	1	1	0.000	0.000	0	0	1,017	319	0	319	698
2014	0	0.09920	0.08132	3,900	4,500	8,400	753	1	1	0.000	0.000	0	0	753	0	0	0	753
2015	0	0.10410	0.08533	3,900	4,500	8,400	790	1	1	0.000	0.000	0	0	790	0	0	0	790
2016	0	0.10923	0.08954	3,250	3,750	7,000	691	1	1	0.000	0.000	0	0	691	0	0	0	691
2017	0	0.11461	0.09395	1,950	2,250	4,200	435	0	0	0.000	0.000	0	0	435	0	0	0	435
2018	0	0.12027	0.09859	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2019	0	0.12620	0.10345	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2020	0	0.13242	0.10855	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2021	0	0.13895	0.11390	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2022	0	0.14580	0.11952	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.15299	0.12541	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.16053	0.13160	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.16845	0.13809	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.17676	0.14490	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.18547	0.15204	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				19,500	22,500			4	4					$4,437			$630	$3,807
													NPV =	$3,241			$550	2,692

Total NPV = $2,692
Benefit/Cost Ratio = 5.89

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Residential Lighting**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$43	$0	$43	$124	$0	$124	($81)
2012	135	205	340	260	0	260	80
2013	288	213	501	390	0	390	111
2014	302	222	524	0	0	0	524
2015	333	231	564	0	0	0	564
2016	280	240	520	0	0	0	520
2017	177	250	427	0	0	0	427
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$2,919			$774	$2,145
		NPV =	$2,134			$686	1,448

Total NPV =	$1,448
Benefit/Cost Ratio =	3.11

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.08183
Retail Rate Winter ($/kWh) =	$0.06708
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04991
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$0	$0	$9,657
Incentive Costs =	0	0	40,000
Direct Program Costs =	0	0	398,400
Total Utility Project Costs =	$0	$0	$448,057
14) Direct Participant Costs ($/Part.) =	$0	$0	$0
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	1.000	1.000	1.000
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	0	0	0
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	0	0	800
20) Incentive/Participant =	$50	$50	$50
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	0	0
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	0	800
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$161,167	1.24
Utility Cost Test	$161,167	1.24
Societal Test	$1,357,020	3.85
Participant Test	$32,500	#DIV/0!
Total Resource Cost Test	$440,653	2.09

Table 1
Ratepayer Impact Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Direct Program Costs (O)	Costs: Total Project Costs (P)	Annual Benefits Less Costs (Q)
1	2011	0	$0.02860	$0	$0.00000	$0	0	0	0	$98.68	$0	$0	$0.05091	0	0	0	$0	$0	$0	$0	$0	$0
2	2012	0	0.02988	0	0.00000	0	0	0	0	102.62	0	0	0.05193	0	0	0	0	0	0	0	0	0
3	2013	0	0.03195	0	0.00000	0	893	0	893	106.73	95,310	95,310	0.05296	0	0	0	0	9,657	40,000	398,400	448,057	(352,747)
4	2014	0	0.03348	0	0.00000	0	893	0	893	111.00	99,123	99,123	0.05402	0	0	0	0	9,657	40,000	0	49,657	49,466
5	2015	0	0.03688	0	0.00000	0	893	0	893	115.44	103,088	103,088	0.05510	0	0	0	0	9,657	40,000	0	49,657	53,431
6	2016	0	0.03720	0	0.00000	0	893	0	893	120.05	107,205	107,205	0.05621	0	0	0	0	9,657	40,000	0	49,657	57,548
7	2017	0	0.03911	0	0.00000	0	893	0	893	124.86	111,500	111,500	0.05733	0	0	0	0	9,657	40,000	0	49,657	61,843
8	2018	0	0.04251	0	0.00000	0	893	0	893	129.85	115,956	115,956	0.05848	0	0	0	0	9,657	40,000	0	49,657	66,299
9	2019	0	0.04456	0	0.00000	0	893	0	893	135.05	120,600	120,600	0.05965	0	0	0	0	9,657	40,000	0	49,657	70,943
10	2020	0	0.04769	0	0.00000	0	893	0	893	140.45	125,422	125,422	0.06084	0	0	0	0	9,657	40,000	0	49,657	75,765
11	2021	0	0.04800	0	0.00000	0	893	0	893	146.07	130,441	130,441	0.06206	0	0	0	0	9,657	40,000	0	49,657	80,784
12	2022	0	0.04834	0	0.00000	0	893	0	893	151.91	135,656	135,656	0.06330	0	0	0	0	9,657	40,000	0	49,657	85,999
13	2023	0	0.04871	0	0.00000	0	893	0	893	157.98	141,076	141,076	0.06456	0	0	0	0	9,657	40,000	0	49,657	91,419
14	2024	0	0.04911	0	0.00000	0	893	0	893	164.30	146,720	146,720	0.06586	0	0	0	0	9,657	40,000	0	49,657	97,063
15	2025	0	0.04954	0	0.00000	0	893	0	893	170.88	152,596	152,596	0.06717	0	0	0	0	9,657	40,000	0	49,657	102,939
16	2026	0	0.05000	0	0.00000	0	893	0	893	177.71	158,695	158,695	0.06852	0	0	0	0	9,657	40,000	0	49,657	109,038
17	2027	0	0.05050	0	0.00000	0	893	0	893	184.82	165,044	165,044	0.06989	0	0	0	0	9,657	40,000	0	49,657	115,387
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.07128	0	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.07271	0	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.07416	0	0	0	0	0	0	0	0	0
	Total =	0							13,395			$1,908,432				0					$1,143,255	$765,177
											NPV =	$845,160									$683,993	161,167

Total NPV = $161,167
Benefit/Cost Ratio = 1.24

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0
2013	0	0	95,310	95,310	448,057	448,057	(352,747)
2014	0	0	99,123	99,123	49,657	49,657	49,466
2015	0	0	103,088	103,088	49,657	49,657	53,431
2016	0	0	107,205	107,205	49,657	49,657	57,548
2017	0	0	111,500	111,500	49,657	49,657	61,843
2018	0	0	115,956	115,956	49,657	49,657	66,299
2019	0	0	120,600	120,600	49,657	49,657	70,943
2020	0	0	125,422	125,422	49,657	49,657	75,765
2021	0	0	130,441	130,441	49,657	49,657	80,784
2022	0	0	135,656	135,656	49,657	49,657	85,999
2023	0	0	141,076	141,076	49,657	49,657	91,419
2024	0	0	146,720	146,720	49,657	49,657	97,063
2025	0	0	152,596	152,596	49,657	49,657	102,939
2026	0	0	158,695	158,695	49,657	49,657	109,038
2027	0	0	165,044	165,044	49,657	49,657	115,387
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$1,908,432		$1,143,255	$765,177
			NPV =	$845,160		$683,993	161,167

Total NPV =	$161,167
Benefit/Cost Ratio =	1.24

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0	0	0
2013	0	0	95,310	31,973	127,283	448,057	(40,000)	408,057	(280,774)
2014	0	0	99,123	34,250	133,373	49,657	(40,000)	9,657	123,716
2015	0	0	103,088	36,689	139,777	49,657	(40,000)	9,657	130,120
2016	0	0	107,205	39,299	146,504	49,657	(40,000)	9,657	136,847
2017	0	0	111,500	42,099	153,599	49,657	(40,000)	9,657	143,942
2018	0	0	115,956	45,095	161,051	49,657	(40,000)	9,657	151,394
2019	0	0	120,600	48,308	168,908	49,657	(40,000)	9,657	159,251
2020	0	0	125,422	51,747	177,169	49,657	(40,000)	9,657	167,512
2021	0	0	130,441	55,432	185,873	49,657	(40,000)	9,657	176,216
2022	0	0	135,656	59,378	195,034	49,657	(28,000)	21,657	173,377
2023	0	0	141,076	63,603	204,679	49,657	(40,000)	9,657	195,022
2024	0	0	146,720	68,132	214,852	49,657	(40,000)	9,657	205,195
2025	0	0	152,596	72,986	225,582	49,657	(40,000)	9,657	215,925
2026	0	0	158,695	78,180	236,875	49,657	(40,000)	9,657	227,218
2027	0	0	165,044	83,747	248,791	49,657	(40,000)	9,657	239,134
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$2,719,350			$555,255	$2,164,095
				NPV =	$1,832,565			$475,545	1,357,020

Total NPV = $1,357,020
Benefit/Cost Ratio = 3.85

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$0	$0.08587	$0.07039	0	0	0	$0	0	0	$0.000	$0.000	$0	$0	$0	$0	$0	$0	$0
2012	0	0.09010	0.07386	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2013	40,000	0.09454	0.07750	0	0	0	0	800	0	0.000	0.000	0	0	40,000	0	0	0	40,000
2014	0	0.09920	0.08132	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2015	0	0.10410	0.08533	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2016	0	0.10923	0.08954	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2017	0	0.11461	0.09395	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2018	0	0.12027	0.09859	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2019	0	0.12620	0.10345	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2020	0	0.13242	0.10855	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2021	0	0.13895	0.11390	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2022	0	0.14580	0.11952	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.15299	0.12541	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.16053	0.13160	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.16845	0.13809	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.17676	0.14490	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.18547	0.15204	0	0	0	0	800	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19462	0.15954	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20421	0.16740	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21428	0.17566	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				0	0			12,000	0					$40,000			$0	$40,000
													NPV =	$32,500			$0	32,500

Total NPV = $32,500
Benefit/Cost Ratio = #DIV/0!

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Residential AC Cycling**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0
2013	0	95,310	95,310	448,057	(40,000)	408,057	(312,747)
2014	0	99,123	99,123	49,657	(40,000)	9,657	89,466
2015	0	103,088	103,088	49,657	(40,000)	9,657	93,431
2016	0	107,205	107,205	49,657	(40,000)	9,657	97,548
2017	0	111,500	111,500	49,657	(40,000)	9,657	101,843
2018	0	115,956	115,956	49,657	(40,000)	9,657	106,299
2019	0	120,600	120,600	49,657	(40,000)	9,657	110,943
2020	0	125,422	125,422	49,657	(40,000)	9,657	115,765
2021	0	130,441	130,441	49,657	(40,000)	9,657	120,784
2022	0	135,656	135,656	49,657	(28,000)	21,657	113,999
2023	0	141,076	141,076	49,657	(40,000)	9,657	131,419
2024	0	146,720	146,720	49,657	(40,000)	9,657	137,063
2025	0	152,596	152,596	49,657	(40,000)	9,657	142,939
2026	0	158,695	158,695	49,657	(40,000)	9,657	149,038
2027	0	165,044	165,044	49,657	(40,000)	9,657	155,387
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$1,908,432			$555,255	$1,353,177
		NPV =	$845,160			$404,508	440,653

Total NPV =	$440,653
Benefit/Cost Ratio =	2.09

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical Lighting**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$3,573	$7,146	$3,573
Incentive Costs =	14,800	29,600	14,800
Total Utility Project Costs =	$18,373	$36,746	$18,373
14) Direct Participant Costs ($/Part.) =	$5,000	$5,000	$5,000
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	18	18	18
16) Avg Summer kW/part. Saved =	5.200	5.200	5.200
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	6,167	6,167	6,167
17a) Avg. Winter kWh/Part. Saved =	12,333	12,333	12,333
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	10	5
20) Incentive/Participant =	$2,960	$2,960	$2,960
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	30,835	61,670	30,835
Annual Winter Kwh Saved	61,665	123,330	61,665
23) Annual Summer KW Saved	26	52	26
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$149,710	2.29
Utility Cost Test	$198,734	3.96
Societal Test	$474,543	5.33
Participant Test	$173,867	2.85
Total Resource Cost Test	$161,433	2.54

Table 1
Ratepayer Impact Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	99,414	$0.02860	$2,843	$0.00000	$0	29	0	29	$98.68	$2,862	$5,705	$0.02243	30,835	61,665	92,500	$1,258	$3,573	$14,800	$19,631	($13,926)
2	2012	298,243	0.02988	8,912	0.00000	0	87	0	87	102.62	8,928	17,840	0.02288	92,505	184,995	277,500	3,848	7,146	29,600	40,594	(22,754)
3	2013	397,658	0.03195	12,705	0.00000	0	116	0	116	106.73	12,381	25,086	0.02334	123,340	246,660	370,000	5,234	3,573	14,800	23,607	1,479
4	2014	397,658	0.03348	13,314	0.00000	0	116	0	116	111.00	12,876	26,190	0.02380	123,340	246,660	370,000	5,338	0	0	5,338	20,852
5	2015	397,658	0.03688	14,666	0.00000	0	116	0	116	115.44	13,391	28,057	0.02428	123,340	246,660	370,000	5,445	0	0	5,445	22,612
6	2016	397,658	0.03720	14,793	0.00000	0	116	0	116	120.05	13,926	28,719	0.02476	123,340	246,660	370,000	5,553	0	0	5,553	23,166
7	2017	397,658	0.03911	15,552	0.00000	0	116	0	116	124.86	14,484	30,036	0.02526	123,340	246,660	370,000	5,665	0	0	5,665	24,371
8	2018	397,658	0.04251	16,904	0.00000	0	116	0	116	129.85	15,063	31,967	0.02576	123,340	246,660	370,000	5,777	0	0	5,777	26,190
9	2019	397,658	0.04456	17,720	0.00000	0	116	0	116	135.05	15,666	33,386	0.02628	123,340	246,660	370,000	5,894	0	0	5,894	27,492
10	2020	397,658	0.04769	18,964	0.00000	0	116	0	116	140.45	16,292	35,256	0.02681	123,340	246,660	370,000	6,013	0	0	6,013	29,243
11	2021	397,658	0.04800	19,088	0.00000	0	116	0	116	146.07	16,944	36,032	0.02734	123,340	246,660	370,000	6,131	0	0	6,131	29,901
12	2022	397,658	0.04834	19,223	0.00000	0	116	0	116	151.91	17,622	36,845	0.02789	123,340	246,660	370,000	6,255	0	0	6,255	30,590
13	2023	397,658	0.04871	19,370	0.00000	0	116	0	116	157.98	18,326	37,696	0.02845	123,340	246,660	370,000	6,380	0	0	6,380	31,316
14	2024	397,658	0.04911	19,529	0.00000	0	116	0	116	164.30	19,059	38,588	0.02902	123,340	246,660	370,000	6,508	0	0	6,508	32,080
15	2025	397,658	0.04954	19,700	0.00000	0	116	0	116	170.88	19,822	39,522	0.02960	123,340	246,660	370,000	6,638	0	0	6,638	32,884
16	2026	397,658	0.05000	19,883	0.00000	0	116	0	116	177.71	20,614	40,497	0.03019	123,340	246,660	370,000	6,771	0	0	6,771	33,726
17	2027	397,658	0.05050	20,082	0.00000	0	116	0	116	184.82	21,439	41,521	0.03079	123,340	246,660	370,000	6,905	0	0	6,905	34,616
18	2028	397,658	0.05103	20,292	0.00000	0	116	0	116	192.21	22,296	42,588	0.03141	123,340	246,660	370,000	7,044	0	0	7,044	35,544
19	2029	298,243	0.05160	15,389	0.00000	0	87	0	87	199.90	17,391	32,780	0.03204	92,505	184,995	277,500	5,389	0	0	5,389	27,391
20	2030	99,414	0.05220	5,189	0.00000	0	29	0	29	207.90	6,029	11,218	0.03268	30,835	61,665	92,500	1,832	0	0	1,832	9,386
Total =		7,157,842							2,088			$619,529				6,660,000				$183,370	$436,159
											NPV =	$265,924								$116,214	149,710

Total NPV = $149,710
Benefit/Cost Ratio = 2.29

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$2,843	$0	$2,862	$5,705	$18,373	$18,373	($12,668)
2012	8,912	0	8,928	17,840	36,746	36,746	(18,906)
2013	12,705	0	12,381	25,086	18,373	18,373	6,713
2014	13,314	0	12,876	26,190	0	0	26,190
2015	14,666	0	13,391	28,057	0	0	28,057
2016	14,793	0	13,926	28,719	0	0	28,719
2017	15,552	0	14,484	30,036	0	0	30,036
2018	16,904	0	15,063	31,967	0	0	31,967
2019	17,720	0	15,666	33,386	0	0	33,386
2020	18,964	0	16,292	35,256	0	0	35,256
2021	19,088	0	16,944	36,032	0	0	36,032
2022	19,223	0	17,622	36,845	0	0	36,845
2023	19,370	0	18,326	37,696	0	0	37,696
2024	19,529	0	19,059	38,588	0	0	38,588
2025	19,700	0	19,822	39,522	0	0	39,522
2026	19,883	0	20,614	40,497	0	0	40,497
2027	20,082	0	21,439	41,521	0	0	41,521
2028	20,292	0	22,296	42,588	0	0	42,588
2029	15,389	0	17,391	32,780	0	0	32,780
2030	5,189	0	6,029	11,218	0	0	11,218
Total =				$619,529		$73,492	$546,037
			NPV =	$265,924		$67,190	198,734

Total NPV =	$198,734
Benefit/Cost Ratio =	3.96

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$2,843	$0	$2,862	$1,804	$7,509	$18,373	$10,200	$28,573	($21,064)
2012	8,912	0	8,928	5,810	23,650	36,746	20,400	57,146	(33,496)
2013	12,705	0	12,381	8,416	33,502	18,373	10,200	28,573	4,929
2014	13,314	0	12,876	9,049	35,239	0	0	0	35,239
2015	14,666	0	13,391	9,985	38,042	0	0	0	38,042
2016	14,793	0	13,926	10,528	39,247	0	0	0	39,247
2017	15,552	0	14,484	11,341	41,377	0	0	0	41,377
2018	16,904	0	15,063	12,432	44,399	0	0	0	44,399
2019	17,720	0	15,666	13,373	46,759	0	0	0	46,759
2020	18,964	0	16,292	14,546	49,802	0	0	0	49,802
2021	19,088	0	16,944	15,312	51,344	0	0	0	51,344
2022	19,223	0	17,622	16,127	52,972	0	0	0	52,972
2023	19,370	0	18,326	16,995	54,691	0	0	0	54,691
2024	19,529	0	19,059	17,919	56,507	0	0	0	56,507
2025	19,700	0	19,822	18,903	58,425	0	0	0	58,425
2026	19,883	0	20,614	19,951	60,448	0	0	0	60,448
2027	20,082	0	21,439	21,069	62,590	0	0	0	62,590
2028	20,292	0	22,296	22,258	64,846	0	0	0	64,846
2029	15,389	0	17,391	17,646	50,426	0	0	0	50,426
2030	5,189	0	6,029	6,220	17,438	0	0	0	17,438
Total =					$889,213			$114,292	$774,921
				NPV =	$584,233			$109,690	474,543

Total NPV =	$474,543
Benefit/Cost Ratio =	5.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$14,800	$0.05644	$0.04173	30,835	61,665	92,500	$4,314	26	0	$25.500	$41.820	$663	$0	$19,777	$25,528	$0	$25,528	($5,751)
2012	29,600	0.05923	0.04379	92,505	184,995	277,500	13,580	78	0	26.010	42.656	2,029	0	45,209	52,132	0	52,132	(6,923)
2013	14,800	0.06215	0.04595	123,340	246,660	370,000	19,000	104	0	26.530	43.510	2,759	0	36,559	26,616	0	26,616	9,943
2014	0	0.06521	0.04821	123,340	246,660	370,000	19,934	104	0	27.061	44.380	2,814	0	22,748	0	0	0	22,748
2015	0	0.06843	0.05059	123,340	246,660	370,000	20,919	104	0	27.602	45.267	2,871	0	23,790	0	0	0	23,790
2016	0	0.07180	0.05309	123,340	246,660	370,000	21,951	104	0	28.154	46.173	2,928	0	24,879	0	0	0	24,879
2017	0	0.07534	0.05570	123,340	246,660	370,000	23,031	104	0	28.717	47.096	2,987	0	26,018	0	0	0	26,018
2018	0	0.07906	0.05845	123,340	246,660	370,000	24,169	104	0	29.291	48.038	3,046	0	27,215	0	0	0	27,215
2019	0	0.08295	0.06133	123,340	246,660	370,000	25,359	104	0	29.877	48.999	3,107	0	28,466	0	0	0	28,466
2020	0	0.08704	0.06436	123,340	246,660	370,000	26,611	104	0	30.475	49.979	3,169	0	29,780	0	0	0	29,780
2021	0	0.09134	0.06753	123,340	246,660	370,000	27,923	104	0	31.084	50.978	3,233	0	31,156	0	0	0	31,156
2022	0	0.09584	0.07086	123,340	246,660	370,000	29,299	104	0	31.706	51.998	3,297	0	32,596	0	0	0	32,596
2023	0	0.10057	0.07435	123,340	246,660	370,000	30,743	104	0	32.340	53.038	3,363	0	34,106	0	0	0	34,106
2024	0	0.10552	0.07802	123,340	246,660	370,000	32,259	104	0	32.987	54.099	3,431	0	35,690	0	0	0	35,690
2025	0	0.11073	0.08187	123,340	246,660	370,000	33,851	104	0	33.647	55.181	3,499	0	37,350	0	0	0	37,350
2026	0	0.11619	0.08590	123,340	246,660	370,000	35,519	104	0	34.320	56.284	3,569	0	39,088	0	0	0	39,088
2027	0	0.12192	0.09014	123,340	246,660	370,000	37,272	104	0	35.006	57.410	3,641	0	40,913	0	0	0	40,913
2028	0	0.12793	0.09459	123,340	246,660	370,000	39,110	104	0	35.706	58.558	3,713	0	42,823	0	0	0	42,823
2029	0	0.13424	0.09925	92,505	184,995	277,500	30,779	78	0	36.420	59.729	2,841	0	33,620	0	0	0	33,620
2030	0	0.14086	0.10414	30,835	61,665	92,500	10,765	26	0	37.149	60.924	966	0	11,731	0	0	0	11,731
Total =				2,220,120	4,439,880			1,872	0					$623,514			$104,276	$519,238
													NPV =	$268,012			$94,145	173,867

Total NPV =	$173,867
Benefit/Cost Ratio =	2.85

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical Lighting**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$2,843	$2,862	$5,705	$18,373	$10,200	$28,573	($22,868)
2012	8,912	8,928	17,840	36,746	20,400	57,146	(39,306)
2013	12,705	12,381	25,086	18,373	10,200	28,573	(3,487)
2014	13,314	12,876	26,190	0	0	0	26,190
2015	14,666	13,391	28,057	0	0	0	28,057
2016	14,793	13,926	28,719	0	0	0	28,719
2017	15,552	14,484	30,036	0	0	0	30,036
2018	16,904	15,063	31,967	0	0	0	31,967
2019	17,720	15,666	33,386	0	0	0	33,386
2020	18,964	16,292	35,256	0	0	0	35,256
2021	19,088	16,944	36,032	0	0	0	36,032
2022	19,223	17,622	36,845	0	0	0	36,845
2023	19,370	18,326	37,696	0	0	0	37,696
2024	19,529	19,059	38,588	0	0	0	38,588
2025	19,700	19,822	39,522	0	0	0	39,522
2026	19,883	20,614	40,497	0	0	0	40,497
2027	20,082	21,439	41,521	0	0	0	41,521
2028	20,292	22,296	42,588	0	0	0	42,588
2029	15,389	17,391	32,780	0	0	0	32,780
2030	5,189	6,029	11,218	0	0	0	11,218
		Total =	$619,529			$114,292	$505,237
		NPV =	$265,924			$104,491	161,433

Total NPV =	$161,433
Benefit/Cost Ratio =	2.54

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$453	$905	$1,358
Incentive Costs =	1,875	3,750	5,625
Total Utility Project Costs =	$2,328	$4,655	$6,983
14) Direct Participant Costs ($/Part.) =	$1,400	$1,400	$1,400
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	0.465	0.465	0.465
16a) Avg Winter kW/part Saved =	0.465	0.465	0.465
17) Avg. Summer kWh/Part. Saved =	1,630	1,630	1,630
17a) Avg. Winter kWh/Part. Saved =	3,262	3,262	3,262
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	10	15
20) Incentive/Participant =	$375	$375	$375
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	8,150	16,300	24,450
Annual Winter Kwh Saved	16,310	32,620	48,930
23) Annual Summer KW Saved	2	5	7
Annual Winter KW Saved	2	5	7

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$58,323	2.84
Utility Cost Test	$77,657	7.27
Societal Test	$161,994	4.83
Participant Test	$55,559	2.44
Total Resource Cost Test	$50,384	2.27

Table 1
Ratepayer Impact Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	26,288	$0.02860	$752	$0.00000	$0	3	3	6	$98.68	$592	$1,344	$0.02243	8,150	16,310	24,460	$333	$453	$1,875	$2,661	($1,317)
2	2012	78,866	0.02988	2,357	0.00000	0	8	8	16	102.62	1,642	3,999	0.02288	24,450	48,930	73,380	1,018	905	3,750	5,673	(1,674)
3	2013	157,730	0.03195	5,039	0.00000	0	16	16	32	106.73	3,415	8,454	0.02334	48,900	97,860	146,760	2,076	1,358	5,625	9,059	(605)
4	2014	157,730	0.03348	5,281	0.00000	0	16	16	32	111.00	3,552	8,833	0.02380	48,900	97,860	146,760	2,117	0	0	2,117	6,716
5	2015	157,730	0.03688	5,817	0.00000	0	16	16	32	115.44	3,694	9,511	0.02428	48,900	97,860	146,760	2,160	0	0	2,160	7,351
6	2016	157,730	0.03720	5,868	0.00000	0	16	16	32	120.05	3,842	9,710	0.02476	48,900	97,860	146,760	2,203	0	0	2,203	7,507
7	2017	157,730	0.03911	6,169	0.00000	0	16	16	32	124.86	3,996	10,165	0.02526	48,900	97,860	146,760	2,247	0	0	2,247	7,918
8	2018	157,730	0.04251	6,705	0.00000	0	16	16	32	129.85	4,155	10,860	0.02576	48,900	97,860	146,760	2,291	0	0	2,291	8,569
9	2019	157,730	0.04456	7,028	0.00000	0	16	16	32	135.05	4,322	11,350	0.02628	48,900	97,860	146,760	2,338	0	0	2,338	9,012
10	2020	157,730	0.04769	7,522	0.00000	0	16	16	32	140.45	4,494	12,016	0.02681	48,900	97,860	146,760	2,385	0	0	2,385	9,631
11	2021	157,730	0.04800	7,571	0.00000	0	16	16	32	146.07	4,674	12,245	0.02734	48,900	97,860	146,760	2,432	0	0	2,432	9,813
12	2022	157,730	0.04834	7,625	0.00000	0	16	16	32	151.91	4,861	12,486	0.02789	48,900	97,860	146,760	2,481	0	0	2,481	10,005
13	2023	157,730	0.04871	7,683	0.00000	0	16	16	32	157.98	5,055	12,738	0.02845	48,900	97,860	146,760	2,531	0	0	2,531	10,207
14	2024	157,730	0.04911	7,746	0.00000	0	16	16	32	164.30	5,258	13,004	0.02902	48,900	97,860	146,760	2,581	0	0	2,581	10,423
15	2025	157,730	0.04954	7,814	0.00000	0	16	16	32	170.88	5,468	13,282	0.02960	48,900	97,860	146,760	2,633	0	0	2,633	10,649
16	2026	157,730	0.05000	7,887	0.00000	0	16	16	32	177.71	5,687	13,574	0.03019	48,900	97,860	146,760	2,686	0	0	2,686	10,888
17	2027	157,730	0.05050	7,965	0.00000	0	16	16	32	184.82	5,914	13,879	0.03079	48,900	97,860	146,760	2,739	0	0	2,739	11,140
18	2028	157,730	0.05103	8,049	0.00000	0	16	16	32	192.21	6,151	14,200	0.03141	48,900	97,860	146,760	2,794	0	0	2,794	11,406
19	2029	157,730	0.05160	8,139	0.00000	0	16	16	32	199.90	6,397	14,536	0.03204	48,900	97,860	146,760	2,850	0	0	2,850	11,686
20	2030	157,730	0.05220	8,234	0.00000	0	16	16	32	207.90	6,653	14,887	0.03268	48,900	97,860	146,760	2,907	0	0	2,907	11,980
Total =		2,944,294							598			$221,073				2,739,520				$59,768	$161,305
											NPV =	$90,044								$31,721	58,323

Total NPV = $58,323
Benefit/Cost Ratio = 2.84

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$752	$0	$592	$1,344	$2,328	$2,328	($984)
2012	2,357	0	1,642	3,999	4,655	4,655	(656)
2013	5,039	0	3,415	8,454	6,983	6,983	1,471
2014	5,281	0	3,552	8,833	0	0	8,833
2015	5,817	0	3,694	9,511	0	0	9,511
2016	5,868	0	3,842	9,710	0	0	9,710
2017	6,169	0	3,996	10,165	0	0	10,165
2018	6,705	0	4,155	10,860	0	0	10,860
2019	7,028	0	4,322	11,350	0	0	11,350
2020	7,522	0	4,494	12,016	0	0	12,016
2021	7,571	0	4,674	12,245	0	0	12,245
2022	7,625	0	4,861	12,486	0	0	12,486
2023	7,683	0	5,055	12,738	0	0	12,738
2024	7,746	0	5,258	13,004	0	0	13,004
2025	7,814	0	5,468	13,282	0	0	13,282
2026	7,887	0	5,687	13,574	0	0	13,574
2027	7,965	0	5,914	13,879	0	0	13,879
2028	8,049	0	6,151	14,200	0	0	14,200
2029	8,139	0	6,397	14,536	0	0	14,536
2030	8,234	0	6,653	14,887	0	0	14,887
Total =				$221,073		$13,966	$207,107
			NPV =	$90,044		$12,387	77,657

Total NPV =	$77,657
Benefit/Cost Ratio =	7.27

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$752	$0	$592	$425	$1,769	$2,328	$5,125	$7,453	($5,684)
2012	2,357	0	1,642	1,302	5,301	4,655	10,250	14,905	(9,604)
2013	5,039	0	3,415	2,836	11,290	6,983	15,375	22,358	(11,068)
2014	5,281	0	3,552	3,052	11,885	0	0	0	11,885
2015	5,817	0	3,694	3,385	12,896	0	0	0	12,896
2016	5,868	0	3,842	3,559	13,269	0	0	0	13,269
2017	6,169	0	3,996	3,838	14,003	0	0	0	14,003
2018	6,705	0	4,155	4,223	15,083	0	0	0	15,083
2019	7,028	0	4,322	4,546	15,896	0	0	0	15,896
2020	7,522	0	4,494	4,958	16,974	0	0	0	16,974
2021	7,571	0	4,674	5,204	17,449	0	0	0	17,449
2022	7,625	0	4,861	5,465	17,951	0	0	0	17,951
2023	7,683	0	5,055	5,743	18,481	0	0	0	18,481
2024	7,746	0	5,258	6,039	19,043	0	0	0	19,043
2025	7,814	0	5,468	6,353	19,635	0	0	0	19,635
2026	7,887	0	5,687	6,687	20,261	0	0	0	20,261
2027	7,965	0	5,914	7,043	20,922	0	0	0	20,922
2028	8,049	0	6,151	7,422	21,622	0	0	0	21,622
2029	8,139	0	6,397	7,825	22,361	0	0	0	22,361
2030	8,234	0	6,653	8,254	23,141	0	0	0	23,141
Total =					$319,232			$44,716	$274,516
				NPV =	$204,322			$42,328	161,994

Total NPV =	$161,994
Benefit/Cost Ratio =	4.83

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,875	$0.05644	$0.04173	8,150	16,310	24,460	$1,141	2	2	$25.500	$41.820	$135	$0	$3,151	$7,148	$0	$7,148	($3,997)
2012	3,750	0.05923	0.04379	24,450	48,930	73,380	3,591	7	7	26.010	42.656	481	0	7,822	14,597	0	14,597	(6,775)
2013	5,625	0.06215	0.04595	48,900	97,860	146,760	7,536	14	14	26.530	43.510	981	0	14,142	22,358	0	22,358	(8,216)
2014	0	0.06521	0.04821	48,900	97,860	146,760	7,907	14	14	27.061	44.380	1,000	0	8,907	0	0	0	8,907
2015	0	0.06843	0.05059	48,900	97,860	146,760	8,297	14	14	27.602	45.267	1,020	0	9,317	0	0	0	9,317
2016	0	0.07180	0.05309	48,900	97,860	146,760	8,706	14	14	28.154	46.173	1,041	0	9,747	0	0	0	9,747
2017	0	0.07534	0.05570	48,900	97,860	146,760	9,135	14	14	28.717	47.096	1,061	0	10,196	0	0	0	10,196
2018	0	0.07906	0.05845	48,900	97,860	146,760	9,586	14	14	29.291	48.038	1,083	0	10,669	0	0	0	10,669
2019	0	0.08295	0.06133	48,900	97,860	146,760	10,058	14	14	29.877	48.999	1,104	0	11,162	0	0	0	11,162
2020	0	0.08704	0.06436	48,900	97,860	146,760	10,555	14	14	30.475	49.979	1,126	0	11,681	0	0	0	11,681
2021	0	0.09134	0.06753	48,900	97,860	146,760	11,075	14	14	31.084	50.978	1,149	0	12,224	0	0	0	12,224
2022	0	0.09584	0.07086	48,900	97,860	146,760	11,621	14	14	31.706	51.998	1,172	0	12,793	0	0	0	12,793
2023	0	0.10057	0.07435	48,900	97,860	146,760	12,194	14	14	32.340	53.038	1,195	0	13,389	0	0	0	13,389
2024	0	0.10552	0.07802	48,900	97,860	146,760	12,795	14	14	32.987	54.099	1,219	0	14,014	0	0	0	14,014
2025	0	0.11073	0.08187	48,900	97,860	146,760	13,426	14	14	33.647	55.181	1,244	0	14,670	0	0	0	14,670
2026	0	0.11619	0.08590	48,900	97,860	146,760	14,088	14	14	34.320	56.284	1,268	0	15,356	0	0	0	15,356
2027	0	0.12192	0.09014	48,900	97,860	146,760	14,783	14	14	35.006	57.410	1,294	0	16,077	0	0	0	16,077
2028	0	0.12793	0.09459	48,900	97,860	146,760	15,512	14	14	35.706	58.558	1,320	0	16,832	0	0	0	16,832
2029	0	0.13424	0.09925	48,900	97,860	146,760	16,277	14	14	36.420	59.729	1,346	0	17,623	0	0	0	17,623
2030	0	0.14086	0.10414	48,900	97,860	146,760	17,079	14	14	37.149	60.924	1,373	0	18,452	0	0	0	18,452
Total =				912,800	1,826,720			261	261					$248,224			$44,103	$204,121
													NPV =	$94,030			$38,471	55,559

Total NPV =	$55,559
Benefit/Cost Ratio =	2.44

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Motors - Replacement**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$752	$592	$1,344	$2,328	$5,125	$7,453	($6,109)
2012	2,357	1,642	3,999	4,655	10,250	14,905	(10,906)
2013	5,039	3,415	8,454	6,983	15,375	22,358	(13,904)
2014	5,281	3,552	8,833	0	0	0	8,833
2015	5,817	3,694	9,511	0	0	0	9,511
2016	5,868	3,842	9,710	0	0	0	9,710
2017	6,169	3,996	10,165	0	0	0	10,165
2018	6,705	4,155	10,860	0	0	0	10,860
2019	7,028	4,322	11,350	0	0	0	11,350
2020	7,522	4,494	12,016	0	0	0	12,016
2021	7,571	4,674	12,245	0	0	0	12,245
2022	7,625	4,861	12,486	0	0	0	12,486
2023	7,683	5,055	12,738	0	0	0	12,738
2024	7,746	5,258	13,004	0	0	0	13,004
2025	7,814	5,468	13,282	0	0	0	13,282
2026	7,887	5,687	13,574	0	0	0	13,574
2027	7,965	5,914	13,879	0	0	0	13,879
2028	8,049	6,151	14,200	0	0	0	14,200
2029	8,139	6,397	14,536	0	0	0	14,536
2030	8,234	6,653	14,887	0	0	0	14,887
		Total =	$221,073			$44,716	$176,357
		NPV =	$90,044			$39,661	50,384

Total NPV = $50,384
Benefit/Cost Ratio = 2.27

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$121	$241	$362
Incentive Costs =	500	1,000	1,500
Total Utility Project Costs =	$621	$1,241	$1,862
14) Direct Participant Costs ($/Part.) =	$201	$201	$201
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	0.113	0.113	0.113
16a) Avg Winter kW/part Saved =	0.113	0.113	0.113
17) Avg. Summer kWh/Part. Saved =	401	401	401
17a) Avg. Winter kWh/Part. Saved =	801	801	801
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	10	15
20) Incentive/Participant =	$100	$100	$100
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	2,005	4,010	6,015
Annual Winter Kwh Saved	4,005	8,010	12,015
23) Annual Summer KW Saved	1	1	2
Annual Winter KW Saved	1	1	2

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$14,275	2.77
Utility Cost Test	$19,025	6.76
Societal Test	$44,230	7.92
Participant Test	$17,597	4.19
Total Resource Cost Test	$16,338	3.73

Table 1
Ratepayer Impact Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	6,459	$0.02860	$185	$0.00000	$0	1	1	2	$98.68	$197	$382	$0.02243	2,005	4,005	6,010	$82	$121	$500	$703	($321)
2	2012	19,378	0.02988	579	0.00000	0	2	2	4	102.62	410	989	0.02288	6,015	12,015	18,030	250	241	1,000	1,491	(502)
3	2013	38,755	0.03195	1,238	0.00000	0	4	4	8	106.73	854	2,092	0.02334	12,030	24,030	36,060	510	362	1,500	2,372	(280)
4	2014	38,755	0.03348	1,298	0.00000	0	4	4	8	111.00	888	2,186	0.02380	12,030	24,030	36,060	520	0	0	520	1,666
5	2015	38,755	0.03688	1,429	0.00000	0	4	4	8	115.44	924	2,353	0.02428	12,030	24,030	36,060	531	0	0	531	1,822
6	2016	38,755	0.03720	1,442	0.00000	0	4	4	8	120.05	960	2,402	0.02476	12,030	24,030	36,060	541	0	0	541	1,861
7	2017	38,755	0.03911	1,516	0.00000	0	4	4	8	124.86	999	2,515	0.02526	12,030	24,030	36,060	552	0	0	552	1,963
8	2018	38,755	0.04251	1,647	0.00000	0	4	4	8	129.85	1,039	2,686	0.02576	12,030	24,030	36,060	563	0	0	563	2,123
9	2019	38,755	0.04456	1,727	0.00000	0	4	4	8	135.05	1,080	2,807	0.02628	12,030	24,030	36,060	574	0	0	574	2,233
10	2020	38,755	0.04769	1,848	0.00000	0	4	4	8	140.45	1,124	2,972	0.02681	12,030	24,030	36,060	586	0	0	586	2,386
11	2021	38,755	0.04800	1,860	0.00000	0	4	4	8	146.07	1,169	3,029	0.02734	12,030	24,030	36,060	598	0	0	598	2,431
12	2022	38,755	0.04834	1,873	0.00000	0	4	4	8	151.91	1,215	3,088	0.02789	12,030	24,030	36,060	610	0	0	610	2,478
13	2023	38,755	0.04871	1,888	0.00000	0	4	4	8	157.98	1,264	3,152	0.02845	12,030	24,030	36,060	622	0	0	622	2,530
14	2024	38,755	0.04911	1,903	0.00000	0	4	4	8	164.30	1,314	3,217	0.02902	12,030	24,030	36,060	634	0	0	634	2,583
15	2025	38,755	0.04954	1,920	0.00000	0	4	4	8	170.88	1,367	3,287	0.02960	12,030	24,030	36,060	647	0	0	647	2,640
16	2026	38,755	0.05000	1,938	0.00000	0	4	4	8	177.71	1,422	3,360	0.03019	12,030	24,030	36,060	660	0	0	660	2,700
17	2027	38,755	0.05050	1,957	0.00000	0	4	4	8	184.82	1,479	3,436	0.03079	12,030	24,030	36,060	673	0	0	673	2,763
18	2028	38,755	0.05103	1,978	0.00000	0	4	4	8	192.21	1,538	3,516	0.03141	12,030	24,030	36,060	687	0	0	687	2,829
19	2029	38,755	0.05160	2,000	0.00000	0	4	4	8	199.90	1,599	3,599	0.03204	12,030	24,030	36,060	700	0	0	700	2,899
20	2030	38,755	0.05220	2,023	0.00000	0	4	4	8	207.90	1,663	3,686	0.03268	12,030	24,030	36,060	714	0	0	714	2,972
Total =		723,427							150			$54,754				673,120				$14,978	$39,776
											NPV =	$22,328								$8,053	14,275

Total NPV = $14,275
Benefit/Cost Ratio = 2.77

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$185	$0	$197	$382	$621	$621	($239)
2012	579	0	410	989	1,241	1,241	(252)
2013	1,238	0	854	2,092	1,862	1,862	230
2014	1,298	0	888	2,186	0	0	2,186
2015	1,429	0	924	2,353	0	0	2,353
2016	1,442	0	960	2,402	0	0	2,402
2017	1,516	0	999	2,515	0	0	2,515
2018	1,647	0	1,039	2,686	0	0	2,686
2019	1,727	0	1,080	2,807	0	0	2,807
2020	1,848	0	1,124	2,972	0	0	2,972
2021	1,860	0	1,169	3,029	0	0	3,029
2022	1,873	0	1,215	3,088	0	0	3,088
2023	1,888	0	1,264	3,152	0	0	3,152
2024	1,903	0	1,314	3,217	0	0	3,217
2025	1,920	0	1,367	3,287	0	0	3,287
2026	1,938	0	1,422	3,360	0	0	3,360
2027	1,957	0	1,479	3,436	0	0	3,436
2028	1,978	0	1,538	3,516	0	0	3,516
2029	2,000	0	1,599	3,599	0	0	3,599
2030	2,023	0	1,663	3,686	0	0	3,686
Total =				$54,754		$3,724	$51,030
			NPV =	$22,328		$3,303	19,025

Total NPV =	$19,025
Benefit/Cost Ratio =	6.76

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$185	$0	$197	$121	$503	$621	$505	$1,126	($623)
2012	579	0	410	322	1,311	1,241	1,010	2,251	(940)
2013	1,238	0	854	702	2,794	1,862	1,515	3,377	(583)
2014	1,298	0	888	755	2,941	0	0	0	2,941
2015	1,429	0	924	837	3,190	0	0	0	3,190
2016	1,442	0	960	881	3,283	0	0	0	3,283
2017	1,516	0	999	950	3,465	0	0	0	3,465
2018	1,647	0	1,039	1,045	3,731	0	0	0	3,731
2019	1,727	0	1,080	1,124	3,931	0	0	0	3,931
2020	1,848	0	1,124	1,226	4,198	0	0	0	4,198
2021	1,860	0	1,169	1,287	4,316	0	0	0	4,316
2022	1,873	0	1,215	1,352	4,440	0	0	0	4,440
2023	1,888	0	1,264	1,421	4,573	0	0	0	4,573
2024	1,903	0	1,314	1,494	4,711	0	0	0	4,711
2025	1,920	0	1,367	1,572	4,859	0	0	0	4,859
2026	1,938	0	1,422	1,655	5,015	0	0	0	5,015
2027	1,957	0	1,479	1,744	5,180	0	0	0	5,180
2028	1,978	0	1,538	1,838	5,354	0	0	0	5,354
2029	2,000	0	1,599	1,937	5,536	0	0	0	5,536
2030	2,023	0	1,663	2,044	5,730	0	0	0	5,730
Total =					$79,061			$6,754	$72,307
				NPV =	$50,623			$6,393	44,230

Total NPV = $44,230
Benefit/Cost Ratio = 7.92

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$500	$0.05644	$0.04173	2,005	4,005	6,010	$280	1	1	$25.500	$41.820	$67	$0	$847	$1,026	$0	$1,026	($179)
2012	1,000	0.05923	0.04379	6,015	12,015	18,030	882	2	2	26.010	42.656	137	0	2,019	2,096	0	2,096	(77)
2013	1,500	0.06215	0.04595	12,030	24,030	36,060	1,852	3	3	26.530	43.510	210	0	3,562	3,210	0	3,210	352
2014	0	0.06521	0.04821	12,030	24,030	36,060	1,943	3	3	27.061	44.380	214	0	2,157	0	0	0	2,157
2015	0	0.06843	0.05059	12,030	24,030	36,060	2,039	3	3	27.602	45.267	219	0	2,258	0	0	0	2,258
2016	0	0.07180	0.05309	12,030	24,030	36,060	2,140	3	3	28.154	46.173	223	0	2,363	0	0	0	2,363
2017	0	0.07534	0.05570	12,030	24,030	36,060	2,245	3	3	28.717	47.096	227	0	2,472	0	0	0	2,472
2018	0	0.07906	0.05845	12,030	24,030	36,060	2,356	3	3	29.291	48.038	232	0	2,588	0	0	0	2,588
2019	0	0.08295	0.06133	12,030	24,030	36,060	2,472	3	3	29.877	48.999	237	0	2,709	0	0	0	2,709
2020	0	0.08704	0.06436	12,030	24,030	36,060	2,594	3	3	30.475	49.979	241	0	2,835	0	0	0	2,835
2021	0	0.09134	0.06753	12,030	24,030	36,060	2,722	3	3	31.084	50.978	246	0	2,968	0	0	0	2,968
2022	0	0.09584	0.07086	12,030	24,030	36,060	2,856	3	3	31.706	51.998	251	0	3,107	0	0	0	3,107
2023	0	0.10057	0.07435	12,030	24,030	36,060	2,996	3	3	32.340	53.038	256	0	3,252	0	0	0	3,252
2024	0	0.10552	0.07802	12,030	24,030	36,060	3,144	3	3	32.987	54.099	261	0	3,405	0	0	0	3,405
2025	0	0.11073	0.08187	12,030	24,030	36,060	3,299	3	3	33.647	55.181	266	0	3,565	0	0	0	3,565
2026	0	0.11619	0.08590	12,030	24,030	36,060	3,462	3	3	34.320	56.284	272	0	3,734	0	0	0	3,734
2027	0	0.12192	0.09014	12,030	24,030	36,060	3,633	3	3	35.006	57.410	277	0	3,910	0	0	0	3,910
2028	0	0.12793	0.09459	12,030	24,030	36,060	3,812	3	3	35.706	58.558	283	0	4,095	0	0	0	4,095
2029	0	0.13424	0.09925	12,030	24,030	36,060	4,000	3	3	36.420	59.729	288	0	4,288	0	0	0	4,288
2030	0	0.14086	0.10414	12,030	24,030	36,060	4,197	3	3	37.149	60.924	294	0	4,491	0	0	0	4,491
Total =				224,560	448,560			57	57					$60,625			$6,332	$54,293
													NPV =	$23,120			$5,523	17,597

Total NPV = $17,597
Benefit/Cost Ratio = 4.19

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical Motors - New / on Failure**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$185	$197	$382	$621	$505	$1,126	($744)
2012	579	410	989	1,241	1,010	2,251	(1,262)
2013	1,238	854	2,092	1,862	1,515	3,377	(1,285)
2014	1,298	888	2,186	0	0	0	2,186
2015	1,429	924	2,353	0	0	0	2,353
2016	1,442	960	2,402	0	0	0	2,402
2017	1,516	999	2,515	0	0	0	2,515
2018	1,647	1,039	2,686	0	0	0	2,686
2019	1,727	1,080	2,807	0	0	0	2,807
2020	1,848	1,124	2,972	0	0	0	2,972
2021	1,860	1,169	3,029	0	0	0	3,029
2022	1,873	1,215	3,088	0	0	0	3,088
2023	1,888	1,264	3,152	0	0	0	3,152
2024	1,903	1,314	3,217	0	0	0	3,217
2025	1,920	1,367	3,287	0	0	0	3,287
2026	1,938	1,422	3,360	0	0	0	3,360
2027	1,957	1,479	3,436	0	0	0	3,436
2028	1,978	1,538	3,516	0	0	0	3,516
2029	2,000	1,599	3,599	0	0	0	3,599
2030	2,023	1,663	3,686	0	0	0	3,686
		Total =	$54,754			$6,754	$48,000
		NPV =	$22,328			$5,990	16,338

Total NPV = $16,338
Benefit/Cost Ratio = 3.73

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$905	$905	$1,811
Incentive Costs =	3,750	3,750	7,500
Total Utility Project Costs =	$4,655	$4,655	$9,311
14) Direct Participant Costs ($/Part.) =	$2,500	$2,500	$2,500
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	4.400	4.400	4.400
16a) Avg Winter kW/part Saved =	4.400	4.400	4.400
17) Avg. Summer kWh/Part. Saved =	7,074	7,074	7,074
17a) Avg. Winter kWh/Part. Saved =	14,148	14,148	14,148
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	5	10
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	35,370	35,370	70,740
Annual Winter Kwh Saved	70,740	70,740	141,480
23) Annual Summer KW Saved	22	22	44
Annual Winter KW Saved	22	22	44

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$265,944	4.98
Utility Cost Test	$316,185	19.99
Societal Test	$638,421	13.53
Participant Test	$207,843	5.50
Total Resource Cost Test	$284,886	6.94

Table 1
Ratepayer Impact Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	114,042	$0.02860	$3,262	$0.00000	$0	25	25	50	$98.68	$4,934	$8,196	$0.02243	35,370	70,740	106,110	$1,443	$905	$3,750	$6,098	$2,098
2	2012	228,084	0.02988	6,815	0.00000	0	49	49	98	102.62	10,057	16,872	0.02288	70,740	141,480	212,220	2,943	905	3,750	7,598	9,274
3	2013	456,167	0.03195	14,575	0.00000	0	98	98	196	106.73	20,919	35,494	0.02334	141,480	282,960	424,440	6,005	1,811	7,500	15,316	20,178
4	2014	456,167	0.03348	15,272	0.00000	0	98	98	196	111.00	21,756	37,028	0.02380	141,480	282,960	424,440	6,123	0	0	6,123	30,905
5	2015	456,167	0.03688	16,823	0.00000	0	98	98	196	115.44	22,626	39,449	0.02428	141,480	282,960	424,440	6,246	0	0	6,246	33,203
6	2016	456,167	0.03720	16,969	0.00000	0	98	98	196	120.05	23,530	40,499	0.02476	141,480	282,960	424,440	6,370	0	0	6,370	34,129
7	2017	456,167	0.03911	17,841	0.00000	0	98	98	196	124.86	24,473	42,314	0.02526	141,480	282,960	424,440	6,498	0	0	6,498	35,816
8	2018	456,167	0.04251	19,392	0.00000	0	98	98	196	129.85	25,451	44,843	0.02576	141,480	282,960	424,440	6,627	0	0	6,627	38,216
9	2019	456,167	0.04456	20,327	0.00000	0	98	98	196	135.05	26,470	46,797	0.02628	141,480	282,960	424,440	6,761	0	0	6,761	40,036
10	2020	456,167	0.04769	21,755	0.00000	0	98	98	196	140.45	27,528	49,283	0.02681	141,480	282,960	424,440	6,897	0	0	6,897	42,386
11	2021	456,167	0.04800	21,896	0.00000	0	98	98	196	146.07	28,630	50,526	0.02734	141,480	282,960	424,440	7,034	0	0	7,034	43,492
12	2022	456,167	0.04834	22,051	0.00000	0	98	98	196	151.91	29,774	51,825	0.02789	141,480	282,960	424,440	7,175	0	0	7,175	44,650
13	2023	456,167	0.04871	22,220	0.00000	0	98	98	196	157.98	30,964	53,184	0.02845	141,480	282,960	424,440	7,319	0	0	7,319	45,865
14	2024	456,167	0.04911	22,402	0.00000	0	98	98	196	164.30	32,203	54,605	0.02902	141,480	282,960	424,440	7,466	0	0	7,466	47,139
15	2025	456,167	0.04954	22,599	0.00000	0	98	98	196	170.88	33,492	56,091	0.02960	141,480	282,960	424,440	7,615	0	0	7,615	48,476
16	2026	342,125	0.05000	17,106	0.00000	0	74	74	148	177.71	26,301	43,407	0.03019	106,110	212,220	318,330	5,825	0	0	5,825	37,582
17	2027	228,084	0.05050	11,518	0.00000	0	49	49	98	184.82	18,112	29,630	0.03079	70,740	141,480	212,220	3,961	0	0	3,961	25,669
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.03141	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.03204	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.03268	0	0	0	0	0	0	0	0
Total =		6,842,506							2,942			$700,043				6,366,600				$120,929	$579,114
											NPV =	$332,837								$66,893	265,944

Total NPV = $265,944
Benefit/Cost Ratio = 4.98

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$3,262	$0	$4,934	$8,196	$4,655	$4,655	$3,541
2012	6,815	0	10,057	16,872	4,655	4,655	12,217
2013	14,575	0	20,919	35,494	9,311	9,311	26,183
2014	15,272	0	21,756	37,028	0	0	37,028
2015	16,823	0	22,626	39,449	0	0	39,449
2016	16,969	0	23,530	40,499	0	0	40,499
2017	17,841	0	24,473	42,314	0	0	42,314
2018	19,392	0	25,451	44,843	0	0	44,843
2019	20,327	0	26,470	46,797	0	0	46,797
2020	21,755	0	27,528	49,283	0	0	49,283
2021	21,896	0	28,630	50,526	0	0	50,526
2022	22,051	0	29,774	51,825	0	0	51,825
2023	22,220	0	30,964	53,184	0	0	53,184
2024	22,402	0	32,203	54,605	0	0	54,605
2025	22,599	0	33,492	56,091	0	0	56,091
2026	17,106	0	26,301	43,407	0	0	43,407
2027	11,518	0	18,112	29,630	0	0	29,630
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$700,043		$18,621	$681,422
			NPV =	$332,837		$16,652	316,185

Total NPV =	$316,185
Benefit/Cost Ratio =	19.99

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits					Costs			
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Annual Benefits Less Costs (I)
2011	$3,262	$0	$4,934	$2,592	$10,788	$4,655	$8,750	$13,405	($2,617)
2012	6,815	0	10,057	5,495	22,367	4,655	8,750	13,405	8,962
2013	14,575	0	20,919	11,907	47,401	9,311	17,500	26,811	20,590
2014	15,272	0	21,756	12,794	49,822	0	0	0	49,822
2015	16,823	0	22,626	14,040	53,489	0	0	0	53,489
2016	16,969	0	23,530	14,846	55,345	0	0	0	55,345
2017	17,841	0	24,473	15,977	58,291	0	0	0	58,291
2018	19,392	0	25,451	17,439	62,282	0	0	0	62,282
2019	20,327	0	26,470	18,745	65,542	0	0	0	65,542
2020	21,755	0	27,528	20,333	69,616	0	0	0	69,616
2021	21,896	0	28,630	21,472	71,998	0	0	0	71,998
2022	22,051	0	29,774	22,684	74,509	0	0	0	74,509
2023	22,220	0	30,964	23,977	77,161	0	0	0	77,161
2024	22,402	0	32,203	25,357	79,962	0	0	0	79,962
2025	22,599	0	33,492	26,828	82,919	0	0	0	82,919
2026	17,106	0	26,301	21,384	64,791	0	0	0	64,791
2027	11,518	0	18,112	15,035	44,665	0	0	0	44,665
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$990,948			$53,621	$937,327
				NPV =	$689,360			$50,939	638,421

Total NPV = $638,421
Benefit/Cost Ratio = 13.53

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$3,750	$0.05644	$0.04173	35,370	70,740	106,110	$4,948	22	22	$25.500	$41.820	$1,481	$0	$10,179	$12,764	$0	$12,764	($2,585)
2012	3,750	0.05923	0.04379	70,740	141,480	212,220	10,385	44	44	26.010	42.656	3,021	0	17,156	13,033	0	13,033	4,123
2013	7,500	0.06215	0.04595	141,480	282,960	424,440	21,795	88	88	26.530	43.510	6,163	0	35,458	26,616	0	26,616	8,842
2014	0	0.06521	0.04821	141,480	282,960	424,440	22,867	88	88	27.061	44.380	6,287	0	29,154	0	0	0	29,154
2015	0	0.06843	0.05059	141,480	282,960	424,440	23,996	88	88	27.602	45.267	6,412	0	30,408	0	0	0	30,408
2016	0	0.07180	0.05309	141,480	282,960	424,440	25,181	88	88	28.154	46.173	6,541	0	31,722	0	0	0	31,722
2017	0	0.07534	0.05570	141,480	282,960	424,440	26,420	88	88	28.717	47.096	6,672	0	33,092	0	0	0	33,092
2018	0	0.07906	0.05845	141,480	282,960	424,440	27,724	88	88	29.291	48.038	6,805	0	34,529	0	0	0	34,529
2019	0	0.08295	0.06133	141,480	282,960	424,440	29,090	88	88	29.877	48.999	6,941	0	36,031	0	0	0	36,031
2020	0	0.08704	0.06436	141,480	282,960	424,440	30,526	88	88	30.475	49.979	7,080	0	37,606	0	0	0	37,606
2021	0	0.09134	0.06753	141,480	282,960	424,440	32,031	88	88	31.084	50.978	7,221	0	39,252	0	0	0	39,252
2022	0	0.09584	0.07086	141,480	282,960	424,440	33,610	88	88	31.706	51.998	7,366	0	40,976	0	0	0	40,976
2023	0	0.10057	0.07435	141,480	282,960	424,440	35,267	88	88	32.340	53.038	7,513	0	42,780	0	0	0	42,780
2024	0	0.10552	0.07802	141,480	282,960	424,440	37,006	88	88	32.987	54.099	7,664	0	44,670	0	0	0	44,670
2025	0	0.11073	0.08187	141,480	282,960	424,440	38,832	88	88	33.647	55.181	7,817	0	46,649	0	0	0	46,649
2026	0	0.11619	0.08590	106,110	212,220	318,330	30,559	66	66	34.320	56.284	5,980	0	36,539	0	0	0	36,539
2027	0	0.12192	0.09014	70,740	141,480	212,220	21,378	44	44	35.006	57.410	4,066	0	25,444	0	0	0	25,444
2028	0	0.12793	0.09459	0	0	0	0	0	0	35.706	58.558	0	0	0	0	0	0	0
2029	0	0.13424	0.09925	0	0	0	0	0	0	36.420	59.729	0	0	0	0	0	0	0
2030	0	0.14086	0.10414	0	0	0	0	0	0	37.149	60.924	0	0	0	0	0	0	0
Total =				2,122,200	4,244,400			1,320	1,320					$571,645			$52,413	$519,232
													NPV =	$253,980			$46,137	207,843

Total NPV = $207,843
Benefit/Cost Ratio = 5.50

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Variable Speed Drives - VFD'S**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$3,262	$4,934	$8,196	$4,655	$8,750	$13,405	($5,209)
2012	6,815	10,057	16,872	4,655	8,750	13,405	3,467
2013	14,575	20,919	35,494	9,311	17,500	26,811	8,683
2014	15,272	21,756	37,028	0	0	0	37,028
2015	16,823	22,626	39,449	0	0	0	39,449
2016	16,969	23,530	40,499	0	0	0	40,499
2017	17,841	24,473	42,314	0	0	0	42,314
2018	19,392	25,451	44,843	0	0	0	44,843
2019	20,327	26,470	46,797	0	0	0	46,797
2020	21,755	27,528	49,283	0	0	0	49,283
2021	21,896	28,630	50,526	0	0	0	50,526
2022	22,051	29,774	51,825	0	0	0	51,825
2023	22,220	30,964	53,184	0	0	0	53,184
2024	22,402	32,203	54,605	0	0	0	54,605
2025	22,599	33,492	56,091	0	0	0	56,091
2026	17,106	26,301	43,407	0	0	0	43,407
2027	11,518	18,112	29,630	0	0	0	29,630
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$700,043			$53,621	$646,422
		NPV =	$332,837			$47,951	284,886

Total NPV =	$284,886
Benefit/Cost Ratio =	6.94

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$905	$905	$1,811
Incentive Costs =	3,750	3,750	7,500
Total Utility Project Costs =	$4,655	$4,655	$9,311
14) Direct Participant Costs ($/Part.) =	$1,035	$1,035	$1,035
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	2.430	2.430	2.430
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,593	1,593	1,593
17a) Avg. Winter kWh/Part. Saved =	3,262	3,262	3,262
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	5	10
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	7,965	7,965	15,930
Annual Winter Kwh Saved	16,310	16,310	32,620
23) Annual Summer KW Saved	12	12	24
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$57,063	3.03
Utility Cost Test	$68,557	5.12
Societal Test	$153,387	7.64
Participant Test	$48,253	3.53
Total Resource Cost Test	$63,460	3.92

Table 1
Ratepayer Impact Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	26,089	$0.02860	$746	$0.00000	$0	14	0	14	$98.68	$1,382	$2,128	$0.02243	7,965	16,310	24,275	$330	$905	$3,750	$4,985	($2,857)
2	2012	52,179	0.02988	1,559	0.00000	0	27	0	27	102.62	2,771	4,330	0.02288	15,930	32,620	48,550	673	905	3,750	5,328	(998)
3	2013	104,359	0.03195	3,334	0.00000	0	54	0	54	106.73	5,763	9,097	0.02334	31,860	65,240	97,100	1,374	1,811	7,500	10,685	(1,588)
4	2014	104,359	0.03348	3,494	0.00000	0	54	0	54	111.00	5,994	9,488	0.02380	31,860	65,240	97,100	1,401	0	0	1,401	8,087
5	2015	104,359	0.03688	3,849	0.00000	0	54	0	54	115.44	6,234	10,083	0.02428	31,860	65,240	97,100	1,429	0	0	1,429	8,654
6	2016	104,359	0.03720	3,882	0.00000	0	54	0	54	120.05	6,483	10,365	0.02476	31,860	65,240	97,100	1,457	0	0	1,457	8,908
7	2017	104,359	0.03911	4,081	0.00000	0	54	0	54	124.86	6,742	10,823	0.02526	31,860	65,240	97,100	1,487	0	0	1,487	9,336
8	2018	104,359	0.04251	4,436	0.00000	0	54	0	54	129.85	7,012	11,448	0.02576	31,860	65,240	97,100	1,516	0	0	1,516	9,932
9	2019	104,359	0.04456	4,650	0.00000	0	54	0	54	135.05	7,293	11,943	0.02628	31,860	65,240	97,100	1,547	0	0	1,547	10,396
10	2020	104,359	0.04769	4,977	0.00000	0	54	0	54	140.45	7,584	12,561	0.02681	31,860	65,240	97,100	1,578	0	0	1,578	10,983
11	2021	104,359	0.04800	5,009	0.00000	0	54	0	54	146.07	7,888	12,897	0.02734	31,860	65,240	97,100	1,609	0	0	1,609	11,288
12	2022	104,359	0.04834	5,045	0.00000	0	54	0	54	151.91	8,203	13,248	0.02789	31,860	65,240	97,100	1,641	0	0	1,641	11,607
13	2023	104,359	0.04871	5,083	0.00000	0	54	0	54	157.98	8,531	13,614	0.02845	31,860	65,240	97,100	1,674	0	0	1,674	11,940
14	2024	104,359	0.04911	5,125	0.00000	0	54	0	54	164.30	8,872	13,997	0.02902	31,860	65,240	97,100	1,708	0	0	1,708	12,289
15	2025	104,359	0.04954	5,170	0.00000	0	54	0	54	170.88	9,228	14,398	0.02960	31,860	65,240	97,100	1,742	0	0	1,742	12,656
16	2026	78,269	0.05000	3,913	0.00000	0	41	0	41	177.71	7,286	11,199	0.03019	23,895	48,930	72,825	1,333	0	0	1,333	9,866
17	2027	52,179	0.05050	2,635	0.00000	0	27	0	27	184.82	4,990	7,625	0.03079	15,930	32,620	48,550	906	0	0	906	6,719
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.03141	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.03204	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.03268	0	0	0	0	0	0	0	0
Total =		1,565,383							811			$179,244				1,456,500				$42,026	$137,218
											NPV =	$85,209								$28,146	57,063

Total NPV = $57,063
Benefit/Cost Ratio = 3.03

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$746	$0	$1,382	$2,128	$4,655	$4,655	($2,527)
2012	1,559	0	2,771	4,330	4,655	4,655	(325)
2013	3,334	0	5,763	9,097	9,311	9,311	(214)
2014	3,494	0	5,994	9,488	0	0	9,488
2015	3,849	0	6,234	10,083	0	0	10,083
2016	3,882	0	6,483	10,365	0	0	10,365
2017	4,081	0	6,742	10,823	0	0	10,823
2018	4,436	0	7,012	11,448	0	0	11,448
2019	4,650	0	7,293	11,943	0	0	11,943
2020	4,977	0	7,584	12,561	0	0	12,561
2021	5,009	0	7,888	12,897	0	0	12,897
2022	5,045	0	8,203	13,248	0	0	13,248
2023	5,083	0	8,531	13,614	0	0	13,614
2024	5,125	0	8,872	13,997	0	0	13,997
2025	5,170	0	9,228	14,398	0	0	14,398
2026	3,913	0	7,286	11,199	0	0	11,199
2027	2,635	0	4,990	7,625	0	0	7,625
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$179,244		$18,621	$160,623
			NPV =	$85,209		$16,652	68,557

Total NPV =	$68,557
Benefit/Cost Ratio =	5.12

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$746	$0	$1,382	$673	$2,801	$4,655	$1,425	$6,080	($3,279)
2012	1,559	0	2,771	1,410	5,740	4,655	1,425	6,080	(340)
2013	3,334	0	5,763	3,052	12,149	9,311	2,850	12,161	(12)
2014	3,494	0	5,994	3,278	12,766	0	0	0	12,766
2015	3,849	0	6,234	3,589	13,672	0	0	0	13,672
2016	3,882	0	6,483	3,800	14,165	0	0	0	14,165
2017	4,081	0	6,742	4,086	14,909	0	0	0	14,909
2018	4,436	0	7,012	4,452	15,900	0	0	0	15,900
2019	4,650	0	7,293	4,784	16,727	0	0	0	16,727
2020	4,977	0	7,584	5,182	17,743	0	0	0	17,743
2021	5,009	0	7,888	5,481	18,378	0	0	0	18,378
2022	5,045	0	8,203	5,799	19,047	0	0	0	19,047
2023	5,083	0	8,531	6,138	19,752	0	0	0	19,752
2024	5,125	0	8,872	6,500	20,497	0	0	0	20,497
2025	5,170	0	9,228	6,887	21,285	0	0	0	21,285
2026	3,913	0	7,286	5,517	16,716	0	0	0	16,716
2027	2,635	0	4,990	3,869	11,494	0	0	0	11,494
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$253,741			$24,321	$229,420
				NPV =	$176,492			$23,105	153,387

Total NPV = $153,387
Benefit/Cost Ratio = 7.64

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$3,750	$0.05644	$0.04173	7,965	16,310	24,275	$1,130	12	0	$25.500	$41.820	$306	$0	$5,186	$5,284	$0	$5,284	($98)
2012	3,750	0.05923	0.04379	15,930	32,620	48,550	2,372	24	0	26.010	42.656	624	0	6,746	5,396	0	5,396	1,350
2013	7,500	0.06215	0.04595	31,860	65,240	97,100	4,978	49	0	26.530	43.510	1,300	0	13,778	11,019	0	11,019	2,759
2014	0	0.06521	0.04821	31,860	65,240	97,100	5,223	49	0	27.061	44.380	1,326	0	6,549	0	0	0	6,549
2015	0	0.06843	0.05059	31,860	65,240	97,100	5,481	49	0	27.602	45.267	1,352	0	6,833	0	0	0	6,833
2016	0	0.07180	0.05309	31,860	65,240	97,100	5,751	49	0	28.154	46.173	1,380	0	7,131	0	0	0	7,131
2017	0	0.07534	0.05570	31,860	65,240	97,100	6,034	49	0	28.717	47.096	1,407	0	7,441	0	0	0	7,441
2018	0	0.07906	0.05845	31,860	65,240	97,100	6,332	49	0	29.291	48.038	1,435	0	7,767	0	0	0	7,767
2019	0	0.08295	0.06133	31,860	65,240	97,100	6,644	49	0	29.877	48.999	1,464	0	8,108	0	0	0	8,108
2020	0	0.08704	0.06436	31,860	65,240	97,100	6,972	49	0	30.475	49.979	1,493	0	8,465	0	0	0	8,465
2021	0	0.09134	0.06753	31,860	65,240	97,100	7,316	49	0	31.084	50.978	1,523	0	8,839	0	0	0	8,839
2022	0	0.09584	0.07086	31,860	65,240	97,100	7,676	49	0	31.706	51.998	1,554	0	9,230	0	0	0	9,230
2023	0	0.10057	0.07435	31,860	65,240	97,100	8,055	49	0	32.340	53.038	1,585	0	9,640	0	0	0	9,640
2024	0	0.10552	0.07802	31,860	65,240	97,100	8,452	49	0	32.987	54.099	1,616	0	10,068	0	0	0	10,068
2025	0	0.11073	0.08187	31,860	65,240	97,100	8,869	49	0	33.647	55.181	1,649	0	10,518	0	0	0	10,518
2026	0	0.11619	0.08590	23,895	48,930	72,825	6,979	36	0	34.320	56.284	1,236	0	8,215	0	0	0	8,215
2027	0	0.12192	0.09014	15,930	32,620	48,550	4,883	24	0	35.006	57.410	840	0	5,723	0	0	0	5,723
2028	0	0.12793	0.09459	0	0	0	0	0	0	35.706	58.558	0	0	0	0	0	0	0
2029	0	0.13424	0.09925	0	0	0	0	0	0	36.420	59.729	0	0	0	0	0	0	0
2030	0	0.14086	0.10414	0	0	0	0	0	0	37.149	60.924	0	0	0	0	0	0	0
Total =				477,900	978,600			733	0					$140,237			$21,699	$118,538
													NPV =	$67,354			$19,101	48,253

Total NPV = $48,253
Benefit/Cost Ratio = 3.53

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial AC - Split Systems**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$746	$1,382	$2,128	$4,655	$1,425	$6,080	($3,952)
2012	1,559	2,771	4,330	4,655	1,425	6,080	(1,750)
2013	3,334	5,763	9,097	9,311	2,850	12,161	(3,064)
2014	3,494	5,994	9,488	0	0	0	9,488
2015	3,849	6,234	10,083	0	0	0	10,083
2016	3,882	6,483	10,365	0	0	0	10,365
2017	4,081	6,742	10,823	0	0	0	10,823
2018	4,436	7,012	11,448	0	0	0	11,448
2019	4,650	7,293	11,943	0	0	0	11,943
2020	4,977	7,584	12,561	0	0	0	12,561
2021	5,009	7,888	12,897	0	0	0	12,897
2022	5,045	8,203	13,248	0	0	0	13,248
2023	5,083	8,531	13,614	0	0	0	13,614
2024	5,125	8,872	13,997	0	0	0	13,997
2025	5,170	9,228	14,398	0	0	0	14,398
2026	3,913	7,286	11,199	0	0	0	11,199
2027	2,635	4,990	7,625	0	0	0	7,625
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$179,244			$24,321	$154,923
		NPV =	$85,209			$21,749	63,460

Total NPV = $63,460
Benefit/Cost Ratio = 3.92

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$362	$905	$1,811
Incentive Costs =	1,500	3,750	7,500
Total Utility Project Costs =	$1,862	$4,655	$9,311
14) Direct Participant Costs ($/Part.) =	$1,246	$1,246	$1,246
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	2.790	2.790	2.790
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,806	1,806	1,806
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	5	10
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	3,612	9,030	18,060
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	6	14	28
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$44,154	3.53
Utility Cost Test	$47,728	4.44
Societal Test	$106,475	5.66
Participant Test	$17,966	1.94
Total Resource Cost Test	$40,345	2.90

Table 1
Ratepayer Impact Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	3,882	$0.02860	$111	$0.00000	$0	6	0	6	$98.68	$592	$703	$0.02243	3,612	0	3,612	$49	$362	$1,500	$1,911	($1,208)
2	2012	13,587	0.02988	406	0.00000	0	22	0	22	102.62	2,258	2,664	0.02288	12,642	0	12,642	175	905	3,750	4,830	(2,166)
3	2013	32,997	0.03195	1,054	0.00000	0	53	0	53	106.73	5,657	6,711	0.02334	30,702	0	30,702	434	1,811	7,500	9,745	(3,034)
4	2014	32,997	0.03348	1,105	0.00000	0	53	0	53	111.00	5,883	6,988	0.02380	30,702	0	30,702	443	0	0	443	6,545
5	2015	32,997	0.03688	1,217	0.00000	0	53	0	53	115.44	6,118	7,335	0.02428	30,702	0	30,702	452	0	0	452	6,883
6	2016	32,997	0.03720	1,227	0.00000	0	53	0	53	120.05	6,363	7,590	0.02476	30,702	0	30,702	461	0	0	461	7,129
7	2017	32,997	0.03911	1,291	0.00000	0	53	0	53	124.86	6,618	7,909	0.02526	30,702	0	30,702	470	0	0	470	7,439
8	2018	32,997	0.04251	1,403	0.00000	0	53	0	53	129.85	6,882	8,285	0.02576	30,702	0	30,702	479	0	0	479	7,806
9	2019	32,997	0.04456	1,470	0.00000	0	53	0	53	135.05	7,158	8,628	0.02628	30,702	0	30,702	489	0	0	489	8,139
10	2020	32,997	0.04769	1,574	0.00000	0	53	0	53	140.45	7,444	9,018	0.02681	30,702	0	30,702	499	0	0	499	8,519
11	2021	32,997	0.04800	1,584	0.00000	0	53	0	53	146.07	7,742	9,326	0.02734	30,702	0	30,702	509	0	0	509	8,817
12	2022	32,997	0.04834	1,595	0.00000	0	53	0	53	151.91	8,051	9,646	0.02789	30,702	0	30,702	519	0	0	519	9,127
13	2023	32,997	0.04871	1,607	0.00000	0	53	0	53	157.98	8,373	9,980	0.02845	30,702	0	30,702	529	0	0	529	9,451
14	2024	32,997	0.04911	1,620	0.00000	0	53	0	53	164.30	8,708	10,328	0.02902	30,702	0	30,702	540	0	0	540	9,788
15	2025	32,997	0.04954	1,635	0.00000	0	53	0	53	170.88	9,057	10,692	0.02960	30,702	0	30,702	551	0	0	551	10,141
16	2026	29,115	0.05000	1,456	0.00000	0	47	0	47	177.71	8,352	9,808	0.03019	27,090	0	27,090	496	0	0	496	9,312
17	2027	19,410	0.05050	980	0.00000	0	31	0	31	184.82	5,729	6,709	0.03079	18,060	0	18,060	337	0	0	337	6,372
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.03141	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.03204	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.03268	0	0	0	0	0	0	0	0
Total =		494,955							795			$132,320				460,530				$23,260	$109,060
											NPV =	$61,587								$17,433	44,154

Total NPV = $44,154
Benefit/Cost Ratio = 3.53

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$111	$0	$592	$703	$1,862	$1,862	($1,159)
2012	406	0	2,258	2,664	4,655	4,655	(1,991)
2013	1,054	0	5,657	6,711	9,311	9,311	(2,600)
2014	1,105	0	5,883	6,988	0	0	6,988
2015	1,217	0	6,118	7,335	0	0	7,335
2016	1,227	0	6,363	7,590	0	0	7,590
2017	1,291	0	6,618	7,909	0	0	7,909
2018	1,403	0	6,882	8,285	0	0	8,285
2019	1,470	0	7,158	8,628	0	0	8,628
2020	1,574	0	7,444	9,018	0	0	9,018
2021	1,584	0	7,742	9,326	0	0	9,326
2022	1,595	0	8,051	9,646	0	0	9,646
2023	1,607	0	8,373	9,980	0	0	9,980
2024	1,620	0	8,708	10,328	0	0	10,328
2025	1,635	0	9,057	10,692	0	0	10,692
2026	1,456	0	8,352	9,808	0	0	9,808
2027	980	0	5,729	6,709	0	0	6,709
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$132,320		$15,828	$116,492
			NPV =	$61,587		$13,859	47,728

Total NPV =	$47,728
Benefit/Cost Ratio =	4.44

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$111	$0	$592	$222	$925	$1,862	$992	$2,854	($1,929)
2012	406	0	2,258	868	3,532	4,655	2,480	7,135	(3,603)
2013	1,054	0	5,657	2,251	8,962	9,311	4,960	14,271	(5,309)
2014	1,105	0	5,883	2,415	9,403	0	0	0	9,403
2015	1,217	0	6,118	2,611	9,946	0	0	0	9,946
2016	1,227	0	6,363	2,782	10,372	0	0	0	10,372
2017	1,291	0	6,618	2,986	10,895	0	0	0	10,895
2018	1,403	0	6,882	3,222	11,507	0	0	0	11,507
2019	1,470	0	7,158	3,456	12,084	0	0	0	12,084
2020	1,574	0	7,444	3,721	12,739	0	0	0	12,739
2021	1,584	0	7,742	3,963	13,289	0	0	0	13,289
2022	1,595	0	8,051	4,222	13,868	0	0	0	13,868
2023	1,607	0	8,373	4,499	14,479	0	0	0	14,479
2024	1,620	0	8,708	4,796	15,124	0	0	0	15,124
2025	1,635	0	9,057	5,114	15,806	0	0	0	15,806
2026	1,456	0	8,352	4,832	14,640	0	0	0	14,640
2027	980	0	5,729	3,404	10,113	0	0	0	10,113
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$187,684			$24,260	$163,424
				NPV =	$129,307			$22,832	106,475

Total NPV = $106,475
Benefit/Cost Ratio = 5.66

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,500	$0.05644	$0.04173	3,612	0	3,612	$204	6	0	$25.500	$41.820	$153	$0	$1,857	$2,545	$0	$2,545	($688)
2012	3,750	0.05923	0.04379	12,642	0	12,642	749	20	0	26.010	42.656	520	0	5,019	6,496	0	6,496	(1,477)
2013	7,500	0.06215	0.04595	30,702	0	30,702	1,908	47	0	26.530	43.510	1,247	0	10,655	13,265	0	13,265	(2,610)
2014	0	0.06521	0.04821	30,702	0	30,702	2,002	47	0	27.061	44.380	1,272	0	3,274	0	0	0	3,274
2015	0	0.06843	0.05059	30,702	0	30,702	2,101	47	0	27.602	45.267	1,297	0	3,398	0	0	0	3,398
2016	0	0.07180	0.05309	30,702	0	30,702	2,204	47	0	28.154	46.173	1,323	0	3,527	0	0	0	3,527
2017	0	0.07534	0.05570	30,702	0	30,702	2,313	47	0	28.717	47.096	1,350	0	3,663	0	0	0	3,663
2018	0	0.07906	0.05845	30,702	0	30,702	2,427	47	0	29.291	48.038	1,377	0	3,804	0	0	0	3,804
2019	0	0.08295	0.06133	30,702	0	30,702	2,547	47	0	29.877	48.999	1,404	0	3,951	0	0	0	3,951
2020	0	0.08704	0.06436	30,702	0	30,702	2,672	47	0	30.475	49.979	1,432	0	4,104	0	0	0	4,104
2021	0	0.09134	0.06753	30,702	0	30,702	2,804	47	0	31.084	50.978	1,461	0	4,265	0	0	0	4,265
2022	0	0.09584	0.07086	30,702	0	30,702	2,942	47	0	31.706	51.998	1,490	0	4,432	0	0	0	4,432
2023	0	0.10057	0.07435	30,702	0	30,702	3,088	47	0	32.340	53.038	1,520	0	4,608	0	0	0	4,608
2024	0	0.10552	0.07802	30,702	0	30,702	3,240	47	0	32.987	54.099	1,550	0	4,790	0	0	0	4,790
2025	0	0.11073	0.08187	30,702	0	30,702	3,400	47	0	33.647	55.181	1,581	0	4,981	0	0	0	4,981
2026	0	0.11619	0.08590	27,090	0	27,090	3,148	42	0	34.320	56.284	1,441	0	4,589	0	0	0	4,589
2027	0	0.12192	0.09014	18,060	0	18,060	2,202	28	0	35.006	57.410	980	0	3,182	0	0	0	3,182
2028	0	0.12793	0.09459	0	0	0	0	0	0	35.706	58.558	0	0	0	0	0	0	0
2029	0	0.13424	0.09925	0	0	0	0	0	0	36.420	59.729	0	0	0	0	0	0	0
2030	0	0.14086	0.10414	0	0	0	0	0	0	37.149	60.924	0	0	0	0	0	0	0
Total =				460,530	0			707	0					$74,099			$22,306	$51,793
													NPV =	$37,144			$19,178	17,966

Total NPV =	$17,966
Benefit/Cost Ratio =	1.94

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical AC - Packaged Systems**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$111	$592	$703	$1,862	$992	$2,854	($2,151)
2012	406	2,258	2,664	4,655	2,480	7,135	(4,471)
2013	1,054	5,657	6,711	9,311	4,960	14,271	(7,560)
2014	1,105	5,883	6,988	0	0	0	6,988
2015	1,217	6,118	7,335	0	0	0	7,335
2016	1,227	6,363	7,590	0	0	0	7,590
2017	1,291	6,618	7,909	0	0	0	7,909
2018	1,403	6,882	8,285	0	0	0	8,285
2019	1,470	7,158	8,628	0	0	0	8,628
2020	1,574	7,444	9,018	0	0	0	9,018
2021	1,584	7,742	9,326	0	0	0	9,326
2022	1,595	8,051	9,646	0	0	0	9,646
2023	1,607	8,373	9,980	0	0	0	9,980
2024	1,620	8,708	10,328	0	0	0	10,328
2025	1,635	9,057	10,692	0	0	0	10,692
2026	1,456	8,352	9,808	0	0	0	9,808
2027	980	5,729	6,709	0	0	0	6,709
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$132,320			$24,260	$108,060
		NPV =	$61,587			$21,242	40,345

Total NPV =	$40,345
Benefit/Cost Ratio =	2.90

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$604	$604	$604
Incentive Costs =	2,500	2,500	2,500
Total Utility Project Costs =	$3,104	$3,104	$3,104
14) Direct Participant Costs ($/Part.) =	$1,997	$1,997	$1,997
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	4.950	4.950	4.950
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	4,315	4,315	4,315
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	1	1
20) Incentive/Participant =	$2,500	$2,500	$2,500
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	4,315	4,315	4,315
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	5	5	5
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$14,278	2.39
Utility Cost Test	$16,041	2.88
Societal Test	$47,960	7.40
Participant Test	$12,975	3.30
Total Resource Cost Test	$17,421	3.44

Table 1
Ratepayer Impact Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	4,638	$0.02860	$133	$0.00000	$0	6	0	6	$98.68	$592	$725	$0.02243	4,315	0	4,315	$59	$604	$2,500	$3,163	($2,438)
2	2012	9,275	0.02988	277	0.00000	0	11	0	11	102.62	1,129	1,406	0.02288	8,630	0	8,630	120	604	2,500	3,224	(1,818)
3	2013	13,913	0.03195	445	0.00000	0	17	0	17	106.73	1,814	2,259	0.02334	12,945	0	12,945	183	604	2,500	3,287	(1,028)
4	2014	13,913	0.03348	466	0.00000	0	17	0	17	111.00	1,887	2,353	0.02380	12,945	0	12,945	187	0	0	187	2,166
5	2015	13,913	0.03688	513	0.00000	0	17	0	17	115.44	1,962	2,475	0.02428	12,945	0	12,945	191	0	0	191	2,284
6	2016	13,913	0.03720	518	0.00000	0	17	0	17	120.05	2,041	2,559	0.02476	12,945	0	12,945	194	0	0	194	2,365
7	2017	13,913	0.03911	544	0.00000	0	17	0	17	124.86	2,123	2,667	0.02526	12,945	0	12,945	198	0	0	198	2,469
8	2018	13,913	0.04251	591	0.00000	0	17	0	17	129.85	2,207	2,798	0.02576	12,945	0	12,945	202	0	0	202	2,596
9	2019	13,913	0.04456	620	0.00000	0	17	0	17	135.05	2,296	2,916	0.02628	12,945	0	12,945	206	0	0	206	2,710
10	2020	13,913	0.04769	664	0.00000	0	17	0	17	140.45	2,388	3,052	0.02681	12,945	0	12,945	210	0	0	210	2,842
11	2021	13,913	0.04800	668	0.00000	0	17	0	17	146.07	2,483	3,151	0.02734	12,945	0	12,945	215	0	0	215	2,936
12	2022	13,913	0.04834	673	0.00000	0	17	0	17	151.91	2,582	3,255	0.02789	12,945	0	12,945	219	0	0	219	3,036
13	2023	13,913	0.04871	678	0.00000	0	17	0	17	157.98	2,686	3,364	0.02845	12,945	0	12,945	223	0	0	223	3,141
14	2024	13,913	0.04911	683	0.00000	0	17	0	17	164.30	2,793	3,476	0.02902	12,945	0	12,945	228	0	0	228	3,248
15	2025	13,913	0.04954	689	0.00000	0	17	0	17	170.88	2,905	3,594	0.02960	12,945	0	12,945	232	0	0	232	3,362
16	2026	13,913	0.05000	696	0.00000	0	17	0	17	177.71	3,021	3,717	0.03019	12,945	0	12,945	237	0	0	237	3,480
17	2027	13,913	0.05050	703	0.00000	0	17	0	17	184.82	3,142	3,845	0.03079	12,945	0	12,945	242	0	0	242	3,603
18	2028	13,913	0.05103	710	0.00000	0	17	0	17	192.21	3,268	3,978	0.03141	12,945	0	12,945	246	0	0	246	3,732
19	2029	13,913	0.05160	718	0.00000	0	17	0	17	199.90	3,398	4,116	0.03204	12,945	0	12,945	251	0	0	251	3,865
20	2030	13,913	0.05220	726	0.00000	0	17	0	17	207.90	3,534	4,260	0.03268	12,945	0	12,945	256	0	0	256	4,004
Total =		264,347							323			$59,966				245,955				$13,411	$46,555
											NPV =	$24,560								$10,282	14,278

Total NPV = $14,278
Benefit/Cost Ratio = 2.39

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$133	$0	$592	$725	$3,104	$3,104	($2,379)
2012	277	0	1,129	1,406	3,104	3,104	(1,698)
2013	445	0	1,814	2,259	3,104	3,104	(845)
2014	466	0	1,887	2,353	0	0	2,353
2015	513	0	1,962	2,475	0	0	2,475
2016	518	0	2,041	2,559	0	0	2,559
2017	544	0	2,123	2,667	0	0	2,667
2018	591	0	2,207	2,798	0	0	2,798
2019	620	0	2,296	2,916	0	0	2,916
2020	664	0	2,388	3,052	0	0	3,052
2021	668	0	2,483	3,151	0	0	3,151
2022	673	0	2,582	3,255	0	0	3,255
2023	678	0	2,686	3,364	0	0	3,364
2024	683	0	2,793	3,476	0	0	3,476
2025	689	0	2,905	3,594	0	0	3,594
2026	696	0	3,021	3,717	0	0	3,717
2027	703	0	3,142	3,845	0	0	3,845
2028	710	0	3,268	3,978	0	0	3,978
2029	718	0	3,398	4,116	0	0	4,116
2030	726	0	3,534	4,260	0	0	4,260
Total =				$59,966		$9,312	$50,654
			NPV =	$24,560		$8,519	16,041

Total NPV =	$16,041
Benefit/Cost Ratio =	2.88

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$133	$0	$592	$229	$954	$3,104	($503)	$2,601	($1,647)
2012	277	0	1,129	458	1,864	3,104	(503)	2,601	(737)
2013	445	0	1,814	758	3,017	3,104	(503)	2,601	416
2014	466	0	1,887	813	3,166	0	0	0	3,166
2015	513	0	1,962	881	3,356	0	0	0	3,356
2016	518	0	2,041	938	3,497	0	0	0	3,497
2017	544	0	2,123	1,007	3,674	0	0	0	3,674
2018	591	0	2,207	1,088	3,886	0	0	0	3,886
2019	620	0	2,296	1,168	4,084	0	0	0	4,084
2020	664	0	2,388	1,259	4,311	0	0	0	4,311
2021	668	0	2,483	1,339	4,490	0	0	0	4,490
2022	673	0	2,582	1,425	4,680	0	0	0	4,680
2023	678	0	2,686	1,517	4,881	0	0	0	4,881
2024	683	0	2,793	1,614	5,090	0	0	0	5,090
2025	689	0	2,905	1,719	5,313	0	0	0	5,313
2026	696	0	3,021	1,831	5,548	0	0	0	5,548
2027	703	0	3,142	1,951	5,796	0	0	0	5,796
2028	710	0	3,268	2,079	6,057	0	0	0	6,057
2029	718	0	3,398	2,216	6,332	0	0	0	6,332
2030	726	0	3,534	2,362	6,622	0	0	0	6,622
Total =					$86,618			$7,803	$78,815
				NPV =	$55,450			$7,490	47,960

Total NPV = $47,960
Benefit/Cost Ratio = 7.40

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$2,500	$0.05644	$0.04173	4,315	0	4,315	$244	5	0	$25.500	$41.820	$128	$0	$2,872	$2,039	$0	$2,039	$833
2012	2,500	0.05923	0.04379	8,630	0	8,630	511	10	0	26.010	42.656	260	0	3,271	2,082	0	2,082	1,189
2013	2,500	0.06215	0.04595	12,945	0	12,945	805	15	0	26.530	43.510	398	0	3,703	2,126	0	2,126	1,577
2014	0	0.06521	0.04821	12,945	0	12,945	844	15	0	27.061	44.380	406	0	1,250	0	0	0	1,250
2015	0	0.06843	0.05059	12,945	0	12,945	886	15	0	27.602	45.267	414	0	1,300	0	0	0	1,300
2016	0	0.07180	0.05309	12,945	0	12,945	929	15	0	28.154	46.173	422	0	1,351	0	0	0	1,351
2017	0	0.07534	0.05570	12,945	0	12,945	975	15	0	28.717	47.096	431	0	1,406	0	0	0	1,406
2018	0	0.07906	0.05845	12,945	0	12,945	1,023	15	0	29.291	48.038	439	0	1,462	0	0	0	1,462
2019	0	0.08295	0.06133	12,945	0	12,945	1,074	15	0	29.877	48.999	448	0	1,522	0	0	0	1,522
2020	0	0.08704	0.06436	12,945	0	12,945	1,127	15	0	30.475	49.979	457	0	1,584	0	0	0	1,584
2021	0	0.09134	0.06753	12,945	0	12,945	1,182	15	0	31.084	50.978	466	0	1,648	0	0	0	1,648
2022	0	0.09584	0.07086	12,945	0	12,945	1,241	15	0	31.706	51.998	476	0	1,717	0	0	0	1,717
2023	0	0.10057	0.07435	12,945	0	12,945	1,302	15	0	32.340	53.038	485	0	1,787	0	0	0	1,787
2024	0	0.10552	0.07802	12,945	0	12,945	1,366	15	0	32.987	54.099	495	0	1,861	0	0	0	1,861
2025	0	0.11073	0.08187	12,945	0	12,945	1,433	15	0	33.647	55.181	505	0	1,938	0	0	0	1,938
2026	0	0.11619	0.08590	12,945	0	12,945	1,504	15	0	34.320	56.284	515	0	2,019	0	0	0	2,019
2027	0	0.12192	0.09014	12,945	0	12,945	1,578	15	0	35.006	57.410	525	0	2,103	0	0	0	2,103
2028	0	0.12793	0.09459	12,945	0	12,945	1,656	15	0	35.706	58.558	536	0	2,192	0	0	0	2,192
2029	0	0.13424	0.09925	12,945	0	12,945	1,738	15	0	36.420	59.729	546	0	2,284	0	0	0	2,284
2030	0	0.14086	0.10414	12,945	0	12,945	1,823	15	0	37.149	60.924	557	0	2,380	0	0	0	2,380
Total =				245,955	0			285	0					$39,650			$6,247	$33,403
													NPV =	$18,618			$5,643	12,975

Total NPV =	$12,975
Benefit/Cost Ratio =	3.30

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical AC - Water Cooled Chillers**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$133	$592	$725	$3,104	($503)	$2,601	($1,876)
2012	277	1,129	1,406	3,104	(503)	2,601	(1,195)
2013	445	1,814	2,259	3,104	(503)	2,601	(342)
2014	466	1,887	2,353	0	0	0	2,353
2015	513	1,962	2,475	0	0	0	2,475
2016	518	2,041	2,559	0	0	0	2,559
2017	544	2,123	2,667	0	0	0	2,667
2018	591	2,207	2,798	0	0	0	2,798
2019	620	2,296	2,916	0	0	0	2,916
2020	664	2,388	3,052	0	0	0	3,052
2021	668	2,483	3,151	0	0	0	3,151
2022	673	2,582	3,255	0	0	0	3,255
2023	678	2,686	3,364	0	0	0	3,364
2024	683	2,793	3,476	0	0	0	3,476
2025	689	2,905	3,594	0	0	0	3,594
2026	696	3,021	3,717	0	0	0	3,717
2027	703	3,142	3,845	0	0	0	3,845
2028	710	3,268	3,978	0	0	0	3,978
2029	718	3,398	4,116	0	0	0	4,116
2030	726	3,534	4,260	0	0	0	4,260
		Total =	$59,966			$7,803	$52,163
		NPV =	$24,560			$7,139	17,421

Total NPV = $17,421
Benefit/Cost Ratio = 3.44

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$604	$604	$604
Incentive Costs =	2,500	2,500	2,500
Total Utility Project Costs =	$3,104	$3,104	$3,104
14) Direct Participant Costs ($/Part.) =	$7,276	$7,276	$7,276
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	11.250	11.250	11.250
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	2,762	2,762	2,762
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	1	1
20) Incentive/Participant =	$2,500	$2,500	$2,500
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	2,762	2,762	2,762
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	11	11	11
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$37,444	4.88
Utility Cost Test	$38,573	5.53
Societal Test	$83,832	4.69
Participant Test	($527)	0.97
Total Resource Cost Test	$25,464	2.18

Table 1
Ratepayer Impact Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,968	$0.02860	$85	$0.00000	$0	13	0	13	$98.68	$1,283	$1,368	$0.02243	2,762	0	2,762	$38	$604	$2,500	$3,142	($1,774)
2	2012	5,937	0.02988	177	0.00000	0	25	0	25	102.62	2,566	2,743	0.02288	5,524	0	5,524	77	604	2,500	3,181	(438)
3	2013	8,905	0.03195	285	0.00000	0	38	0	38	106.73	4,056	4,341	0.02334	8,286	0	8,286	117	604	2,500	3,221	1,120
4	2014	8,905	0.03348	298	0.00000	0	38	0	38	111.00	4,218	4,516	0.02380	8,286	0	8,286	120	0	0	120	4,396
5	2015	8,905	0.03688	328	0.00000	0	38	0	38	115.44	4,387	4,715	0.02428	8,286	0	8,286	122	0	0	122	4,593
6	2016	8,905	0.03720	331	0.00000	0	38	0	38	120.05	4,562	4,893	0.02476	8,286	0	8,286	124	0	0	124	4,769
7	2017	8,905	0.03911	348	0.00000	0	38	0	38	124.86	4,745	5,093	0.02526	8,286	0	8,286	127	0	0	127	4,966
8	2018	8,905	0.04251	379	0.00000	0	38	0	38	129.85	4,934	5,313	0.02576	8,286	0	8,286	129	0	0	129	5,184
9	2019	8,905	0.04456	397	0.00000	0	38	0	38	135.05	5,132	5,529	0.02628	8,286	0	8,286	132	0	0	132	5,397
10	2020	8,905	0.04769	425	0.00000	0	38	0	38	140.45	5,337	5,762	0.02681	8,286	0	8,286	135	0	0	135	5,627
11	2021	8,905	0.04800	427	0.00000	0	38	0	38	146.07	5,551	5,978	0.02734	8,286	0	8,286	137	0	0	137	5,841
12	2022	8,905	0.04834	430	0.00000	0	38	0	38	151.91	5,773	6,203	0.02789	8,286	0	8,286	140	0	0	140	6,063
13	2023	8,905	0.04871	434	0.00000	0	38	0	38	157.98	6,003	6,437	0.02845	8,286	0	8,286	143	0	0	143	6,294
14	2024	8,905	0.04911	437	0.00000	0	38	0	38	164.30	6,243	6,680	0.02902	8,286	0	8,286	146	0	0	146	6,534
15	2025	8,905	0.04954	441	0.00000	0	38	0	38	170.88	6,493	6,934	0.02960	8,286	0	8,286	149	0	0	149	6,785
16	2026	8,905	0.05000	445	0.00000	0	38	0	38	177.71	6,753	7,198	0.03019	8,286	0	8,286	152	0	0	152	7,046
17	2027	8,905	0.05050	450	0.00000	0	38	0	38	184.82	7,023	7,473	0.03079	8,286	0	8,286	155	0	0	155	7,318
18	2028	8,905	0.05103	454	0.00000	0	38	0	38	192.21	7,304	7,758	0.03141	8,286	0	8,286	158	0	0	158	7,600
19	2029	8,905	0.05160	459	0.00000	0	38	0	38	199.90	7,596	8,055	0.03204	8,286	0	8,286	161	0	0	161	7,894
20	2030	8,905	0.05220	465	0.00000	0	38	0	38	207.90	7,900	8,365	0.03268	8,286	0	8,286	164	0	0	164	8,201
Total =		169,195							722			$115,354				157,434				$11,938	$103,416
											NPV =	$47,092								$9,648	37,444

Total NPV = $37,444
Benefit/Cost Ratio = 4.88

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits				Costs		
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Annual Benefits Less Costs (G)
2011	$85	$0	$1,283	$1,368	$3,104	$3,104	($1,736)
2012	177	0	2,566	2,743	3,104	3,104	(361)
2013	285	0	4,056	4,341	3,104	3,104	1,237
2014	298	0	4,218	4,516	0	0	4,516
2015	328	0	4,387	4,715	0	0	4,715
2016	331	0	4,562	4,893	0	0	4,893
2017	348	0	4,745	5,093	0	0	5,093
2018	379	0	4,934	5,313	0	0	5,313
2019	397	0	5,132	5,529	0	0	5,529
2020	425	0	5,337	5,762	0	0	5,762
2021	427	0	5,551	5,978	0	0	5,978
2022	430	0	5,773	6,203	0	0	6,203
2023	434	0	6,003	6,437	0	0	6,437
2024	437	0	6,243	6,680	0	0	6,680
2025	441	0	6,493	6,934	0	0	6,934
2026	445	0	6,753	7,198	0	0	7,198
2027	450	0	7,023	7,473	0	0	7,473
2028	454	0	7,304	7,758	0	0	7,758
2029	459	0	7,596	8,055	0	0	8,055
2030	465	0	7,900	8,365	0	0	8,365
Total =				$115,354		$9,312	$106,042
			NPV =	$47,092		$8,519	38,573

Total NPV = $38,573
Benefit/Cost Ratio = 5.53

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$85	$0	$1,283	$433	$1,801	$3,104	$4,776	$7,880	($6,079)
2012	177	0	2,566	893	3,636	3,104	4,776	7,880	(4,244)
2013	285	0	4,056	1,456	5,797	3,104	4,776	7,880	(2,083)
2014	298	0	4,218	1,560	6,076	0	0	0	6,076
2015	328	0	4,387	1,678	6,393	0	0	0	6,393
2016	331	0	4,562	1,794	6,687	0	0	0	6,687
2017	348	0	4,745	1,923	7,016	0	0	0	7,016
2018	379	0	4,934	2,066	7,379	0	0	0	7,379
2019	397	0	5,132	2,215	7,744	0	0	0	7,744
2020	425	0	5,337	2,377	8,139	0	0	0	8,139
2021	427	0	5,551	2,540	8,518	0	0	0	8,518
2022	430	0	5,773	2,715	8,918	0	0	0	8,918
2023	434	0	6,003	2,902	9,339	0	0	0	9,339
2024	437	0	6,243	3,102	9,782	0	0	0	9,782
2025	441	0	6,493	3,317	10,251	0	0	0	10,251
2026	445	0	6,753	3,546	10,744	0	0	0	10,744
2027	450	0	7,023	3,792	11,265	0	0	0	11,265
2028	454	0	7,304	4,055	11,813	0	0	0	11,813
2029	459	0	7,596	4,336	12,391	0	0	0	12,391
2030	465	0	7,900	4,638	13,003	0	0	0	13,003
Total =					$166,692			$23,640	$143,052
				NPV =	$106,523			$22,691	83,832

Total NPV = $83,832
Benefit/Cost Ratio = 4.69

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$2,500	$0.05644	$0.04173	2,762	0	2,762	$156	11	0	$25.500	$41.820	$281	$0	$2,937	$7,430	$0	$7,430	($4,493)
2012	2,500	0.05923	0.04379	5,524	0	5,524	327	23	0	26.010	42.656	598	0	3,425	7,586	0	7,586	(4,161)
2013	2,500	0.06215	0.04595	8,286	0	8,286	515	34	0	26.530	43.510	902	0	3,917	7,746	0	7,746	(3,829)
2014	0	0.06521	0.04821	8,286	0	8,286	540	34	0	27.061	44.380	920	0	1,460	0	0	0	1,460
2015	0	0.06843	0.05059	8,286	0	8,286	567	34	0	27.602	45.267	938	0	1,505	0	0	0	1,505
2016	0	0.07180	0.05309	8,286	0	8,286	595	34	0	28.154	46.173	957	0	1,552	0	0	0	1,552
2017	0	0.07534	0.05570	8,286	0	8,286	624	34	0	28.717	47.096	976	0	1,600	0	0	0	1,600
2018	0	0.07906	0.05845	8,286	0	8,286	655	34	0	29.291	48.038	996	0	1,651	0	0	0	1,651
2019	0	0.08295	0.06133	8,286	0	8,286	687	34	0	29.877	48.999	1,016	0	1,703	0	0	0	1,703
2020	0	0.08704	0.06436	8,286	0	8,286	721	34	0	30.475	49.979	1,036	0	1,757	0	0	0	1,757
2021	0	0.09134	0.06753	8,286	0	8,286	757	34	0	31.084	50.978	1,057	0	1,814	0	0	0	1,814
2022	0	0.09584	0.07086	8,286	0	8,286	794	34	0	31.706	51.998	1,078	0	1,872	0	0	0	1,872
2023	0	0.10057	0.07435	8,286	0	8,286	833	34	0	32.340	53.038	1,100	0	1,933	0	0	0	1,933
2024	0	0.10552	0.07802	8,286	0	8,286	874	34	0	32.987	54.099	1,122	0	1,996	0	0	0	1,996
2025	0	0.11073	0.08187	8,286	0	8,286	918	34	0	33.647	55.181	1,144	0	2,062	0	0	0	2,062
2026	0	0.11619	0.08590	8,286	0	8,286	963	34	0	34.320	56.284	1,167	0	2,130	0	0	0	2,130
2027	0	0.12192	0.09014	8,286	0	8,286	1,010	34	0	35.006	57.410	1,190	0	2,200	0	0	0	2,200
2028	0	0.12793	0.09459	8,286	0	8,286	1,060	34	0	35.706	58.558	1,214	0	2,274	0	0	0	2,274
2029	0	0.13424	0.09925	8,286	0	8,286	1,112	34	0	36.420	59.729	1,238	0	2,350	0	0	0	2,350
2030	0	0.14086	0.10414	8,286	0	8,286	1,167	34	0	37.149	60.924	1,263	0	2,430	0	0	0	2,430
Total =				157,434	0			646	0					$42,568			$22,762	$19,806
													NPV =	$20,034			$20,562	(527)

Total NPV = ($527)
Benefit/Cost Ratio = 0.97

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial AC - Centrifugal Chillers**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$85	$1,283	$1,368	$3,104	$4,776	$7,880	($6,512)
2012	177	2,566	2,743	3,104	4,776	7,880	(5,137)
2013	285	4,056	4,341	3,104	4,776	7,880	(3,539)
2014	298	4,218	4,516	0	0	0	4,516
2015	328	4,387	4,715	0	0	0	4,715
2016	331	4,562	4,893	0	0	0	4,893
2017	348	4,745	5,093	0	0	0	5,093
2018	379	4,934	5,313	0	0	0	5,313
2019	397	5,132	5,529	0	0	0	5,529
2020	425	5,337	5,762	0	0	0	5,762
2021	427	5,551	5,978	0	0	0	5,978
2022	430	5,773	6,203	0	0	0	6,203
2023	434	6,003	6,437	0	0	0	6,437
2024	437	6,243	6,680	0	0	0	6,680
2025	441	6,493	6,934	0	0	0	6,934
2026	445	6,753	7,198	0	0	0	7,198
2027	450	7,023	7,473	0	0	0	7,473
2028	454	7,304	7,758	0	0	0	7,758
2029	459	7,596	8,055	0	0	0	8,055
2030	465	7,900	8,365	0	0	0	8,365
		Total =	$115,354			$23,640	$91,714
		NPV =	$47,092			$21,628	25,464

Total NPV = $25,464
Benefit/Cost Ratio = 2.18

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$4,829	$7,243	$12,072
Incentive Costs =	20,000	30,000	50,000
Total Utility Project Costs =	$24,829	$37,243	$62,072
14) Direct Participant Costs ($/Part.) =	$20,000	$20,000	$20,000
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	10	10	10
16) Avg Summer kW/part. Saved =	15.000	15.000	15.000
16a) Avg Winter kW/part Saved =	15.000	15.000	15.000
17) Avg. Summer kWh/Part. Saved =	50,000	50,000	50,000
17a) Avg. Winter kWh/Part. Saved =	50,000	50,000	50,000
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	3	5
20) Incentive/Participant =	$10,000	$10,000	$10,000
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	100,000	150,000	250,000
Annual Winter Kwh Saved	100,000	150,000	250,000
23) Annual Summer KW Saved	30	45	75
Annual Winter KW Saved	30	45	75

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$293,093	2.45
Utility Cost Test	$384,729	4.48
Societal Test	$691,850	4.26
Participant Test	$328,212	2.79
Total Resource Cost Test	$295,743	2.48

Table 1
Ratepayer Impact Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	214,950	$0.02860	$6,148	$0.00000	$0	33	33	66	$98.68	$6,513	$12,661	$0.02243	100,000	100,000	200,000	$2,719	$4,829	$20,000	$27,548	($14,887)
2	2012	537,376	0.02988	16,057	0.00000	0	84	84	168	102.62	17,240	33,297	0.02288	250,000	250,000	500,000	6,934	7,243	30,000	44,177	(10,880)
3	2013	1,074,750	0.03195	34,338	0.00000	0	167	167	334	106.73	35,648	69,986	0.02334	500,000	500,000	1,000,000	14,147	12,072	50,000	76,219	(6,233)
4	2014	1,074,750	0.03348	35,983	0.00000	0	167	167	334	111.00	37,074	73,057	0.02380	500,000	500,000	1,000,000	14,426	0	0	14,426	58,631
5	2015	1,074,750	0.03688	39,637	0.00000	0	167	167	334	115.44	38,557	78,194	0.02428	500,000	500,000	1,000,000	14,717	0	0	14,717	63,477
6	2016	1,074,750	0.03720	39,981	0.00000	0	167	167	334	120.05	40,097	80,078	0.02476	500,000	500,000	1,000,000	15,008	0	0	15,008	65,070
7	2017	1,074,750	0.03911	42,033	0.00000	0	167	167	334	124.86	41,703	83,736	0.02526	500,000	500,000	1,000,000	15,311	0	0	15,311	68,425
8	2018	1,074,750	0.04251	45,688	0.00000	0	167	167	334	129.85	43,370	89,058	0.02576	500,000	500,000	1,000,000	15,614	0	0	15,614	73,444
9	2019	1,074,750	0.04456	47,891	0.00000	0	167	167	334	135.05	45,107	92,998	0.02628	500,000	500,000	1,000,000	15,929	0	0	15,929	77,069
10	2020	1,074,750	0.04769	51,255	0.00000	0	167	167	334	140.45	46,910	98,165	0.02681	500,000	500,000	1,000,000	16,250	0	0	16,250	81,915
11	2021	859,800	0.04800	41,270	0.00000	0	134	134	268	146.07	39,147	80,417	0.02734	400,000	400,000	800,000	13,257	0	0	13,257	67,160
12	2022	537,376	0.04834	25,977	0.00000	0	84	84	168	151.91	25,521	51,498	0.02789	250,000	250,000	500,000	8,452	0	0	8,452	43,046
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.02845	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.02902	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.02960	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.03019	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.03079	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.03141	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.03204	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.03268	0	0	0	0	0	0	0	0
Total =		10,747,502							3,342			$843,145				10,000,000				$276,908	$566,237
											NPV =	$495,201								$202,108	293,093

Total NPV = $293,093
Benefit/Cost Ratio = 2.45

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$6,148	$0	$6,513	$12,661	$24,829	$24,829	($12,168)
2012	16,057	0	17,240	33,297	37,243	37,243	(3,946)
2013	34,338	0	35,648	69,986	62,072	62,072	7,914
2014	35,983	0	37,074	73,057	0	0	73,057
2015	39,637	0	38,557	78,194	0	0	78,194
2016	39,981	0	40,097	80,078	0	0	80,078
2017	42,033	0	41,703	83,736	0	0	83,736
2018	45,688	0	43,370	89,058	0	0	89,058
2019	47,891	0	45,107	92,998	0	0	92,998
2020	51,255	0	46,910	98,165	0	0	98,165
2021	41,270	0	39,147	80,417	0	0	80,417
2022	25,977	0	25,521	51,498	0	0	51,498
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$843,145		$124,144	$719,001
			NPV =	$495,201		$110,472	384,729

Total NPV =	$384,729
Benefit/Cost Ratio =	4.48

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$6,148	$0	$6,513	$4,004	$16,665	$24,829	$20,000	$44,829	($28,164)
2012	16,057	0	17,240	10,845	44,142	37,243	30,000	67,243	(23,101)
2013	34,338	0	35,648	23,478	93,464	62,072	50,000	112,072	(18,608)
2014	35,983	0	37,074	25,243	98,300	0	0	0	98,300
2015	39,637	0	38,557	27,829	106,023	0	0	0	106,023
2016	39,981	0	40,097	29,355	109,433	0	0	0	109,433
2017	42,033	0	41,703	31,616	115,352	0	0	0	115,352
2018	45,688	0	43,370	34,635	123,693	0	0	0	123,693
2019	47,891	0	45,107	37,252	130,250	0	0	0	130,250
2020	51,255	0	46,910	40,501	138,666	0	0	0	138,666
2021	41,270	0	39,147	34,174	114,591	0	0	0	114,591
2022	25,977	0	25,521	22,541	74,039	0	0	0	74,039
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$1,164,618			$224,144	$940,474
				NPV =	$904,327			$212,477	691,850

Total NPV =	$691,850
Benefit/Cost Ratio =	4.26

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$20,000	$0.05644	$0.04173	100,000	100,000	200,000	$9,817	30	30	$25.500	$41.820	$2,020	$0	$31,837	$40,844	$0	$40,844	($9,007)
2012	30,000	0.05923	0.04379	250,000	250,000	500,000	25,755	75	75	26.010	42.656	5,150	0	60,905	62,559	0	62,559	(1,654)
2013	50,000	0.06215	0.04595	500,000	500,000	1,000,000	54,050	150	150	26.530	43.510	10,506	0	114,556	106,465	0	106,465	8,091
2014	0	0.06521	0.04821	500,000	500,000	1,000,000	56,710	150	150	27.061	44.380	10,716	0	67,426	0	0	0	67,426
2015	0	0.06843	0.05059	500,000	500,000	1,000,000	59,510	150	150	27.602	45.267	10,930	0	70,440	0	0	0	70,440
2016	0	0.07180	0.05309	500,000	500,000	1,000,000	62,445	150	150	28.154	46.173	11,149	0	73,594	0	0	0	73,594
2017	0	0.07534	0.05570	500,000	500,000	1,000,000	65,520	150	150	28.717	47.096	11,372	0	76,892	0	0	0	76,892
2018	0	0.07906	0.05845	500,000	500,000	1,000,000	68,755	150	150	29.291	48.038	11,599	0	80,354	0	0	0	80,354
2019	0	0.08295	0.06133	500,000	500,000	1,000,000	72,140	150	150	29.877	48.999	11,831	0	83,971	0	0	0	83,971
2020	0	0.08704	0.06436	500,000	500,000	1,000,000	75,700	150	150	30.475	49.979	12,068	0	87,768	0	0	0	87,768
2021	0	0.09134	0.06753	400,000	400,000	800,000	63,548	120	120	31.084	50.978	9,847	0	73,395	0	0	0	73,395
2022	0	0.09584	0.07086	250,000	250,000	500,000	41,675	75	75	31.706	51.998	6,278	0	47,953	0	0	0	47,953
2023	0	0.10057	0.07435	0	0	0	0	0	0	32.340	53.038	0	0	0	0	0	0	0
2024	0	0.10552	0.07802	0	0	0	0	0	0	32.987	54.099	0	0	0	0	0	0	0
2025	0	0.11073	0.08187	0	0	0	0	0	0	33.647	55.181	0	0	0	0	0	0	0
2026	0	0.11619	0.08590	0	0	0	0	0	0	34.320	56.284	0	0	0	0	0	0	0
2027	0	0.12192	0.09014	0	0	0	0	0	0	35.006	57.410	0	0	0	0	0	0	0
2028	0	0.12793	0.09459	0	0	0	0	0	0	35.706	58.558	0	0	0	0	0	0	0
2029	0	0.13424	0.09925	0	0	0	0	0	0	36.420	59.729	0	0	0	0	0	0	0
2030	0	0.14086	0.10414	0	0	0	0	0	0	37.149	60.924	0	0	0	0	0	0	0
Total =				5,000,000	5,000,000			1,500	1,500					$869,091			$209,868	$659,223
													NPV =	$511,949			$183,737	328,212

Total NPV = $328,212
Benefit/Cost Ratio = 2.79

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Partnership Program (Custom)**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$6,148	$6,513	$12,661	$24,829	$20,000	$44,829	($32,168)
2012	16,057	17,240	33,297	37,243	30,000	67,243	(33,946)
2013	34,338	35,648	69,986	62,072	50,000	112,072	(42,086)
2014	35,983	37,074	73,057	0	0	0	73,057
2015	39,637	38,557	78,194	0	0	0	78,194
2016	39,981	40,097	80,078	0	0	0	80,078
2017	42,033	41,703	83,736	0	0	0	83,736
2018	45,688	43,370	89,058	0	0	0	89,058
2019	47,891	45,107	92,998	0	0	0	92,998
2020	51,255	46,910	98,165	0	0	0	98,165
2021	41,270	39,147	80,417	0	0	0	80,417
2022	25,977	25,521	51,498	0	0	0	51,498
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$843,145			$224,144	$619,001
		NPV =	$495,201			$199,458	295,743

Total NPV =	$295,743
Benefit/Cost Ratio =	2.48

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
MONTANA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05379
Retail Rate Winter ($/kWh) =	$0.03977
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00115
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$25.00
3a) Retail Winter Demand Rate ($/kW/season) =	$41.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.02199
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$0	$0	$0
Incentive Costs =	0	0	0
Direct Program Costs =	0	57,540	115,080
Total Utility Project Costs =	$0	$57,540	$115,080
14) Direct Participant Costs ($/Part.) =	$0	$0	$0
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	10	10	10
16) Avg Summer kW/part. Saved =	400.000	400.000	400.000
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	10,000	10,000	10,000
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	0	3	5
20) Incentive/Participant =	$0	$0	$0
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	30,000	50,000
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	1,200	2,000
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$1,561,572	2.50
Utility Cost Test	$1,561,572	2.50
Societal Test	$3,442,684	3.47
Participant Test	$535,024	#DIV/0!
Total Resource Cost Test	$1,561,572	2.50

Table 1
Ratepayer Impact Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Direct Program Costs (O)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	0	$0.02860	$0	$0.00000	$0	0	0	0	$98.68	$0	$0	$0.02243	0	0	0	$0	$0	$0	$0	$0	$0
2	2012	32,243	0.02988	963	0.00000	0	1,340	0	1,340	102.62	137,511	138,474	0.02288	30,000	0	30,000	416	0	0	57,540	57,956	80,518
3	2013	85,980	0.03195	2,747	0.00000	0	3,573	0	3,573	106.73	381,346	384,093	0.02334	80,000	0	80,000	1,132	0	0	172,620	173,752	210,341
4	2014	85,980	0.03348	2,879	0.00000	0	3,573	0	3,573	111.00	396,603	399,482	0.02380	80,000	0	80,000	1,154	0	0	172,620	173,774	225,708
5	2015	85,980	0.03688	3,171	0.00000	0	3,573	0	3,573	115.44	412,467	415,638	0.02428	80,000	0	80,000	1,177	0	0	172,620	173,797	241,841
6	2016	85,980	0.03720	3,198	0.00000	0	3,573	0	3,573	120.05	428,939	432,137	0.02476	80,000	0	80,000	1,201	0	0	172,620	173,821	258,316
7	2017	85,980	0.03911	3,363	0.00000	0	3,573	0	3,573	124.86	446,125	449,488	0.02526	80,000	0	80,000	1,225	0	0	172,620	173,845	275,643
8	2018	85,980	0.04251	3,655	0.00000	0	3,573	0	3,573	129.85	463,954	467,609	0.02576	80,000	0	80,000	1,249	0	0	172,620	173,869	293,740
9	2019	85,980	0.04456	3,831	0.00000	0	3,573	0	3,573	135.05	482,534	486,365	0.02628	80,000	0	80,000	1,274	0	0	172,620	173,894	312,471
10	2020	85,980	0.04769	4,100	0.00000	0	3,573	0	3,573	140.45	501,828	505,928	0.02681	80,000	0	80,000	1,300	0	0	172,620	173,920	332,008
11	2021	85,980	0.04800	4,127	0.00000	0	3,573	0	3,573	146.07	521,908	526,035	0.02734	80,000	0	80,000	1,326	0	0	172,620	173,946	352,089
12	2022	53,738	0.04834	2,598	0.00000	0	2,233	0	2,233	151.91	339,215	341,813	0.02789	50,000	0	50,000	845	0	0	172,620	173,465	168,348
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.02845	0	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.02902	0	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.02960	0	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.03019	0	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.03079	0	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.03141	0	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.03204	0	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.03268	0	0	0	0	0	0	0	0	0
Total =		859,801							35,730			$4,547,062				800,000					$1,796,039	$2,751,023
											NPV =	$2,605,330									$1,043,758	1,561,572

Total NPV = $1,561,572
Benefit/Cost Ratio = 2.50

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	963	0	137,511	138,474	57,956	57,956	80,518
2013	2,747	0	381,346	384,093	173,752	173,752	210,341
2014	2,879	0	396,603	399,482	173,774	173,774	225,708
2015	3,171	0	412,467	415,638	173,797	173,797	241,841
2016	3,198	0	428,939	432,137	173,821	173,821	258,316
2017	3,363	0	446,125	449,488	173,845	173,845	275,643
2018	3,655	0	463,954	467,609	173,869	173,869	293,740
2019	3,831	0	482,534	486,365	173,894	173,894	312,471
2020	4,100	0	501,828	505,928	173,920	173,920	332,008
2021	4,127	0	521,908	526,035	173,946	173,946	352,089
2022	2,598	0	339,215	341,813	173,465	173,465	168,348
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$4,547,062		$1,796,039	$2,751,023
			NPV =	$2,605,330		$1,043,758	1,561,572

Total NPV =	$1,561,572
Benefit/Cost Ratio =	2.50

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	963	0	137,511	45,100	183,574	57,956	0	57,956	125,618
2013	2,747	0	381,346	128,851	512,944	173,752	0	173,752	339,192
2014	2,879	0	396,603	138,033	537,515	173,774	0	173,774	363,741
2015	3,171	0	412,467	147,924	563,562	173,797	0	173,797	389,765
2016	3,198	0	428,939	158,410	590,547	173,821	0	173,821	416,726
2017	3,363	0	446,125	169,714	619,202	173,845	0	173,845	445,357
2018	3,655	0	463,954	181,852	649,461	173,869	0	173,869	475,592
2019	3,831	0	482,534	194,821	681,186	173,894	0	173,894	507,292
2020	4,100	0	501,828	208,737	714,665	173,920	0	173,920	540,745
2021	4,127	0	521,908	223,544	749,579	173,946	0	173,946	575,633
2022	2,598	0	339,215	149,614	491,427	173,465	0	173,465	317,962
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$6,293,662			$1,796,039	$4,497,623
				NPV =	$4,834,672			$1,391,988	3,442,684

Total NPV = $3,442,684
Benefit/Cost Ratio = 3.47

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$0	$0.05644	$0.04173	0	0	0	$0	0	0	$25.500	$41.820	$0	$0	$0	$0	$0	$0	$0
2012	0	0.05923	0.04379	30,000	0	30,000	1,777	1,200	0	26.010	42.656	31,212	0	32,989	0	0	0	32,989
2013	0	0.06215	0.04595	80,000	0	80,000	4,972	3,200	0	26.530	43.510	84,896	0	89,868	0	0	0	89,868
2014	0	0.06521	0.04821	80,000	0	80,000	5,217	3,200	0	27.061	44.380	86,595	0	91,812	0	0	0	91,812
2015	0	0.06843	0.05059	80,000	0	80,000	5,474	3,200	0	27.602	45.267	88,326	0	93,800	0	0	0	93,800
2016	0	0.07180	0.05309	80,000	0	80,000	5,744	3,200	0	28.154	46.173	90,093	0	95,837	0	0	0	95,837
2017	0	0.07534	0.05570	80,000	0	80,000	6,027	3,200	0	28.717	47.096	91,894	0	97,921	0	0	0	97,921
2018	0	0.07906	0.05845	80,000	0	80,000	6,325	3,200	0	29.291	48.038	93,731	0	100,056	0	0	0	100,056
2019	0	0.08295	0.06133	80,000	0	80,000	6,636	3,200	0	29.877	48.999	95,606	0	102,242	0	0	0	102,242
2020	0	0.08704	0.06436	80,000	0	80,000	6,963	3,200	0	30.475	49.979	97,520	0	104,483	0	0	0	104,483
2021	0	0.09134	0.06753	80,000	0	80,000	7,307	3,200	0	31.084	50.978	99,469	0	106,776	0	0	0	106,776
2022	0	0.09584	0.07086	50,000	0	50,000	4,792	2,000	0	31.706	51.998	63,412	0	68,204	0	0	0	68,204
2023	0	0.10057	0.07435	0	0	0	0	0	0	32.340	53.038	0	0	0	0	0	0	0
2024	0	0.10552	0.07802	0	0	0	0	0	0	32.987	54.099	0	0	0	0	0	0	0
2025	0	0.11073	0.08187	0	0	0	0	0	0	33.647	55.181	0	0	0	0	0	0	0
2026	0	0.11619	0.08590	0	0	0	0	0	0	34.320	56.284	0	0	0	0	0	0	0
2027	0	0.12192	0.09014	0	0	0	0	0	0	35.006	57.410	0	0	0	0	0	0	0
2028	0	0.12793	0.09459	0	0	0	0	0	0	35.706	58.558	0	0	0	0	0	0	0
2029	0	0.13424	0.09925	0	0	0	0	0	0	36.420	59.729	0	0	0	0	0	0	0
2030	0	0.14086	0.10414	0	0	0	0	0	0	37.149	60.924	0	0	0	0	0	0	0
Total =				800,000	0			32,000	0					$983,988			$0	$983,988
													NPV =	$535,024			$0	535,024

Total NPV = $535,024
Benefit/Cost Ratio = #DIV/0!

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Demand Response Program**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	963	137,511	138,474	57,956	0	57,956	80,518
2013	2,747	381,346	384,093	173,752	0	173,752	210,341
2014	2,879	396,603	399,482	173,774	0	173,774	225,708
2015	3,171	412,467	415,638	173,797	0	173,797	241,841
2016	3,198	428,939	432,137	173,821	0	173,821	258,316
2017	3,363	446,125	449,488	173,845	0	173,845	275,643
2018	3,655	463,954	467,609	173,869	0	173,869	293,740
2019	3,831	482,534	486,365	173,894	0	173,894	312,471
2020	4,100	501,828	505,928	173,920	0	173,920	332,008
2021	4,127	521,908	526,035	173,946	0	173,946	352,089
2022	2,598	339,215	341,813	173,465	0	173,465	168,348
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$4,547,062			$1,796,039	$2,751,023
		NPV =	$2,605,330			$1,043,758	1,561,572

Total NPV =	$1,561,572
Benefit/Cost Ratio =	2.50

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	
Retail Rate Winter ($/kWh) =	
Retail Escalation Rate =	
1a) Power Supply Cost Adjustment	
Fuel Escalation Rate =	
2) Avg. System Marginal Energy Cost ($/kWh) =	
Escalation Rate =	
3) Retail Summer Demand Rate ($/kW/season) =	
3a) Retail Winter Demand Rate ($/kW/season) =	
Escalation Rate =	
4) Electric Margin ($/kWh) =	
Escalation Rate =	
5) System Peak Shaving Demand Cost ($/kW/yr)	
Reserve Capacity=	
Escalation Rate =	
6) System Variable O&M ($/kWh) =	
Escalation Rate =	
7) Environmental Damage Factor =	
Escalation Rate =	
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$20,671	$28,645	$53,125
Incentive Costs =	$317,440	$398,740	$676,560
Total Utility Project Costs =	$338,111	$427,385	$729,685
14) Direct Participant Costs ($/Part.) =			
Escalation Rate =			
14a) Other Participant Costs (Annual $/Part.) =			
Escalation Rate =			
14b) Other Participant Savings (Annual $/Part.) =			
Escalation Rate =			
15) Project Life (Years) =			
16) Avg Summer kW/part. Saved =			
16a) Avg Winter kW/part Saved =			
17) Avg. Summer kWh/Part. Saved =			
17a) Avg. Winter kWh/Part. Saved =			
18a) System Demand Line Loss Factor			
18b) System Energy Line Loss Factor			
19) Number of Participants =	414	540	3,722
20) Incentive/Participant =			
21) Effective Federal & State Income Tax Rate =			
22) Annual Summer Kwh Saved	662,079	962,379	1,356,284
Annual Winter Kwh Saved	722,345	987,665	1,343,005
23) Annual Summer KW Saved	447	4,174	10,954
Annual Winter KW Saved	378	459	642

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$14,147,872	5.74
Utility Cost Test	$14,785,286	7.29
Societal Test	$25,035,219	3.86
Participant Test	$6,380,251	4.06
Total Resource Cost Test	$9,939,020	2.38

Table 1
Ratepayer Impact Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

		Benefits												Costs					
t	Year	Summer kWh Requirements Reduction (A1)	Winter kWh Requirements Reduction (A2)	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Total Energy Reduction (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	711,569	776,341	1,487,910		$42,554		$0	918		$90,588	$133,142		1,384,424	$18,615	$20,671	$317,440	$356,726	($223,584)
2	2012	1,745,887	1,837,833	3,583,720		107,080		0	6,092		625,161	732,241		3,334,468	44,725	28,645	398,740	472,110	260,131
3	2013	3,203,554	3,281,228	6,484,782		207,189		0	19,038		2,031,925	2,239,114		6,033,757	81,728	53,125	676,560	811,413	1,427,701
4	2014	3,203,554	3,281,228	6,484,782		217,109		0	19,038		2,113,218	2,330,327		6,033,757	83,371	11,778	150,000	245,149	2,085,178
5	2015	3,203,554	3,281,228	6,484,782		239,160		0	19,038		2,197,748	2,436,908		6,033,757	85,052	11,778	150,000	246,830	2,190,078
6	2016	3,197,481	3,281,228	6,478,709		241,011		0	19,029		2,284,434	2,525,445		6,028,107	86,583	11,778	150,000	248,361	2,277,084
7	2017	3,188,373	3,281,228	6,469,601		253,028		0	19,015		2,374,212	2,627,240		6,019,632	88,071	11,778	150,000	249,849	2,377,391
8	2018	3,176,228	3,281,228	6,457,456		274,507		0	18,997		2,466,761	2,741,268		6,008,332	89,504	11,778	150,000	251,282	2,489,986
9	2019	3,176,228	3,281,228	6,457,456		287,745		0	18,997		2,565,547	2,853,292		6,008,332	91,273	11,778	150,000	253,051	2,600,241
10	2020	3,173,777	3,281,228	6,455,005		307,838		0	18,993		2,667,567	2,975,405		6,006,052	93,044	11,778	150,000	254,822	2,720,583
11	2021	2,901,006	3,012,541	5,913,547		283,852		0	18,821		2,749,185	3,033,037		5,502,252	88,243	11,778	150,000	250,021	2,783,016
12	2022	2,421,989	2,636,378	5,058,367		244,521		0	14,557		2,211,352	2,455,873		4,706,552	79,288	11,778	150,000	241,066	2,214,807
13	2023	1,691,159	2,099,003	3,790,162		184,620		0	6,184		976,948	1,161,568		3,526,552	64,822	11,778	150,000	226,600	934,968
14	2024	1,691,159	2,099,003	3,790,162		186,135		0	6,184		1,016,033	1,202,168		3,526,552	66,121	11,778	150,000	227,899	974,269
15	2025	1,505,819	2,020,955	3,526,774		174,716		0	5,824		995,203	1,169,919		3,281,482	59,169	11,778	150,000	220,947	948,972
16	2026	1,185,817	1,742,251	2,928,068		146,405		0	5,277		937,775	1,084,180		2,724,417	46,744	11,778	150,000	208,522	875,658
17	2027	758,099	1,348,495	2,106,594		106,382		0	4,511		833,725	940,107		1,960,077	28,857	11,778	150,000	190,635	749,472
18	2028	541,542	991,796	1,533,338		78,246		0	862		165,686	243,932		1,426,692	21,428	0	0	21,428	222,504
19	2029	442,122	792,972	1,235,094		63,731		0	688		137,532	201,263		1,149,192	17,609	0	0	17,609	183,654
20	2030	309,563	527,874	837,437		43,714		0	456		94,803	138,517		779,192	12,176	0	0	12,176	126,341
Total =				87,563,746					222,519			$33,224,946		81,473,578				$5,006,496	$28,218,450
											NPV =	$17,134,054						$2,986,182	14,147,872

Total NPV = $14,147,872
Benefit/Cost Ratio = 5.74

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated

(K = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M = Program Admin Costs (13)
(N = Incentive/Participant (20) x Number of Participants (19)
(O = (L) + (M) + (N)
(P = (I) - (O)

Table 2
Utility Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$42,554	$0	$90,588	$133,142	$338,111	$338,111	($204,969)
2012	107,080	0	625,161	732,241	427,385	427,385	304,856
2013	207,189	0	2,031,925	2,239,114	729,685	729,685	1,509,429
2014	217,109	0	2,113,218	2,330,327	161,778	161,778	2,168,549
2015	239,160	0	2,197,748	2,436,908	161,778	161,778	2,275,130
2016	241,011	0	2,284,434	2,525,445	161,778	161,778	2,363,667
2017	253,028	0	2,374,212	2,627,240	161,778	161,778	2,465,462
2018	274,507	0	2,466,761	2,741,268	161,778	161,778	2,579,490
2019	287,745	0	2,565,547	2,853,292	161,778	161,778	2,691,514
2020	307,838	0	2,667,567	2,975,405	161,778	161,778	2,813,627
2021	283,852	0	2,749,185	3,033,037	161,778	161,778	2,871,259
2022	244,521	0	2,211,352	2,455,873	161,778	161,778	2,294,095
2023	184,620	0	976,948	1,161,568	161,778	161,778	999,790
2024	186,135	0	1,016,033	1,202,168	161,778	161,778	1,040,390
2025	174,716	0	995,203	1,169,919	161,778	161,778	1,008,141
2026	146,405	0	937,775	1,084,180	161,778	161,778	922,402
2027	106,382	0	833,725	940,107	161,778	161,778	778,329
2028	78,246	0	165,686	243,932	0	0	243,932
2029	63,731	0	137,532	201,263	0	0	201,263
2030	43,714	0	94,803	138,517	0	0	138,517
Total =				$33,224,946		$3,760,073	$29,464,873
			NPV =	$17,134,054		$2,348,768	14,785,286

Total NPV =	$14,785,286
Benefit/Cost Ratio =	7.29

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$42,554	$0	$90,588	$42,102	$175,244	$338,111	$253,336	$591,447	($416,203)
2012	107,080	0	625,161	238,488	970,729	635,514	320,561	956,075	14,654
2013	207,189	0	2,031,925	751,150	2,990,264	2,848,130	275,626	3,123,756	(133,492)
2014	217,109	0	2,113,218	805,201	3,135,528	786,283	(150,000)	636,283	2,499,245
2015	239,160	0	2,197,748	867,286	3,304,194	786,346	(150,000)	636,346	2,667,848
2016	241,011	0	2,284,434	925,761	3,451,206	786,408	(150,000)	636,408	2,814,798
2017	253,028	0	2,374,212	991,970	3,619,210	786,472	(150,000)	636,472	2,982,738
2018	274,507	0	2,466,761	1,066,074	3,807,342	786,537	(150,000)	636,537	3,170,805
2019	287,745	0	2,565,547	1,142,930	3,996,222	786,603	(150,000)	636,603	3,359,619
2020	307,838	0	2,667,567	1,227,598	4,203,003	786,671	(150,000)	636,671	3,566,332
2021	283,852	0	2,749,185	1,288,920	4,321,957	786,740	(150,000)	636,740	3,685,217
2022	244,521	0	2,211,352	1,074,957	3,530,830	785,610	(105,000)	680,610	2,850,220
2023	184,620	0	976,948	523,681	1,685,249	161,778	(150,000)	11,778	1,673,471
2024	186,135	0	1,016,033	558,244	1,760,412	161,778	(150,000)	11,778	1,748,634
2025	174,716	0	995,203	559,568	1,729,487	161,778	(150,000)	11,778	1,717,709
2026	146,405	0	937,775	534,115	1,618,295	161,778	(150,000)	11,778	1,606,517
2027	106,382	0	833,725	477,032	1,417,139	161,778	(150,000)	11,778	1,405,361
2028	78,246	0	165,686	127,490	371,422	0	0	0	371,422
2029	63,731	0	137,532	108,345	309,608	0	0	0	309,608
2030	43,714	0	94,803	76,804	215,321	0	0	0	215,321
Total =					$46,612,662			$10,502,838	$36,109,824
				NPV =	$33,787,712			$8,752,493	25,035,219

Total NPV = $25,035,219
Benefit/Cost Ratio = 3.86

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits												Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$317,440			1,384,424	$63,979	447	378			$26,886	$0	$408,305	$582,818	$0	$582,818	($174,513)
2012	398,740			3,334,468	159,735	4,623	837			233,399	0	791,874	749,977	0	749,977	41,897
2013	676,560			6,033,757	301,660	15,575	1,479			632,509	0	1,610,729	1,013,742	0	1,013,742	596,987
2014	150,000			6,033,757	316,536	15,575	1,479			645,157	0	1,111,693	0	0	0	1,111,693
2015	150,000			6,033,757	332,121	15,575	1,479			658,073	0	1,140,194	0	0	0	1,140,194
2016	150,000			6,028,107	347,937	15,567	1,479			671,224	0	1,169,161	0	0	0	1,169,161
2017	150,000			6,019,632	364,242	15,555	1,479			684,655	0	1,198,897	0	0	0	1,198,897
2018	150,000			6,008,332	381,029	15,539	1,479			698,349	0	1,229,378	0	0	0	1,229,378
2019	150,000			6,008,332	399,801	15,539	1,479			712,309	0	1,262,110	0	0	0	1,262,110
2020	150,000			6,006,052	419,241	15,536	1,479			726,562	0	1,295,803	0	0	0	1,295,803
2021	150,000			5,502,252	406,380	15,455	1,404			730,742	0	1,287,122	0	0	0	1,287,122
2022	150,000			4,706,552	370,572	11,742	1,299			525,117	0	1,045,689	0	0	0	1,045,689
2023	150,000			3,526,552	302,314	4,392	1,149			94,951	0	547,265	0	0	0	547,265
2024	150,000			3,526,552	317,222	4,392	1,149			96,852	0	564,074	0	0	0	564,074
2025	150,000			3,281,482	298,654	4,245	974			98,787	0	547,441	0	0	0	547,441
2026	150,000			2,724,417	249,509	3,975	755			90,846	0	490,355	0	0	0	490,355
2027	150,000			1,960,077	170,858	3,616	426			78,184	0	399,042	0	0	0	399,042
2028	0			1,426,692	130,419	436	338			59,883	0	190,302	0	0	0	190,302
2029	0			1,149,192	110,280	358	260			48,469	0	158,749	0	0	0	158,749
2030	0			779,192	78,547	254	156			32,284	0	110,831	0	0	0	110,831
Total =						178,396	20,957					$16,559,014			$2,346,537	$14,212,477
											NPV =	$8,462,756			$2,082,504	6,380,251

Total NPV =	$6,380,251
Benefit/Cost Ratio =	4.06

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Total Program with Demand Response**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$42,554	$90,588	$133,142	$338,111	$253,336	$591,447	($458,305)
2012	107,080	625,161	732,241	635,514	320,561	956,075	(223,834)
2013	207,189	2,031,925	2,239,114	2,848,130	275,626	3,123,756	(884,642)
2014	217,109	2,113,218	2,330,327	786,283	(150,000)	636,283	1,694,044
2015	239,160	2,197,748	2,436,908	786,346	(150,000)	636,346	1,800,562
2016	241,011	2,284,434	2,525,445	786,408	(150,000)	636,408	1,889,037
2017	253,028	2,374,212	2,627,240	786,472	(150,000)	636,472	1,990,768
2018	274,507	2,466,761	2,741,268	786,537	(150,000)	636,537	2,104,731
2019	287,745	2,565,547	2,853,292	786,603	(150,000)	636,603	2,216,689
2020	307,838	2,667,567	2,975,405	786,671	(150,000)	636,671	2,338,734
2021	283,852	2,749,185	3,033,037	786,740	(150,000)	636,740	2,396,297
2022	244,521	2,211,352	2,455,873	785,610	(105,000)	680,610	1,775,263
2023	184,620	976,948	1,161,568	161,778	(150,000)	11,778	1,149,790
2024	186,135	1,016,033	1,202,168	161,778	(150,000)	11,778	1,190,390
2025	174,716	995,203	1,169,919	161,778	(150,000)	11,778	1,158,141
2026	146,405	937,775	1,084,180	161,778	(150,000)	11,778	1,072,402
2027	106,382	833,725	940,107	161,778	(150,000)	11,778	928,329
2028	78,246	165,686	243,932	0	0	0	243,932
2029	63,731	137,532	201,263	0	0	0	201,263
2030	43,714	94,803	138,517	0	0	0	138,517
		Total =	$33,224,946			$10,502,838	$22,722,108
		NPV =	$17,134,054			$7,195,035	9,939,020

Total NPV =	$9,939,020
Benefit/Cost Ratio =	2.38

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =
Retail Rate Winter ($/kWh) =
Retail Escalation Rate =
1a) Power Supply Cost Adjustment
Fuel Escalation Rate =

2) Avg. System Marginal Energy Cost ($/kWh) =
Escalation Rate =

3) Retail Summer Demand Rate ($/kW/season) =
3a) Retail Winter Demand Rate ($/kW/season) =
Escalation Rate =

4) Electric Margin ($/kWh) =
Escalation Rate =

5) System Peak Shaving Demand Cost ($/kW/yr)
Reserve Capacity=
Escalation Rate =

6) System Variable O&M ($/kWh) =
Escalation Rate =

7) Environmental Damage Factor =
Escalation Rate =

8) Participant Discount Rate = 10.94%

9) Utility Discount Rate = 9.61%

10) Societal Discount Rate = 4.24%

11) General Input Data Year = 2,010

12) Project Analysis Year 1 = 2,011
Project Analysis Year 2 = 2,012
Project Analysis Year 3 = 2,013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$20,671	$28,645	$41,347
Incentive Costs =	$317,440	$398,740	$526,560
Total Utility Project Costs =	$338,111	$427,385	$567,907
14) Direct Participant Costs ($/Part.) =			
Escalation Rate =			
14a) Other Participant Costs (Annual $/Part.) =			
Escalation Rate =			
14b) Other Participant Savings (Annual $/Part.) =			
Escalation Rate =			
15) Project Life (Years) =			
16) Avg Summer kW/part. Saved =			
16a) Avg Winter kW/part Saved =			
17) Avg. Summer kWh/Part. Saved =			
17a) Avg. Winter kWh/Part. Saved =			
18a) System Demand Line Loss Factor			
18b) System Energy Line Loss Factor			
19) Number of Participants =	414	531	704
20) Incentive/Participant =			
21) Effective Federal & State Income Tax Rate =			
22) Annual Summer Kwh Saved	662,079	872,379	1,176,284
Annual Winter Kwh Saved	722,345	987,665	1,343,005
23) Annual Summer KW Saved	447	574	754
Annual Winter KW Saved	378	459	642

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$3,371,396	2.85
Utility Cost Test	$3,989,816	4.32
Societal Test	$8,369,860	4.76
Participant Test	$2,279,964	2.09
Total Resource Cost Test	$3,089,760	2.47

Table 1
Ratepayer Impact Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

		Benefits														Costs						Annual
t	Year	Summer kWh Requirements Reduction (A1)	Winter kWh Requirements Reduction (A2)	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Total Energy Reduction (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Project Costs (O)	Benefits Less Costs (P)
1	2011	$711,569	$776,341	1,487,910		$42,554		$0	$497	$421	918		$90,588	$133,142		$662,079	$722,345	1,384,424	$18,615	$20,671	$317,440	$356,726	($223,584)
2	2012	1,649,159	1,837,833	3,486,992		104,190		0	1,139	934	2,073		212,731	316,921		1,534,458	1,710,010	3,244,468	43,740	28,645	398,740	471,125	(154,204)
3	2013	2,913,371	3,281,228	6,194,599		197,918		0	1,980	1,650	3,630		387,429	585,347		2,710,742	3,053,015	5,763,757	78,715	41,347	526,560	646,622	(61,275)
4	2014	2,913,371	3,281,228	6,194,599		207,394		0	1,980	1,650	3,630		402,930	610,324		2,710,742	3,053,015	5,763,757	80,298	0	0	80,298	530,026
5	2015	2,913,371	3,281,228	6,194,599		228,458		0	1,980	1,650	3,630		419,048	647,506		2,710,742	3,053,015	5,763,757	81,916	0	0	81,916	565,590
6	2016	2,907,298	3,281,228	6,188,526		230,216		0	1,971	1,650	3,621		434,703	664,919		2,705,092	3,053,015	5,758,107	83,385	0	0	83,385	581,534
7	2017	2,898,190	3,281,228	6,179,418		241,679		0	1,957	1,650	3,607		450,369	692,048		2,696,617	3,053,015	5,749,632	84,809	0	0	84,809	607,239
8	2018	2,886,045	3,281,228	6,167,273		262,171		0	1,939	1,650	3,589		466,032	728,203		2,685,317	3,053,015	5,738,332	86,177	0	0	86,177	642,026
9	2019	2,886,045	3,281,228	6,167,273		274,814		0	1,939	1,650	3,589		484,696	759,510		2,685,317	3,053,015	5,738,332	87,880	0	0	87,880	671,630
10	2020	2,883,594	3,281,228	6,164,822		293,999		0	1,935	1,650	3,585		503,513	797,512		2,683,037	3,053,015	5,736,052	89,583	0	0	89,583	707,929
11	2021	2,610,823	3,012,541	5,623,364		269,923		0	1,846	1,567	3,413		498,538	768,461		2,429,237	2,803,015	5,232,252	84,713	0	0	84,713	683,748
12	2022	2,228,534	2,636,378	4,864,912		235,169		0	1,719	1,449	3,168		481,249	716,418		2,073,537	2,453,015	4,526,552	76,888	0	0	76,888	639,530
13	2023	1,691,159	2,099,003	3,790,162		184,620		0	1,552	1,282	2,834		447,715	632,335		1,573,537	1,953,015	3,526,552	64,822	0	0	64,822	567,513
14	2024	1,691,159	2,099,003	3,790,162		186,135		0	1,552	1,282	2,834		465,628	651,763		1,573,537	1,953,015	3,526,552	66,121	0	0	66,121	585,642
15	2025	1,505,819	2,020,955	3,526,774		174,716		0	1,388	1,086	2,474		422,755	597,471		1,401,087	1,880,395	3,281,482	59,169	0	0	59,169	538,302
16	2026	1,185,817	1,742,251	2,928,068		146,405		0	1,085	842	1,927		342,446	488,851		1,103,342	1,621,075	2,724,417	46,744	0	0	46,744	442,107
17	2027	758,099	1,348,495	2,106,594		106,382		0	686	475	1,161		214,578	320,960		705,372	1,254,705	1,960,077	28,857	0	0	28,857	292,103
18	2028	541,542	991,796	1,533,338		78,246		0	485	377	862		165,686	243,932		503,877	922,815	1,426,692	21,428	0	0	21,428	222,504
19	2029	442,122	792,972	1,235,094		63,731		0	398	290	688		137,532	201,263		411,372	737,820	1,149,192	17,609	0	0	17,609	183,654
20	2030	309,563	527,874	837,437		43,714		0	282	174	456		94,803	138,517		288,032	491,160	779,192	12,176	0	0	12,176	126,341
Total =				84,661,916							51,689			$10,695,403				78,773,578				$2,547,048	$8,148,355
													NPV =	$5,190,532								$1,819,136	3,371,396

Total NPV =	$3,371,396
Benefit/Cost Ratio =	2.85

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M = Program Admin Costs (13)
(N = Incentive/Participant (20) x Number of Participants (19)
(O = (L) + (M) + (N)
(P = (I) - (O)

Table 2
Utility Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$42,554	$0	$90,588	$133,142	$338,111	$338,111	($204,969)
2012	104,190	0	212,731	316,921	427,385	427,385	(110,464)
2013	197,918	0	387,429	585,347	567,907	567,907	17,440
2014	207,394	0	402,930	610,324	0	0	610,324
2015	228,458	0	419,048	647,506	0	0	647,506
2016	230,216	0	434,703	664,919	0	0	664,919
2017	241,679	0	450,369	692,048	0	0	692,048
2018	262,171	0	466,032	728,203	0	0	728,203
2019	274,814	0	484,696	759,510	0	0	759,510
2020	293,999	0	503,513	797,512	0	0	797,512
2021	269,923	0	498,538	768,461	0	0	768,461
2022	235,169	0	481,249	716,418	0	0	716,418
2023	184,620	0	447,715	632,335	0	0	632,335
2024	186,135	0	465,628	651,763	0	0	651,763
2025	174,716	0	422,755	597,471	0	0	597,471
2026	146,405	0	342,446	488,851	0	0	488,851
2027	106,382	0	214,578	320,960	0	0	320,960
2028	78,246	0	165,686	243,932	0	0	243,932
2029	63,731	0	137,532	201,263	0	0	201,263
2030	43,714	0	94,803	138,517	0	0	138,517
Total =				$10,695,403		$1,333,403	$9,362,000
			NPV =	$5,190,532		$1,200,716	3,989,816

Total NPV =	$3,989,816
Benefit/Cost Ratio =	4.32

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$42,554	$0	$90,588	$42,102	$175,244	$338,111	$253,336	$591,447	($416,203)
2012	104,190	0	212,731	103,220	420,141	427,385	320,561	747,946	(327,805)
2013	197,918	0	387,429	196,365	781,712	567,907	425,626	993,533	(211,821)
2014	207,394	0	402,930	210,886	821,210	0	0	0	821,210
2015	228,458	0	419,048	230,443	877,949	0	0	0	877,949
2016	230,216	0	434,703	243,741	908,660	0	0	0	908,660
2017	241,679	0	450,369	261,297	953,345	0	0	0	953,345
2018	262,171	0	466,032	283,196	1,011,399	0	0	0	1,011,399
2019	274,814	0	484,696	304,233	1,063,743	0	0	0	1,063,743
2020	293,999	0	503,513	329,038	1,126,550	0	0	0	1,126,550
2021	269,923	0	498,538	326,566	1,095,027	0	0	0	1,095,027
2022	235,169	0	481,249	313,583	1,030,001	0	0	0	1,030,001
2023	184,620	0	447,715	285,082	917,417	0	0	0	917,417
2024	186,135	0	465,628	302,655	954,418	0	0	0	954,418
2025	174,716	0	422,755	285,768	883,239	0	0	0	883,239
2026	146,405	0	342,446	240,829	729,680	0	0	0	729,680
2027	106,382	0	214,578	162,862	483,822	0	0	0	483,822
2028	78,246	0	165,686	127,490	371,422	0	0	0	371,422
2029	63,731	0	137,532	108,345	309,608	0	0	0	309,608
2030	43,714	0	94,803	76,804	215,321	0	0	0	215,321
Total =					$15,129,908			$2,332,926	$12,796,982
				NPV =	$10,593,182			$2,223,322	8,369,860

Total NPV =	$8,369,860
Benefit/Cost Ratio =	4.76

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits													Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$317,440			$662,079	$722,345	1,384,424	$63,979	447	378			$26,886	$0	$408,305	$582,818	$0	$582,818	($174,513)
2012	398,740			1,534,458	1,710,010	3,244,468	155,700	1,023	837			64,854	0	619,294	749,977	0	749,977	(130,683)
2013	526,560			2,710,742	3,053,015	5,763,757	288,956	1,775	1,479			116,766	0	932,282	1,013,742	0	1,013,742	(81,460)
2014	0			2,710,742	3,053,015	5,763,757	303,206	1,775	1,479			119,100	0	422,306	0	0	0	422,306
2015	0			2,710,742	3,053,015	5,763,757	318,135	1,775	1,479			121,486	0	439,621	0	0	0	439,621
2016	0			2,705,092	3,053,015	5,758,107	333,262	1,767	1,479			123,912	0	457,174	0	0	0	457,174
2017	0			2,696,617	3,053,015	5,749,632	348,844	1,755	1,479			126,392	0	475,236	0	0	0	475,236
2018	0			2,685,317	3,053,015	5,738,332	364,869	1,739	1,479			128,919	0	493,788	0	0	0	493,788
2019	0			2,685,317	3,053,015	5,738,332	382,845	1,739	1,479			131,496	0	514,341	0	0	0	514,341
2020	0			2,683,037	3,053,015	5,736,052	401,451	1,736	1,479			134,128	0	535,579	0	0	0	535,579
2021	0			2,429,237	2,803,015	5,232,252	387,712	1,655	1,404			126,460	0	514,172	0	0	0	514,172
2022	0			2,073,537	2,453,015	4,526,552	357,513	1,542	1,299			114,206	0	471,719	0	0	0	471,719
2023	0			1,573,537	1,953,015	3,526,552	302,314	1,392	1,149			94,951	0	397,265	0	0	0	397,265
2024	0			1,573,537	1,953,015	3,526,552	317,222	1,392	1,149			96,852	0	414,074	0	0	0	414,074
2025	0			1,401,087	1,880,395	3,281,482	298,654	1,245	974			98,787	0	397,441	0	0	0	397,441
2026	0			1,103,342	1,621,075	2,724,417	249,509	975	755			90,846	0	340,355	0	0	0	340,355
2027	0			705,372	1,254,705	1,960,077	170,858	616	426			78,184	0	249,042	0	0	0	249,042
2028	0			503,877	922,815	1,426,692	130,419	436	338			59,883	0	190,302	0	0	0	190,302
2029	0			411,372	737,820	1,149,192	110,280	358	260			48,469	0	158,749	0	0	0	158,749
2030	0			288,032	491,160	779,192	78,547	254	156			32,284	0	110,831	0	0	0	110,831
Total =				35,847,073	42,926,505			25,396	20,957					$8,541,876			$2,346,537	$6,195,339
													NPV =	$4,362,468			$2,082,504	2,279,964

Total NPV =	$2,279,964
Benefit/Cost Ratio =	2.09

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Total Program without Demand Response**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$42,554	$90,588	$133,142	$338,111	$253,336	$591,447	($458,305)
2012	104,190	212,731	316,921	427,385	320,561	747,946	(431,025)
2013	197,918	387,429	585,347	567,907	425,626	993,533	(408,186)
2014	207,394	402,930	610,324	0	0	0	610,324
2015	228,458	419,048	647,506	0	0	0	647,506
2016	230,216	434,703	664,919	0	0	0	664,919
2017	241,679	450,369	692,048	0	0	0	692,048
2018	262,171	466,032	728,203	0	0	0	728,203
2019	274,814	484,696	759,510	0	0	0	759,510
2020	293,999	503,513	797,512	0	0	0	797,512
2021	269,923	498,538	768,461	0	0	0	768,461
2022	235,169	481,249	716,418	0	0	0	716,418
2023	184,620	447,715	632,335	0	0	0	632,335
2024	186,135	465,628	651,763	0	0	0	651,763
2025	174,716	422,755	597,471	0	0	0	597,471
2026	146,405	342,446	488,851	0	0	0	488,851
2027	106,382	214,578	320,960	0	0	0	320,960
2028	78,246	165,686	243,932	0	0	0	243,932
2029	63,731	137,532	201,263	0	0	0	201,263
2030	43,714	94,803	138,517	0	0	0	138,517
		Total =	$10,695,403			$2,332,926	$8,362,477
		NPV =	$5,190,532			$2,100,772	3,089,760

Total NPV =	$3,089,760
Benefit/Cost Ratio =	2.47

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$391	$431	$707
Incentive Costs =	6,000	6,000	9,000
Total Utility Project Costs =	$6,391	$6,431	$9,707
14) Direct Participant Costs ($/Part.) =	$520	$520	$520
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.690	0.690	0.690
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	908	908	908
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	20	20	30
20) Incentive/Participant =	$300	$300	$300
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	18,160	18,160	27,240
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	14	14	21
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$37,186	2.09
Utility Cost Test	$50,910	3.50
Societal Test	$106,847	3.95
Participant Test	$30,010	1.89
Total Resource Cost Test	$37,003	2.08

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	19,517	$0.02860	$558	$0.00000	$0	15	0	15	$98.68	$1,480	$2,038	$0.04223	18,160	0	18,160	$465	$391	$6,000	$6,856	($4,818)
2	2012	39,035	0.02988	1,166	0.00000	0	31	0	31	102.62	3,181	4,347	0.04307	36,320	0	36,320	948	431	6,000	7,379	(3,032)
3	2013	68,311	0.03195	2,183	0.00000	0	54	0	54	106.73	5,763	7,946	0.04393	63,560	0	63,560	1,692	707	9,000	11,399	(3,453)
4	2014	68,311	0.03348	2,287	0.00000	0	54	0	54	111.00	5,994	8,281	0.04481	63,560	0	63,560	1,726	0	0	1,726	6,555
5	2015	68,311	0.03688	2,519	0.00000	0	54	0	54	115.44	6,234	8,753	0.04571	63,560	0	63,560	1,761	0	0	1,761	6,992
6	2016	68,311	0.03720	2,541	0.00000	0	54	0	54	120.05	6,483	9,024	0.04662	63,560	0	63,560	1,796	0	0	1,796	7,228
7	2017	68,311	0.03911	2,672	0.00000	0	54	0	54	124.86	6,742	9,414	0.04756	63,560	0	63,560	1,832	0	0	1,832	7,582
8	2018	68,311	0.04251	2,904	0.00000	0	54	0	54	129.85	7,012	9,916	0.04851	63,560	0	63,560	1,869	0	0	1,869	8,047
9	2019	68,311	0.04456	3,044	0.00000	0	54	0	54	135.05	7,293	10,337	0.04948	63,560	0	63,560	1,906	0	0	1,906	8,431
10	2020	68,311	0.04769	3,258	0.00000	0	54	0	54	140.45	7,584	10,842	0.05047	63,560	0	63,560	1,944	0	0	1,944	8,898
11	2021	68,311	0.04800	3,279	0.00000	0	54	0	54	146.07	7,888	11,167	0.05148	63,560	0	63,560	1,983	0	0	1,983	9,184
12	2022	68,311	0.04834	3,302	0.00000	0	54	0	54	151.91	8,203	11,505	0.05251	63,560	0	63,560	2,023	0	0	2,023	9,482
13	2023	68,311	0.04871	3,327	0.00000	0	54	0	54	157.98	8,531	11,858	0.05356	63,560	0	63,560	2,063	0	0	2,063	9,795
14	2024	68,311	0.04911	3,355	0.00000	0	54	0	54	164.30	8,872	12,227	0.05463	63,560	0	63,560	2,105	0	0	2,105	10,122
15	2025	48,794	0.04954	2,417	0.00000	0	39	0	39	170.88	6,664	9,081	0.05572	45,400	0	45,400	1,533	0	0	1,533	7,548
16	2026	29,276	0.05000	1,464	0.00000	0	23	0	23	177.71	4,087	5,551	0.05683	27,240	0	27,240	938	0	0	938	4,613
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05797	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0
Total =		956,354							756			$142,287				889,840				$49,113	$93,174
											NPV =	$71,248								$34,062	37,186

Total NPV = $37,186
Benefit/Cost Ratio = 2.09

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$558	$0	$1,480	$2,038	$6,391	$6,391	($4,353)
2012	1,166	0	3,181	4,347	6,431	6,431	(2,084)
2013	2,183	0	5,763	7,946	9,707	9,707	(1,761)
2014	2,287	0	5,994	8,281	0	0	8,281
2015	2,519	0	6,234	8,753	0	0	8,753
2016	2,541	0	6,483	9,024	0	0	9,024
2017	2,672	0	6,742	9,414	0	0	9,414
2018	2,904	0	7,012	9,916	0	0	9,916
2019	3,044	0	7,293	10,337	0	0	10,337
2020	3,258	0	7,584	10,842	0	0	10,842
2021	3,279	0	7,888	11,167	0	0	11,167
2022	3,302	0	8,203	11,505	0	0	11,505
2023	3,327	0	8,531	11,858	0	0	11,858
2024	3,355	0	8,872	12,227	0	0	12,227
2025	2,417	0	6,664	9,081	0	0	9,081
2026	1,464	0	4,087	5,551	0	0	5,551
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$142,287		$22,529	$119,758
			NPV =	$71,248		$20,338	50,910

Total NPV =	$50,910
Benefit/Cost Ratio =	3.50

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$558	$0	$1,480	$644	$2,682	$6,391	$4,400	$10,791	($8,109)
2012	1,166	0	3,181	1,416	5,763	6,431	4,400	10,831	(5,068)
2013	2,183	0	5,763	2,666	10,612	9,707	6,600	16,307	(5,695)
2014	2,287	0	5,994	2,861	11,142	0	0	0	11,142
2015	2,519	0	6,234	3,115	11,868	0	0	0	11,868
2016	2,541	0	6,483	3,308	12,332	0	0	0	12,332
2017	2,672	0	6,742	3,554	12,968	0	0	0	12,968
2018	2,904	0	7,012	3,856	13,772	0	0	0	13,772
2019	3,044	0	7,293	4,141	14,478	0	0	0	14,478
2020	3,258	0	7,584	4,473	15,315	0	0	0	15,315
2021	3,279	0	7,888	4,746	15,913	0	0	0	15,913
2022	3,302	0	8,203	5,036	16,541	0	0	0	16,541
2023	3,327	0	8,531	5,346	17,204	0	0	0	17,204
2024	3,355	0	8,872	5,678	17,905	0	0	0	17,905
2025	2,417	0	6,664	4,343	13,424	0	0	0	13,424
2026	1,464	0	4,087	2,735	8,286	0	0	0	8,286
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$200,205			$37,929	$162,276
				NPV =	$143,036			$36,189	106,847

Total NPV = $106,847
Benefit/Cost Ratio = 3.95

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits													Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$6,000	$0.07570	$0.06041	18,160	0	18,160	$1,375	14	0	$0.000	$0.000	$0	$0	$7,375	$10,619	$0	$10,619	($3,244)
2012	6,000	0.07943	0.06339	36,320	0	36,320	2,885	28	0	0.000	0.000	0	0	8,885	10,844	0	10,844	(1,959)
2013	9,000	0.08335	0.06651	63,560	0	63,560	5,298	48	0	0.000	0.000	0	0	14,298	16,608	0	16,608	(2,310)
2014	0	0.08746	0.06979	63,560	0	63,560	5,559	48	0	0.000	0.000	0	0	5,559	0	0	0	5,559
2015	0	0.09177	0.07323	63,560	0	63,560	5,833	48	0	0.000	0.000	0	0	5,833	0	0	0	5,833
2016	0	0.09629	0.07685	63,560	0	63,560	6,120	48	0	0.000	0.000	0	0	6,120	0	0	0	6,120
2017	0	0.10104	0.08063	63,560	0	63,560	6,422	48	0	0.000	0.000	0	0	6,422	0	0	0	6,422
2018	0	0.10602	0.08461	63,560	0	63,560	6,739	48	0	0.000	0.000	0	0	6,739	0	0	0	6,739
2019	0	0.11125	0.08878	63,560	0	63,560	7,071	48	0	0.000	0.000	0	0	7,071	0	0	0	7,071
2020	0	0.11674	0.09316	63,560	0	63,560	7,420	48	0	0.000	0.000	0	0	7,420	0	0	0	7,420
2021	0	0.12249	0.09775	63,560	0	63,560	7,785	48	0	0.000	0.000	0	0	7,785	0	0	0	7,785
2022	0	0.12854	0.10258	63,560	0	63,560	8,170	48	0	0.000	0.000	0	0	8,170	0	0	0	8,170
2023	0	0.13487	0.10763	63,560	0	63,560	8,572	48	0	0.000	0.000	0	0	8,572	0	0	0	8,572
2024	0	0.14152	0.11294	63,560	0	63,560	8,995	48	0	0.000	0.000	0	0	8,995	0	0	0	8,995
2025	0	0.14850	0.11851	45,400	0	45,400	6,742	35	0	0.000	0.000	0	0	6,742	0	0	0	6,742
2026	0	0.15582	0.12435	27,240	0	27,240	4,245	21	0	0.000	0.000	0	0	4,245	0	0	0	4,245
2027	0	0.16351	0.13049	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				889,840	0			674	0					$120,231			$38,071	$82,160
													NPV =	$63,898			$33,888	30,010

Total NPV =	$30,010
Benefit/Cost Ratio =	1.89

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 1 (14.5 SEER)**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$558	$1,480	$2,038	$6,391	$4,400	$10,791	($8,753)
2012	1,166	3,181	4,347	6,431	4,400	10,831	(6,484)
2013	2,183	5,763	7,946	9,707	6,600	16,307	(8,361)
2014	2,287	5,994	8,281	0	0	0	8,281
2015	2,519	6,234	8,753	0	0	0	8,753
2016	2,541	6,483	9,024	0	0	0	9,024
2017	2,672	6,742	9,414	0	0	0	9,414
2018	2,904	7,012	9,916	0	0	0	9,916
2019	3,044	7,293	10,337	0	0	0	10,337
2020	3,258	7,584	10,842	0	0	0	10,842
2021	3,279	7,888	11,167	0	0	0	11,167
2022	3,302	8,203	11,505	0	0	0	11,505
2023	3,327	8,531	11,858	0	0	0	11,858
2024	3,355	8,872	12,227	0	0	0	12,227
2025	2,417	6,664	9,081	0	0	0	9,081
2026	1,464	4,087	5,551	0	0	0	5,551
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$142,287			$37,929	$104,358
		NPV =	$71,248			$34,245	37,003

Total NPV =	$37,003
Benefit/Cost Ratio =	2.08

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$3,126	$3,448	$4,711
Incentive Costs =	48,000	48,000	60,000
Total Utility Project Costs =	$51,126	$51,448	$64,711
14) Direct Participant Costs ($/Part.) =	$1,037	$1,037	$1,037
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.567	0.567	0.567
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,098	1,098	1,098
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	80	80	100
20) Incentive/Participant =	$600	$600	$600
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	87,840	87,840	109,800
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	45	45	57
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$33,612	1.16
Utility Cost Test	$95,553	1.63
Societal Test	$226,142	1.84
Participant Test	$91,287	1.36
Total Resource Cost Test	($7,675)	0.97

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	94,406	$0.02860	$2,700	$0.00000	$0	51	0	51	$98.68	$5,033	$7,733	$0.04223	87,840	0	87,840	$2,248	$3,126	$48,000	$53,374	($45,641)
2	2012	188,812	0.02988	5,642	0.00000	0	101	0	101	102.62	10,365	16,007	0.04307	175,680	0	175,680	4,586	3,448	48,000	56,034	(40,027)
3	2013	306,820	0.03195	9,803	0.00000	0	165	0	165	106.73	17,610	27,413	0.04393	285,480	0	285,480	7,601	4,711	60,000	72,312	(44,899)
4	2014	306,820	0.03348	10,272	0.00000	0	165	0	165	111.00	18,315	28,587	0.04481	285,480	0	285,480	7,754	0	0	7,754	20,833
5	2015	306,820	0.03688	11,316	0.00000	0	165	0	165	115.44	19,048	30,364	0.04571	285,480	0	285,480	7,910	0	0	7,910	22,454
6	2016	306,820	0.03720	11,414	0.00000	0	165	0	165	120.05	19,808	31,222	0.04662	285,480	0	285,480	8,067	0	0	8,067	23,155
7	2017	306,820	0.03911	12,000	0.00000	0	165	0	165	124.86	20,602	32,602	0.04756	285,480	0	285,480	8,230	0	0	8,230	24,372
8	2018	306,820	0.04251	13,043	0.00000	0	165	0	165	129.85	21,425	34,468	0.04851	285,480	0	285,480	8,394	0	0	8,394	26,074
9	2019	306,820	0.04456	13,672	0.00000	0	165	0	165	135.05	22,283	35,955	0.04948	285,480	0	285,480	8,562	0	0	8,562	27,393
10	2020	306,820	0.04769	14,632	0.00000	0	165	0	165	140.45	23,174	37,806	0.05047	285,480	0	285,480	8,733	0	0	8,733	29,073
11	2021	306,820	0.04800	14,727	0.00000	0	165	0	165	146.07	24,102	38,829	0.05148	285,480	0	285,480	8,908	0	0	8,908	29,921
12	2022	306,820	0.04834	14,832	0.00000	0	165	0	165	151.91	25,065	39,897	0.05251	285,480	0	285,480	9,086	0	0	9,086	30,811
13	2023	306,820	0.04871	14,945	0.00000	0	165	0	165	157.98	26,067	41,012	0.05356	285,480	0	285,480	9,268	0	0	9,268	31,744
14	2024	306,820	0.04911	15,068	0.00000	0	165	0	165	164.30	27,110	42,178	0.05463	285,480	0	285,480	9,453	0	0	9,453	32,725
15	2025	212,414	0.04954	10,523	0.00000	0	114	0	114	170.88	19,480	30,003	0.05572	197,640	0	197,640	6,675	0	0	6,675	23,328
16	2026	118,008	0.05000	5,900	0.00000	0	63	0	63	177.71	11,196	17,096	0.05683	109,800	0	109,800	3,782	0	0	3,782	13,314
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05797	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0
Total =		4,295,480							2,309			$491,172				3,996,720				$286,542	$204,630
											NPV =	$247,478								$213,866	33,612

Total NPV = $33,612
Benefit/Cost Ratio = 1.16

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$2,700	$0	$5,033	$7,733	$51,126	$51,126	($43,393)
2012	5,642	0	10,365	16,007	51,448	51,448	(35,441)
2013	9,803	0	17,610	27,413	64,711	64,711	(37,298)
2014	10,272	0	18,315	28,587	0	0	28,587
2015	11,316	0	19,048	30,364	0	0	30,364
2016	11,414	0	19,808	31,222	0	0	31,222
2017	12,000	0	20,602	32,602	0	0	32,602
2018	13,043	0	21,425	34,468	0	0	34,468
2019	13,672	0	22,283	35,955	0	0	35,955
2020	14,632	0	23,174	37,806	0	0	37,806
2021	14,727	0	24,102	38,829	0	0	38,829
2022	14,832	0	25,065	39,897	0	0	39,897
2023	14,945	0	26,067	41,012	0	0	41,012
2024	15,068	0	27,110	42,178	0	0	42,178
2025	10,523	0	19,480	30,003	0	0	30,003
2026	5,900	0	11,196	17,096	0	0	17,096
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$491,172		$167,285	$323,887
			NPV =	$247,478		$151,925	95,553

Total NPV =	$95,553
Benefit/Cost Ratio =	1.63

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$2,700	$0	$5,033	$2,445	$10,178	$51,126	$34,960	$86,086	($75,908)
2012	5,642	0	10,365	5,213	21,220	51,448	34,960	86,408	(65,188)
2013	9,803	0	17,610	9,196	36,609	64,711	43,700	108,411	(71,802)
2014	10,272	0	18,315	9,878	38,465	0	0	0	38,465
2015	11,316	0	19,048	10,806	41,170	0	0	0	41,170
2016	11,414	0	19,808	11,445	42,667	0	0	0	42,667
2017	12,000	0	20,602	12,310	44,912	0	0	0	44,912
2018	13,043	0	21,425	13,405	47,873	0	0	0	47,873
2019	13,672	0	22,283	14,402	50,357	0	0	0	50,357
2020	14,632	0	23,174	15,598	53,404	0	0	0	53,404
2021	14,727	0	24,102	16,501	55,330	0	0	0	55,330
2022	14,832	0	25,065	17,463	57,360	0	0	0	57,360
2023	14,945	0	26,067	18,490	59,502	0	0	0	59,502
2024	15,068	0	27,110	19,586	61,764	0	0	0	61,764
2025	10,523	0	19,480	14,350	44,353	0	0	0	44,353
2026	5,900	0	11,196	8,422	25,518	0	0	0	25,518
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$690,682			$280,905	$409,777
				NPV =	$494,892			$268,750	226,142

Total NPV =	$226,142
Benefit/Cost Ratio =	1.84

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$48,000	$0.07570	$0.06041	87,840	0	87,840	$6,649	45	0	$0.000	$0.000	$0	$0	$54,649	$84,710	$0	$84,710	($30,061)
2012	48,000	0.07943	0.06339	175,680	0	175,680	13,954	91	0	0.000	0.000	0	0	61,954	86,498	0	86,498	(24,544)
2013	60,000	0.08335	0.06651	285,480	0	285,480	23,795	147	0	0.000	0.000	0	0	83,795	110,404	0	110,404	(26,609)
2014	0	0.08746	0.06979	285,480	0	285,480	24,968	147	0	0.000	0.000	0	0	24,968	0	0	0	24,968
2015	0	0.09177	0.07323	285,480	0	285,480	26,198	147	0	0.000	0.000	0	0	26,198	0	0	0	26,198
2016	0	0.09629	0.07685	285,480	0	285,480	27,489	147	0	0.000	0.000	0	0	27,489	0	0	0	27,489
2017	0	0.10104	0.08063	285,480	0	285,480	28,845	147	0	0.000	0.000	0	0	28,845	0	0	0	28,845
2018	0	0.10602	0.08461	285,480	0	285,480	30,267	147	0	0.000	0.000	0	0	30,267	0	0	0	30,267
2019	0	0.11125	0.08878	285,480	0	285,480	31,760	147	0	0.000	0.000	0	0	31,760	0	0	0	31,760
2020	0	0.11674	0.09316	285,480	0	285,480	33,327	147	0	0.000	0.000	0	0	33,327	0	0	0	33,327
2021	0	0.12249	0.09775	285,480	0	285,480	34,968	147	0	0.000	0.000	0	0	34,968	0	0	0	34,968
2022	0	0.12854	0.10258	285,480	0	285,480	36,696	147	0	0.000	0.000	0	0	36,696	0	0	0	36,696
2023	0	0.13487	0.10763	285,480	0	285,480	38,503	147	0	0.000	0.000	0	0	38,503	0	0	0	38,503
2024	0	0.14152	0.11294	285,480	0	285,480	40,401	147	0	0.000	0.000	0	0	40,401	0	0	0	40,401
2025	0	0.14850	0.11851	197,640	0	197,640	29,350	102	0	0.000	0.000	0	0	29,350	0	0	0	29,350
2026	0	0.15582	0.12435	109,800	0	109,800	17,109	57	0	0.000	0.000	0	0	17,109	0	0	0	17,109
2027	0	0.16351	0.13049	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				3,996,720	0			2,059	0					$600,279			$281,612	$318,667
													NPV =	$343,669			$252,382	91,287

Total NPV =	$91,287
Benefit/Cost Ratio =	1.36

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$2,700	$5,033	$7,733	$51,126	$34,960	$86,086	($78,353)
2012	5,642	10,365	16,007	51,448	34,960	86,408	(70,401)
2013	9,803	17,610	27,413	64,711	43,700	108,411	(80,998)
2014	10,272	18,315	28,587	0	0	0	28,587
2015	11,316	19,048	30,364	0	0	0	30,364
2016	11,414	19,808	31,222	0	0	0	31,222
2017	12,000	20,602	32,602	0	0	0	32,602
2018	13,043	21,425	34,468	0	0	0	34,468
2019	13,672	22,283	35,955	0	0	0	35,955
2020	14,632	23,174	37,806	0	0	0	37,806
2021	14,727	24,102	38,829	0	0	0	38,829
2022	14,832	25,065	39,897	0	0	0	39,897
2023	14,945	26,067	41,012	0	0	0	41,012
2024	15,068	27,110	42,178	0	0	0	42,178
2025	10,523	19,480	30,003	0	0	0	30,003
2026	5,900	11,196	17,096	0	0	0	17,096
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$491,172			$280,905	$210,267
		NPV =	$247,478			$255,153	(7,675)

Total NPV = ($7,675)
Benefit/Cost Ratio = 0.97

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$3,907	$5,173	$7,067
Incentive Costs =	60,000	72,000	90,000
Total Utility Project Costs =	$63,907	$77,173	$97,067
14) Direct Participant Costs ($/Part.) =	$1,037	$1,037	$1,037
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.567	0.567	0.567
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	422	422	422
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	100	120	150
20) Incentive/Participant =	$600	$600	$600
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	42,200	50,640	63,300
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	57	68	85
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$22,215	1.09
Utility Cost Test	$55,950	1.26
Societal Test	$162,187	1.43
Participant Test	($48,350)	0.86
Total Resource Cost Test	($90,153)	0.75

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	45,354	$0.02860	$1,297	$0.00000	$0	63	0	63	$98.68	$6,217	$7,514	$0.04223	42,200	0	42,200	$1,080	$3,907	$60,000	$64,987	($57,473)
2	2012	99,780	0.02988	2,981	0.00000	0	139	0	139	102.62	14,264	17,245	0.04307	92,840	0	92,840	2,424	5,173	72,000	79,597	(62,352)
3	2013	167,811	0.03195	5,362	0.00000	0	234	0	234	106.73	24,975	30,337	0.04393	156,140	0	156,140	4,158	7,067	90,000	101,225	(70,888)
4	2014	167,811	0.03348	5,618	0.00000	0	234	0	234	111.00	25,974	31,592	0.04481	156,140	0	156,140	4,241	0	0	4,241	27,351
5	2015	167,811	0.03688	6,189	0.00000	0	234	0	234	115.44	27,013	33,202	0.04571	156,140	0	156,140	4,326	0	0	4,326	28,876
6	2016	167,811	0.03720	6,243	0.00000	0	234	0	234	120.05	28,092	34,335	0.04662	156,140	0	156,140	4,412	0	0	4,412	29,923
7	2017	167,811	0.03911	6,563	0.00000	0	234	0	234	124.86	29,217	35,780	0.04756	156,140	0	156,140	4,501	0	0	4,501	31,279
8	2018	167,811	0.04251	7,134	0.00000	0	234	0	234	129.85	30,385	37,519	0.04851	156,140	0	156,140	4,591	0	0	4,591	32,928
9	2019	167,811	0.04456	7,478	0.00000	0	234	0	234	135.05	31,602	39,080	0.04948	156,140	0	156,140	4,683	0	0	4,683	34,397
10	2020	167,811	0.04769	8,003	0.00000	0	234	0	234	140.45	32,865	40,868	0.05047	156,140	0	156,140	4,776	0	0	4,776	36,092
11	2021	167,811	0.04800	8,055	0.00000	0	234	0	234	146.07	34,180	42,235	0.05148	156,140	0	156,140	4,872	0	0	4,872	37,363
12	2022	167,811	0.04834	8,112	0.00000	0	234	0	234	151.91	35,547	43,659	0.05251	156,140	0	156,140	4,970	0	0	4,970	38,689
13	2023	167,811	0.04871	8,174	0.00000	0	234	0	234	157.98	36,967	45,141	0.05356	156,140	0	156,140	5,069	0	0	5,069	40,072
14	2024	167,811	0.04911	8,241	0.00000	0	234	0	234	164.30	38,446	46,687	0.05463	156,140	0	156,140	5,170	0	0	5,170	41,517
15	2025	122,457	0.04954	6,067	0.00000	0	171	0	171	170.88	29,220	35,287	0.05572	113,940	0	113,940	3,848	0	0	3,848	31,439
16	2026	68,032	0.05000	3,402	0.00000	0	95	0	95	177.71	16,882	20,284	0.05683	63,300	0	63,300	2,180	0	0	2,180	18,104
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05797	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0
Total =		2,349,355							3,276			$540,765				2,185,960				$303,448	$237,317
											NPV =	$271,056								$248,841	22,215

Total NPV = $22,215
Benefit/Cost Ratio = 1.09

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$1,297	$0	$6,217	$7,514	$63,907	$63,907	($56,393)
2012	2,981	0	14,264	17,245	77,173	77,173	(59,928)
2013	5,362	0	24,975	30,337	97,067	97,067	(66,730)
2014	5,618	0	25,974	31,592	0	0	31,592
2015	6,189	0	27,013	33,202	0	0	33,202
2016	6,243	0	28,092	34,335	0	0	34,335
2017	6,563	0	29,217	35,780	0	0	35,780
2018	7,134	0	30,385	37,519	0	0	37,519
2019	7,478	0	31,602	39,080	0	0	39,080
2020	8,003	0	32,865	40,868	0	0	40,868
2021	8,055	0	34,180	42,235	0	0	42,235
2022	8,112	0	35,547	43,659	0	0	43,659
2023	8,174	0	36,967	45,141	0	0	45,141
2024	8,241	0	38,446	46,687	0	0	46,687
2025	6,067	0	29,220	35,287	0	0	35,287
2026	3,402	0	16,882	20,284	0	0	20,284
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$540,765		$238,147	$302,618
			NPV =	$271,056		$215,106	55,950

Total NPV =	$55,950
Benefit/Cost Ratio =	1.26

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$1,297	$0	$6,217	$2,376	$9,890	$63,907	$43,700	$107,607	($97,717)
2012	2,981	0	14,264	5,617	22,862	77,173	52,440	129,613	(106,751)
2013	5,362	0	24,975	10,177	40,514	97,067	65,550	162,617	(122,103)
2014	5,618	0	25,974	10,916	42,508	0	0	0	42,508
2015	6,189	0	27,013	11,816	45,018	0	0	0	45,018
2016	6,243	0	28,092	12,586	46,921	0	0	0	46,921
2017	6,563	0	29,217	13,510	49,290	0	0	0	49,290
2018	7,134	0	30,385	14,591	52,110	0	0	0	52,110
2019	7,478	0	31,602	15,654	54,734	0	0	0	54,734
2020	8,003	0	32,865	16,861	57,729	0	0	0	57,729
2021	8,055	0	34,180	17,948	60,183	0	0	0	60,183
2022	8,112	0	35,547	19,110	62,769	0	0	0	62,769
2023	8,174	0	36,967	20,351	65,492	0	0	0	65,492
2024	8,241	0	38,446	21,680	68,367	0	0	0	68,367
2025	6,067	0	29,220	16,878	52,165	0	0	0	52,165
2026	3,402	0	16,882	9,993	30,277	0	0	0	30,277
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$760,829			$399,837	$360,992
				NPV =	$543,792			$381,605	162,187

Total NPV =	$162,187
Benefit/Cost Ratio =	1.43

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$60,000	$0.07570	$0.06041	42,200	0	42,200	$3,195	57	0	$0.000	$0.000	$0	$0	$63,195	$105,888	$0	$105,888	($42,693)
2012	72,000	0.07943	0.06339	92,840	0	92,840	7,374	125	0	0.000	0.000	0	0	79,374	129,747	0	129,747	(50,373)
2013	90,000	0.08335	0.06651	156,140	0	156,140	13,014	210	0	0.000	0.000	0	0	103,014	165,606	0	165,606	(62,592)
2014	0	0.08746	0.06979	156,140	0	156,140	13,656	210	0	0.000	0.000	0	0	13,656	0	0	0	13,656
2015	0	0.09177	0.07323	156,140	0	156,140	14,329	210	0	0.000	0.000	0	0	14,329	0	0	0	14,329
2016	0	0.09629	0.07685	156,140	0	156,140	15,035	210	0	0.000	0.000	0	0	15,035	0	0	0	15,035
2017	0	0.10104	0.08063	156,140	0	156,140	15,776	210	0	0.000	0.000	0	0	15,776	0	0	0	15,776
2018	0	0.10602	0.08461	156,140	0	156,140	16,554	210	0	0.000	0.000	0	0	16,554	0	0	0	16,554
2019	0	0.11125	0.08878	156,140	0	156,140	17,371	210	0	0.000	0.000	0	0	17,371	0	0	0	17,371
2020	0	0.11674	0.09316	156,140	0	156,140	18,228	210	0	0.000	0.000	0	0	18,228	0	0	0	18,228
2021	0	0.12249	0.09775	156,140	0	156,140	19,126	210	0	0.000	0.000	0	0	19,126	0	0	0	19,126
2022	0	0.12854	0.10258	156,140	0	156,140	20,070	210	0	0.000	0.000	0	0	20,070	0	0	0	20,070
2023	0	0.13487	0.10763	156,140	0	156,140	21,059	210	0	0.000	0.000	0	0	21,059	0	0	0	21,059
2024	0	0.14152	0.11294	156,140	0	156,140	22,097	210	0	0.000	0.000	0	0	22,097	0	0	0	22,097
2025	0	0.14850	0.11851	113,940	0	113,940	16,920	153	0	0.000	0.000	0	0	16,920	0	0	0	16,920
2026	0	0.15582	0.12435	63,300	0	63,300	9,863	85	0	0.000	0.000	0	0	9,863	0	0	0	9,863
2027	0	0.16351	0.13049	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				2,185,960	0			2,940	0					$465,667			$401,241	$64,426
													NPV =	$309,045			$357,395	(48,350)

Total NPV = ($48,350)
Benefit/Cost Ratio = 0.86

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 2 - New**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$1,297	$6,217	$7,514	$63,907	$43,700	$107,607	($100,093)
2012	2,981	14,264	17,245	77,173	52,440	129,613	(112,368)
2013	5,362	24,975	30,337	97,067	65,550	162,617	(132,280)
2014	5,618	25,974	31,592	0	0	0	31,592
2015	6,189	27,013	33,202	0	0	0	33,202
2016	6,243	28,092	34,335	0	0	0	34,335
2017	6,563	29,217	35,780	0	0	0	35,780
2018	7,134	30,385	37,519	0	0	0	37,519
2019	7,478	31,602	39,080	0	0	0	39,080
2020	8,003	32,865	40,868	0	0	0	40,868
2021	8,055	34,180	42,235	0	0	0	42,235
2022	8,112	35,547	43,659	0	0	0	43,659
2023	8,174	36,967	45,141	0	0	0	45,141
2024	8,241	38,446	46,687	0	0	0	46,687
2025	6,067	29,220	35,287	0	0	0	35,287
2026	3,402	16,882	20,284	0	0	0	20,284
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$540,765			$399,837	$140,928
		NPV =	$271,056			$361,209	(90,153)

Total NPV = ($90,153)
Benefit/Cost Ratio = 0.75

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Window AC Units**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$98	$180	$294
Incentive Costs =	1,500	2,500	3,750
Total Utility Project Costs =	$1,598	$2,680	$4,044
14) Direct Participant Costs ($/Part.) =	$75	$75	$75
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	9	9	9
16) Avg Summer kW/part. Saved =	0.108	0.108	0.108
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	76	76	76
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	30	50	75
20) Incentive/Participant =	$50	$50	$50
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	2,280	3,800	5,700
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	3	5	8
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$6,326	1.68
Utility Cost Test	$8,216	2.11
Societal Test	$16,089	2.39
Participant Test	$2,158	1.20
Total Resource Cost Test	$4,765	1.44

Table 1
Ratepayer Impact Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,450	$0.02860	$70	$0.00000	$0	4	0	4	$98.68	$395	$465	$0.04223	2,280	0	2,280	$58	$98	$1,500	$1,656	($1,191)
2	2012	6,534	0.02988	195	0.00000	0	10	0	10	102.62	1,026	1,221	0.04307	6,080	0	6,080	159	180	2,500	2,839	(1,618)
3	2013	12,661	0.03195	405	0.00000	0	19	0	19	106.73	2,028	2,433	0.04393	11,780	0	11,780	314	294	3,750	4,358	(1,925)
4	2014	12,661	0.03348	424	0.00000	0	19	0	19	111.00	2,109	2,533	0.04481	11,780	0	11,780	320	0	0	320	2,213
5	2015	12,661	0.03688	467	0.00000	0	19	0	19	115.44	2,193	2,660	0.04571	11,780	0	11,780	326	0	0	326	2,334
6	2016	12,661	0.03720	471	0.00000	0	19	0	19	120.05	2,281	2,752	0.04662	11,780	0	11,780	333	0	0	333	2,419
7	2017	12,661	0.03911	495	0.00000	0	19	0	19	124.86	2,372	2,867	0.04756	11,780	0	11,780	340	0	0	340	2,527
8	2018	12,661	0.04251	538	0.00000	0	19	0	19	129.85	2,467	3,005	0.04851	11,780	0	11,780	346	0	0	346	2,659
9	2019	12,661	0.04456	564	0.00000	0	19	0	19	135.05	2,566	3,130	0.04948	11,780	0	11,780	353	0	0	353	2,777
10	2020	10,210	0.04769	487	0.00000	0	15	0	15	140.45	2,107	2,594	0.05047	9,500	0	9,500	291	0	0	291	2,303
11	2021	6,126	0.04800	294	0.00000	0	9	0	9	146.07	1,315	1,609	0.05148	5,700	0	5,700	178	0	0	178	1,431
12	2022	0	0.04834	0	0.00000	0	0	0	0	151.91	0	0	0.05251	0	0	0	0	0	0	0	0
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.05356	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.05463	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.05572	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.05683	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05797	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0
Total =		113,947							171			$25,269				106,020				$11,340	$13,929
											NPV =	$15,625								$9,299	6,326

Total NPV = $6,326
Benefit/Cost Ratio = 1.68

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$70	$0	$395	$465	$1,598	$1,598	($1,133)
2012	195	0	1,026	1,221	2,680	2,680	(1,459)
2013	405	0	2,028	2,433	4,044	4,044	(1,611)
2014	424	0	2,109	2,533	0	0	2,533
2015	467	0	2,193	2,660	0	0	2,660
2016	471	0	2,281	2,752	0	0	2,752
2017	495	0	2,372	2,867	0	0	2,867
2018	538	0	2,467	3,005	0	0	3,005
2019	564	0	2,566	3,130	0	0	3,130
2020	487	0	2,107	2,594	0	0	2,594
2021	294	0	1,315	1,609	0	0	1,609
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$25,269		$8,322	$16,947
			NPV =	$15,625		$7,409	8,216

Total NPV = $8,216
Benefit/Cost Ratio = 2.11

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$70	$0	$395	$147	$612	$1,598	$750	$2,348	($1,736)
2012	195	0	1,026	398	1,619	2,680	1,250	3,930	(2,311)
2013	405	0	2,028	816	3,249	4,044	1,875	5,919	(2,670)
2014	424	0	2,109	875	3,408	0	0	0	3,408
2015	467	0	2,193	947	3,607	0	0	0	3,607
2016	471	0	2,281	1,009	3,761	0	0	0	3,761
2017	495	0	2,372	1,082	3,949	0	0	0	3,949
2018	538	0	2,467	1,169	4,174	0	0	0	4,174
2019	564	0	2,566	1,254	4,384	0	0	0	4,384
2020	487	0	2,107	1,070	3,664	0	0	0	3,664
2021	294	0	1,315	684	2,293	0	0	0	2,293
2022	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$34,720			$12,197	$22,523
				NPV =	$27,654			$11,565	16,089

Total NPV = $16,089
Benefit/Cost Ratio = 2.39

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,500	$0.07570	$0.06041	2,280	0	2,280	$173	3	0	$0.000	$0.000	$0	$0	$1,673	$2,297	$0	$2,297	($624)
2012	2,500	0.07943	0.06339	6,080	0	6,080	483	9	0	0.000	0.000	0	0	2,983	3,910	0	3,910	(927)
2013	3,750	0.08335	0.06651	11,780	0	11,780	982	17	0	0.000	0.000	0	0	4,732	5,989	0	5,989	(1,257)
2014	0	0.08746	0.06979	11,780	0	11,780	1,030	17	0	0.000	0.000	0	0	1,030	0	0	0	1,030
2015	0	0.09177	0.07323	11,780	0	11,780	1,081	17	0	0.000	0.000	0	0	1,081	0	0	0	1,081
2016	0	0.09629	0.07685	11,780	0	11,780	1,134	17	0	0.000	0.000	0	0	1,134	0	0	0	1,134
2017	0	0.10104	0.08063	11,780	0	11,780	1,190	17	0	0.000	0.000	0	0	1,190	0	0	0	1,190
2018	0	0.10602	0.08461	11,780	0	11,780	1,249	17	0	0.000	0.000	0	0	1,249	0	0	0	1,249
2019	0	0.11125	0.08878	11,780	0	11,780	1,311	17	0	0.000	0.000	0	0	1,311	0	0	0	1,311
2020	0	0.11674	0.09316	9,500	0	9,500	1,109	14	0	0.000	0.000	0	0	1,109	0	0	0	1,109
2021	0	0.12249	0.09775	5,700	0	5,700	698	8	0	0.000	0.000	0	0	698	0	0	0	698
2022	0	0.12854	0.10258	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.13487	0.10763	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.14152	0.11294	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.14850	0.11851	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.15582	0.12435	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.16351	0.13049	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				106,020	0			153	0					$18,190			$12,196	$5,994
													NPV =	$12,846			$10,687	2,158

Total NPV = $2,158
Benefit/Cost Ratio = 1.20

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Window AC Units**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$70	$395	$465	$1,598	$750	$2,348	($1,883)
2012	195	1,026	1,221	2,680	1,250	3,930	(2,709)
2013	405	2,028	2,433	4,044	1,875	5,919	(3,486)
2014	424	2,109	2,533	0	0	0	2,533
2015	467	2,193	2,660	0	0	0	2,660
2016	471	2,281	2,752	0	0	0	2,752
2017	495	2,372	2,867	0	0	0	2,867
2018	538	2,467	3,005	0	0	0	3,005
2019	564	2,566	3,130	0	0	0	3,130
2020	487	2,107	2,594	0	0	0	2,594
2021	294	1,315	1,609	0	0	0	1,609
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$25,269			$12,197	$13,072
		NPV =	$15,625			$10,860	4,765

Total NPV =	$4,765
Benefit/Cost Ratio =	1.44

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **AC Tune-up**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$147	$242	$353
Incentive Costs =	2,250	3,375	4,500
Total Utility Project Costs =	$2,397	$3,617	$4,853
14) Direct Participant Costs ($/Part.) =	$45	$45	$45
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	5	5	5
16) Avg Summer kW/part. Saved =	0.162	0.162	0.162
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	113	113	113
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	50	75	100
20) Incentive/Participant =	$45	$45	$45
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	5,650	8,475	11,300
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	8	12	16
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$8,289	1.67
Utility Cost Test	$10,888	2.12
Societal Test	$22,249	3.15
Participant Test	$7,662	1.82
Total Resource Cost Test	$10,888	2.12

Table 1
Ratepayer Impact Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	6,072	$0.02860	$174	$0.00000	$0	9	0	9	$98.68	$888	$1,062	$0.04223	5,650	0	5,650	$145	$147	$2,250	$2,542	($1,480)
2	2012	15,181	0.02988	454	0.00000	0	23	0	23	102.62	2,360	2,814	0.04307	14,125	0	14,125	369	242	3,375	3,986	(1,172)
3	2013	27,326	0.03195	873	0.00000	0	41	0	41	106.73	4,376	5,249	0.04393	25,425	0	25,425	677	353	4,500	5,530	(281)
4	2014	27,326	0.03348	915	0.00000	0	41	0	41	111.00	4,551	5,466	0.04481	25,425	0	25,425	691	0	0	691	4,775
5	2015	27,326	0.03688	1,008	0.00000	0	41	0	41	115.44	4,733	5,741	0.04571	25,425	0	25,425	704	0	0	704	5,037
6	2016	21,253	0.03720	791	0.00000	0	32	0	32	120.05	3,842	4,633	0.04662	19,775	0	19,775	559	0	0	559	4,074
7	2017	12,145	0.03911	475	0.00000	0	18	0	18	124.86	2,247	2,722	0.04756	11,300	0	11,300	326	0	0	326	2,396
8	2018	0	0.04251	0	0.00000	0	0	0	0	129.85	0	0	0.04851	0	0	0	0	0	0	0	0
9	2019	0	0.04456	0	0.00000	0	0	0	0	135.05	0	0	0.04948	0	0	0	0	0	0	0	0
10	2020	0	0.04769	0	0.00000	0	0	0	0	140.45	0	0	0.05047	0	0	0	0	0	0	0	0
11	2021	0	0.04800	0	0.00000	0	0	0	0	146.07	0	0	0.05148	0	0	0	0	0	0	0	0
12	2022	0	0.04834	0	0.00000	0	0	0	0	151.91	0	0	0.05251	0	0	0	0	0	0	0	0
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.05356	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.05463	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.05572	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.05683	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05797	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0
Total =		136,629							205			$27,687				127,125				$14,338	$13,349
											NPV =	$20,624								$12,335	8,289

Total NPV = $8,289
Benefit/Cost Ratio = 1.67

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$174	$0	$888	$1,062	$2,397	$2,397	($1,335)
2012	454	0	2,360	2,814	3,617	3,617	(803)
2013	873	0	4,376	5,249	4,853	4,853	396
2014	915	0	4,551	5,466	0	0	5,466
2015	1,008	0	4,733	5,741	0	0	5,741
2016	791	0	3,842	4,633	0	0	4,633
2017	475	0	2,247	2,722	0	0	2,722
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$27,687		$10,867	$16,820
			NPV =	$20,624		$9,736	10,888

Total NPV =	$10,888
Benefit/Cost Ratio =	2.12

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$174	$0	$888	$336	$1,398	$2,397	$0	$2,397	($999)
2012	454	0	2,360	917	3,731	3,617	0	3,617	114
2013	873	0	4,376	1,761	7,010	4,853	0	4,853	2,157
2014	915	0	4,551	1,889	7,355	0	0	0	7,355
2015	1,008	0	4,733	2,043	7,784	0	0	0	7,784
2016	791	0	3,842	1,698	6,331	0	0	0	6,331
2017	475	0	2,247	1,028	3,750	0	0	0	3,750
2018	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$37,359			$10,867	$26,492
				NPV =	$32,582			$10,333	22,249

Total NPV = $22,249
Benefit/Cost Ratio = 3.15

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$2,250	$0.07570	$0.06041	5,650	0	5,650	$428	8	0	$0.000	$0.000	$0	$0	$2,678	$2,297	$0	$2,297	$381
2012	3,375	0.07943	0.06339	14,125	0	14,125	1,122	20	0	0.000	0.000	0	0	4,497	3,519	0	3,519	978
2013	4,500	0.08335	0.06651	25,425	0	25,425	2,119	36	0	0.000	0.000	0	0	6,619	4,791	0	4,791	1,828
2014	0	0.08746	0.06979	25,425	0	25,425	2,224	36	0	0.000	0.000	0	0	2,224	0	0	0	2,224
2015	0	0.09177	0.07323	25,425	0	25,425	2,333	36	0	0.000	0.000	0	0	2,333	0	0	0	2,333
2016	0	0.09629	0.07685	19,775	0	19,775	1,904	28	0	0.000	0.000	0	0	1,904	0	0	0	1,904
2017	0	0.10104	0.08063	11,300	0	11,300	1,142	16	0	0.000	0.000	0	0	1,142	0	0	0	1,142
2018	0	0.10602	0.08461	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2019	0	0.11125	0.08878	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2020	0	0.11674	0.09316	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2021	0	0.12249	0.09775	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2022	0	0.12854	0.10258	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.13487	0.10763	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.14152	0.11294	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.14850	0.11851	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.15582	0.12435	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.16351	0.13049	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				127,125	0			180	0					$21,397			$10,607	$10,790
													NPV =	$17,024			$9,362	7,662

Total NPV = $7,662
Benefit/Cost Ratio = 1.82

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **AC Tune-up**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$174	$888	$1,062	$2,397	$0	$2,397	($1,335)
2012	454	2,360	2,814	3,617	0	3,617	(803)
2013	873	4,376	5,249	4,853	0	4,853	396
2014	915	4,551	5,466	0	0	0	5,466
2015	1,008	4,733	5,741	0	0	0	5,741
2016	791	3,842	4,633	0	0	0	4,633
2017	475	2,247	2,722	0	0	0	2,722
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$27,687			$10,867	$16,820
		NPV =	$20,624			$9,736	10,888

Total NPV =	$10,888
Benefit/Cost Ratio =	2.12

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **New Construction Bundle**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$2,930	$4,849	$7,067
Incentive Costs =	45,000	67,500	90,000
Total Utility Project Costs =	$47,930	$72,349	$97,067
14) Direct Participant Costs ($/Part.) =	$1,337	$1,337	$1,337
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.630	0.630	0.630
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	485	485	485
17a) Avg. Winter kWh/Part. Saved =	504	504	504
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	50	75	100
20) Incentive/Participant =	$900	$900	$900
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	24,250	36,375	48,500
Annual Winter Kwh Saved	25,200	37,800	50,400
23) Annual Summer KW Saved	32	47	63
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	($23,307)	0.90
Utility Cost Test	$24,465	1.13
Societal Test	$141,826	1.47
Participant Test	$42,054	1.15
Total Resource Cost Test	($63,660)	0.77

Table 1
Ratepayer Impact Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	53,147	$0.02860	$1,520	$0.00000	$0	35	0	35	$98.68	$3,454	$4,974	$0.04223	24,250	25,200	49,450	$1,266	$2,930	$45,000	$49,196	($44,222)
2	2012	132,866	0.02988	3,970	0.00000	0	88	0	88	102.62	9,031	13,001	0.04307	60,625	63,000	123,625	3,227	4,849	67,500	75,576	(62,575)
3	2013	239,159	0.03195	7,641	0.00000	0	158	0	158	106.73	16,863	24,504	0.04393	109,125	113,400	222,525	5,925	7,067	90,000	102,992	(78,488)
4	2014	239,159	0.03348	8,007	0.00000	0	158	0	158	111.00	17,538	25,545	0.04481	109,125	113,400	222,525	6,044	0	0	6,044	19,501
5	2015	239,159	0.03688	8,820	0.00000	0	158	0	158	115.44	18,240	27,060	0.04571	109,125	113,400	222,525	6,165	0	0	6,165	20,895
6	2016	239,159	0.03720	8,897	0.00000	0	158	0	158	120.05	18,968	27,865	0.04662	109,125	113,400	222,525	6,288	0	0	6,288	21,577
7	2017	239,159	0.03911	9,354	0.00000	0	158	0	158	124.86	19,728	29,082	0.04756	109,125	113,400	222,525	6,415	0	0	6,415	22,667
8	2018	239,159	0.04251	10,167	0.00000	0	158	0	158	129.85	20,516	30,683	0.04851	109,125	113,400	222,525	6,543	0	0	6,543	24,140
9	2019	239,159	0.04456	10,657	0.00000	0	158	0	158	135.05	21,338	31,995	0.04948	109,125	113,400	222,525	6,674	0	0	6,674	25,321
10	2020	239,159	0.04769	11,405	0.00000	0	158	0	158	140.45	22,191	33,596	0.05047	109,125	113,400	222,525	6,807	0	0	6,807	26,789
11	2021	239,159	0.04800	11,480	0.00000	0	158	0	158	146.07	23,079	34,559	0.05148	109,125	113,400	222,525	6,944	0	0	6,944	27,615
12	2022	239,159	0.04834	11,561	0.00000	0	158	0	158	151.91	24,002	35,563	0.05251	109,125	113,400	222,525	7,082	0	0	7,082	28,481
13	2023	239,159	0.04871	11,649	0.00000	0	158	0	158	157.98	24,961	36,610	0.05356	109,125	113,400	222,525	7,224	0	0	7,224	29,386
14	2024	239,159	0.04911	11,745	0.00000	0	158	0	158	164.30	25,959	37,704	0.05463	109,125	113,400	222,525	7,368	0	0	7,368	30,336
15	2025	186,012	0.04954	9,215	0.00000	0	123	0	123	170.88	21,018	30,233	0.05572	84,875	88,200	173,075	5,845	0	0	5,845	24,388
16	2026	106,292	0.05000	5,315	0.00000	0	70	0	70	177.71	12,440	17,755	0.05683	48,500	50,400	98,900	3,407	0	0	3,407	14,348
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05797	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0
Total =		3,348,225							2,212			$440,729				3,115,350				$310,570	$130,159
											NPV =	$219,193								$242,500	(23,307)

Total NPV = ($23,307)
Benefit/Cost Ratio = 0.90

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$1,520	$0	$3,454	$4,974	$47,930	$47,930	($42,956)
2012	3,970	0	9,031	13,001	72,349	72,349	(59,348)
2013	7,641	0	16,863	24,504	97,067	97,067	(72,563)
2014	8,007	0	17,538	25,545	0	0	25,545
2015	8,820	0	18,240	27,060	0	0	27,060
2016	8,897	0	18,968	27,865	0	0	27,865
2017	9,354	0	19,728	29,082	0	0	29,082
2018	10,167	0	20,516	30,683	0	0	30,683
2019	10,657	0	21,338	31,995	0	0	31,995
2020	11,405	0	22,191	33,596	0	0	33,596
2021	11,480	0	23,079	34,559	0	0	34,559
2022	11,561	0	24,002	35,563	0	0	35,563
2023	11,649	0	24,961	36,610	0	0	36,610
2024	11,745	0	25,959	37,704	0	0	37,704
2025	9,215	0	21,018	30,233	0	0	30,233
2026	5,315	0	12,440	17,755	0	0	17,755
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$440,729		$217,346	$223,383
			NPV =	$219,193		$194,728	24,465

Total NPV =	$24,465
Benefit/Cost Ratio =	1.13

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$1,520	$0	$3,454	$1,573	$6,547	$47,930	$21,850	$69,780	($63,233)
2012	3,970	0	9,031	4,234	17,235	72,349	32,775	105,124	(87,889)
2013	7,641	0	16,863	8,220	32,724	97,067	43,700	140,767	(108,043)
2014	8,007	0	17,538	8,827	34,372	0	0	0	34,372
2015	8,820	0	18,240	9,631	36,691	0	0	0	36,691
2016	8,897	0	18,968	10,215	38,080	0	0	0	38,080
2017	9,354	0	19,728	10,981	40,063	0	0	0	40,063
2018	10,167	0	20,516	11,933	42,616	0	0	0	42,616
2019	10,657	0	21,338	12,816	44,811	0	0	0	44,811
2020	11,405	0	22,191	13,861	47,457	0	0	0	47,457
2021	11,480	0	23,079	14,686	49,245	0	0	0	49,245
2022	11,561	0	24,002	15,566	51,129	0	0	0	51,129
2023	11,649	0	24,961	16,505	53,115	0	0	0	53,115
2024	11,745	0	25,959	17,508	55,212	0	0	0	55,212
2025	9,215	0	21,018	14,460	44,693	0	0	0	44,693
2026	5,315	0	12,440	8,747	26,502	0	0	0	26,502
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$620,492			$315,671	$304,821
				NPV =	$442,002			$300,176	141,826

Total NPV = $141,826
Benefit/Cost Ratio = 1.47

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$45,000	$0.07570	$0.06041	24,250	25,200	49,450	$3,358	32	0	$0.000	$0.000	$0	$0	$48,358	$68,261	$0	$68,261	($19,903)
2012	67,500	0.07943	0.06339	60,625	63,000	123,625	8,809	79	0	0.000	0.000	0	0	76,309	104,551	0	104,551	(28,242)
2013	90,000	0.08335	0.06651	109,125	113,400	222,525	16,638	142	0	0.000	0.000	0	0	106,638	142,343	0	142,343	(35,705)
2014	0	0.08746	0.06979	109,125	113,400	222,525	17,458	142	0	0.000	0.000	0	0	17,458	0	0	0	17,458
2015	0	0.09177	0.07323	109,125	113,400	222,525	18,319	142	0	0.000	0.000	0	0	18,319	0	0	0	18,319
2016	0	0.09629	0.07685	109,125	113,400	222,525	19,222	142	0	0.000	0.000	0	0	19,222	0	0	0	19,222
2017	0	0.10104	0.08063	109,125	113,400	222,525	20,169	142	0	0.000	0.000	0	0	20,169	0	0	0	20,169
2018	0	0.10602	0.08461	109,125	113,400	222,525	21,164	142	0	0.000	0.000	0	0	21,164	0	0	0	21,164
2019	0	0.11125	0.08878	109,125	113,400	222,525	22,208	142	0	0.000	0.000	0	0	22,208	0	0	0	22,208
2020	0	0.11674	0.09316	109,125	113,400	222,525	23,304	142	0	0.000	0.000	0	0	23,304	0	0	0	23,304
2021	0	0.12249	0.09775	109,125	113,400	222,525	24,452	142	0	0.000	0.000	0	0	24,452	0	0	0	24,452
2022	0	0.12854	0.10258	109,125	113,400	222,525	25,659	142	0	0.000	0.000	0	0	25,659	0	0	0	25,659
2023	0	0.13487	0.10763	109,125	113,400	222,525	26,923	142	0	0.000	0.000	0	0	26,923	0	0	0	26,923
2024	0	0.14152	0.11294	109,125	113,400	222,525	28,251	142	0	0.000	0.000	0	0	28,251	0	0	0	28,251
2025	0	0.14850	0.11851	84,875	88,200	173,075	23,057	110	0	0.000	0.000	0	0	23,057	0	0	0	23,057
2026	0	0.15582	0.12435	48,500	50,400	98,900	13,825	63	0	0.000	0.000	0	0	13,825	0	0	0	13,825
2027	0	0.16351	0.13049	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				1,527,750	1,587,600			1,988	0					$515,316			$315,155	$200,161
													NPV =	$320,210			$278,156	42,054

Total NPV = $42,054
Benefit/Cost Ratio = 1.15

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **New Construction Bundle**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$1,520	$3,454	$4,974	$47,930	$21,850	$69,780	($64,806)
2012	3,970	9,031	13,001	72,349	32,775	105,124	(92,123)
2013	7,641	16,863	24,504	97,067	43,700	140,767	(116,263)
2014	8,007	17,538	25,545	0	0	0	25,545
2015	8,820	18,240	27,060	0	0	0	27,060
2016	8,897	18,968	27,865	0	0	0	27,865
2017	9,354	19,728	29,082	0	0	0	29,082
2018	10,167	20,516	30,683	0	0	0	30,683
2019	10,657	21,338	31,995	0	0	0	31,995
2020	11,405	22,191	33,596	0	0	0	33,596
2021	11,480	23,079	34,559	0	0	0	34,559
2022	11,561	24,002	35,563	0	0	0	35,563
2023	11,649	24,961	36,610	0	0	0	36,610
2024	11,745	25,959	37,704	0	0	0	37,704
2025	9,215	21,018	30,233	0	0	0	30,233
2026	5,315	12,440	17,755	0	0	0	17,755
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$440,729			$315,671	$125,058
		NPV =	$219,193			$282,853	(63,660)

Total NPV =	($63,660)
Benefit/Cost Ratio =	0.77

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$1,500	$1,655	$2,714
Incentive Costs =	23,040	23,040	34,560
Total Utility Project Costs =	$24,540	$24,695	$37,274
14) Direct Participant Costs ($/Part.) =	$4,500	$4,500	$4,500
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.000	0.000	0.000
16a) Avg Winter kW/part Saved =	17.500	17.500	17.500
17) Avg. Summer kWh/Part. Saved =	0	0	0
17a) Avg. Winter kWh/Part. Saved =	4,742	4,742	4,742
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	10	10	15
20) Incentive/Participant =	$2,304	$2,304	$2,304
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	0	0
Annual Winter Kwh Saved	47,420	47,420	71,130
23) Annual Summer KW Saved	0	0	0
Annual Winter KW Saved	175	175	263

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$585,974	6.14
Utility Cost Test	$621,816	8.96
Societal Test	$1,248,523	9.01
Participant Test	$19,396	1.13
Total Resource Cost Test	$552,404	4.74

Table 1
Ratepayer Impact Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	50,965	$0.02860	$1,458	$0.00000	$0	0	195	195	$98.68	$19,243	$20,701	$0.04223	0	47,420	47,420	$1,214	$1,500	$23,040	$25,754	($5,053)
2	2012	101,929	0.02988	3,046	0.00000	0	0	391	391	102.62	40,124	43,170	0.04307	0	94,840	94,840	2,476	1,655	23,040	27,171	15,999
3	2013	178,376	0.03195	5,699	0.00000	0	0	684	684	106.73	73,003	78,702	0.04393	0	165,970	165,970	4,419	2,714	34,560	41,693	37,009
4	2014	178,376	0.03348	5,972	0.00000	0	0	684	684	111.00	75,924	81,896	0.04481	0	165,970	165,970	4,508	0	0	4,508	77,388
5	2015	178,376	0.03688	6,579	0.00000	0	0	684	684	115.44	78,961	85,540	0.04571	0	165,970	165,970	4,598	0	0	4,598	80,942
6	2016	178,376	0.03720	6,636	0.00000	0	0	684	684	120.05	82,114	88,750	0.04662	0	165,970	165,970	4,690	0	0	4,690	84,060
7	2017	178,376	0.03911	6,976	0.00000	0	0	684	684	124.86	85,404	92,380	0.04756	0	165,970	165,970	4,784	0	0	4,784	87,596
8	2018	178,376	0.04251	7,583	0.00000	0	0	684	684	129.85	88,817	96,400	0.04851	0	165,970	165,970	4,880	0	0	4,880	91,520
9	2019	178,376	0.04456	7,948	0.00000	0	0	684	684	135.05	92,374	100,322	0.04948	0	165,970	165,970	4,978	0	0	4,978	95,344
10	2020	178,376	0.04769	8,507	0.00000	0	0	684	684	140.45	96,068	104,575	0.05047	0	165,970	165,970	5,077	0	0	5,077	99,498
11	2021	178,376	0.04800	8,562	0.00000	0	0	684	684	146.07	99,912	108,474	0.05148	0	165,970	165,970	5,179	0	0	5,179	103,295
12	2022	178,376	0.04834	8,623	0.00000	0	0	684	684	151.91	103,906	112,529	0.05251	0	165,970	165,970	5,282	0	0	5,282	107,247
13	2023	178,376	0.04871	8,689	0.00000	0	0	684	684	157.98	108,058	116,747	0.05356	0	165,970	165,970	5,388	0	0	5,388	111,359
14	2024	178,376	0.04911	8,760	0.00000	0	0	684	684	164.30	112,381	121,141	0.05463	0	165,970	165,970	5,496	0	0	5,496	115,645
15	2025	127,412	0.04954	6,312	0.00000	0	0	488	488	170.88	83,389	89,701	0.05572	0	118,550	118,550	4,004	0	0	4,004	85,697
16	2026	76,447	0.05000	3,822	0.00000	0	0	293	293	177.71	52,069	55,891	0.05683	0	71,130	71,130	2,450	0	0	2,450	53,441
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05797	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0
Total =		2,497,265							9,575			$1,396,919				2,323,580				$155,932	$1,240,987
											NPV =	$699,910								$113,936	585,974

Total NPV = $585,974
Benefit/Cost Ratio = 6.14

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$1,458	$0	$19,243	$20,701	$24,540	$24,540	($3,839)
2012	3,046	0	40,124	43,170	24,695	24,695	18,475
2013	5,699	0	73,003	78,702	37,274	37,274	41,428
2014	5,972	0	75,924	81,896	0	0	81,896
2015	6,579	0	78,961	85,540	0	0	85,540
2016	6,636	0	82,114	88,750	0	0	88,750
2017	6,976	0	85,404	92,380	0	0	92,380
2018	7,583	0	88,817	96,400	0	0	96,400
2019	7,948	0	92,374	100,322	0	0	100,322
2020	8,507	0	96,068	104,575	0	0	104,575
2021	8,562	0	99,912	108,474	0	0	108,474
2022	8,623	0	103,906	112,529	0	0	112,529
2023	8,689	0	108,058	116,747	0	0	116,747
2024	8,760	0	112,381	121,141	0	0	121,141
2025	6,312	0	83,389	89,701	0	0	89,701
2026	3,822	0	52,069	55,891	0	0	55,891
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$1,396,919		$86,509	$1,310,410
			NPV =	$699,910		$78,094	621,816

Total NPV =	$621,816
Benefit/Cost Ratio =	8.96

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$1,458	$0	$19,243	$6,546	$27,247	$24,540	$21,960	$46,500	($19,253)
2012	3,046	0	40,124	14,060	57,230	24,695	21,960	46,655	10,575
2013	5,699	0	73,003	26,402	105,104	37,274	32,940	70,214	34,890
2014	5,972	0	75,924	28,298	110,194	0	0	0	110,194
2015	6,579	0	78,961	30,443	115,983	0	0	0	115,983
2016	6,636	0	82,114	32,533	121,283	0	0	0	121,283
2017	6,976	0	85,404	34,880	127,260	0	0	0	127,260
2018	7,583	0	88,817	37,490	133,890	0	0	0	133,890
2019	7,948	0	92,374	40,186	140,508	0	0	0	140,508
2020	8,507	0	96,068	43,146	147,721	0	0	0	147,721
2021	8,562	0	99,912	46,097	154,571	0	0	0	154,571
2022	8,623	0	103,906	49,255	161,784	0	0	0	161,784
2023	8,689	0	108,058	52,634	169,381	0	0	0	169,381
2024	8,760	0	112,381	56,254	177,395	0	0	0	177,395
2025	6,312	0	83,389	42,904	132,605	0	0	0	132,605
2026	3,822	0	52,069	27,534	83,425	0	0	0	83,425
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$1,965,581			$163,369	$1,802,212
				NPV =	$1,404,398			$155,875	1,248,523

Total NPV =	$1,248,523
Benefit/Cost Ratio =	9.01

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Thermal Storage with ASHP**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$23,040	$0.07570	$0.06041	0	47,420	47,420	$2,865	0	175	$0.000	$0.000	$0	$0	$25,905	$45,950	$0	$45,950	($20,045)
2012	23,040	0.07943	0.06339	0	94,840	94,840	6,012	0	350	0.000	0.000	0	0	29,052	46,919	0	46,919	(17,867)
2013	34,560	0.08335	0.06651	0	165,970	165,970	11,039	0	613	0.000	0.000	0	0	45,599	71,864	0	71,864	(26,265)
2014	0	0.08746	0.06979	0	165,970	165,970	11,583	0	613	0.000	0.000	0	0	11,583	0	0	0	11,583
2015	0	0.09177	0.07323	0	165,970	165,970	12,154	0	613	0.000	0.000	0	0	12,154	0	0	0	12,154
2016	0	0.09629	0.07685	0	165,970	165,970	12,755	0	613	0.000	0.000	0	0	12,755	0	0	0	12,755
2017	0	0.10104	0.08063	0	165,970	165,970	13,382	0	613	0.000	0.000	0	0	13,382	0	0	0	13,382
2018	0	0.10602	0.08461	0	165,970	165,970	14,043	0	613	0.000	0.000	0	0	14,043	0	0	0	14,043
2019	0	0.11125	0.08878	0	165,970	165,970	14,735	0	613	0.000	0.000	0	0	14,735	0	0	0	14,735
2020	0	0.11674	0.09316	0	165,970	165,970	15,462	0	613	0.000	0.000	0	0	15,462	0	0	0	15,462
2021	0	0.12249	0.09775	0	165,970	165,970	16,224	0	613	0.000	0.000	0	0	16,224	0	0	0	16,224
2022	0	0.12854	0.10258	0	165,970	165,970	17,025	0	613	0.000	0.000	0	0	17,025	0	0	0	17,025
2023	0	0.13487	0.10763	0	165,970	165,970	17,863	0	613	0.000	0.000	0	0	17,863	0	0	0	17,863
2024	0	0.14152	0.11294	0	165,970	165,970	18,745	0	613	0.000	0.000	0	0	18,745	0	0	0	18,745
2025	0	0.14850	0.11851	0	118,550	118,550	14,049	0	438	0.000	0.000	0	0	14,049	0	0	0	14,049
2026	0	0.15582	0.12435	0	71,130	71,130	8,845	0	263	0.000	0.000	0	0	8,845	0	0	0	8,845
2027	0	0.16351	0.13049	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				0	2,323,580			0	8,582					$287,421			$164,733	$122,688
													NPV =	$166,028			$146,632	19,396

Total NPV = $19,396
Benefit/Cost Ratio = 1.13

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Thermal Storage with ASHP**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$1,458	$19,243	$20,701	$24,540	$21,960	$46,500	($25,799)
2012	3,046	40,124	43,170	24,695	21,960	46,655	(3,485)
2013	5,699	73,003	78,702	37,274	32,940	70,214	8,488
2014	5,972	75,924	81,896	0	0	0	81,896
2015	6,579	78,961	85,540	0	0	0	85,540
2016	6,636	82,114	88,750	0	0	0	88,750
2017	6,976	85,404	92,380	0	0	0	92,380
2018	7,583	88,817	96,400	0	0	0	96,400
2019	7,948	92,374	100,322	0	0	0	100,322
2020	8,507	96,068	104,575	0	0	0	104,575
2021	8,562	99,912	108,474	0	0	0	108,474
2022	8,623	103,906	112,529	0	0	0	112,529
2023	8,689	108,058	116,747	0	0	0	116,747
2024	8,760	112,381	121,141	0	0	0	121,141
2025	6,312	83,389	89,701	0	0	0	89,701
2026	3,822	52,069	55,891	0	0	0	55,891
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$1,396,919			$163,369	$1,233,550
		NPV =	$699,910			$147,506	552,404

Total NPV = $552,404
Benefit/Cost Ratio = 4.74

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.07214
Retail Rate Winter ($/kWh) =	$0.05757
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.04140
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$0	$0	$11,778
Incentive Costs =	0	0	150,000
Direct Program Costs =	0	0	1,494,000
Total Utility Project Costs =	$0	$0	$1,655,778
14) Direct Participant Costs ($/Part.) =	$0	$0	$0
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	1.000	1.000	1.000
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	0	0	0
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	0	0	3,000
20) Incentive/Participant =	$50	$50	$50
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	0	0
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	0	3,000
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$778,968	1.33
Utility Cost Test	$778,968	1.33
Societal Test	$5,347,703	4.50
Participant Test	$975,494	#DIV/0!
Total Resource Cost Test	$1,827,038	2.36

Table 1
Ratepayer Impact Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Direct Program Costs (O)	Costs: Total Project Costs (P)	Annual Benefits Less Costs (Q)
1	2011	0	$0.02860	$0	$0.00000	$0	0	0	0	$98.68	$0	$0	$0.04223	0	0	0	$0	$0	$0	$0	$0	$0
2	2012	0	$0.02988	0	0.00000	0	0	0	0	102.62	0	0	0.04307	0	0	0	0	0	0	0	0	0
3	2013	0	$0.03195	0	0.00000	0	3,350	0	3,350	106.73	357,546	357,546	0.04393	0	0	0	0	11,778	150,000	1,494,000	1,655,778	(1,298,232)
4	2014	0	$0.03348	0	0.00000	0	3,350	0	3,350	111.00	371,850	371,850	0.04481	0	0	0	0	11,778	150,000	0	161,778	210,072
5	2015	0	$0.03688	0	0.00000	0	3,350	0	3,350	115.44	386,724	386,724	0.04571	0	0	0	0	11,778	150,000	0	161,778	224,946
6	2016	0	$0.03720	0	0.00000	0	3,350	0	3,350	120.05	402,168	402,168	0.04662	0	0	0	0	11,778	150,000	0	161,778	240,390
7	2017	0	$0.03911	0	0.00000	0	3,350	0	3,350	124.86	418,281	418,281	0.04756	0	0	0	0	11,778	150,000	0	161,778	256,503
8	2018	0	$0.04251	0	0.00000	0	3,350	0	3,350	129.85	434,998	434,998	0.04851	0	0	0	0	11,778	150,000	0	161,778	273,220
9	2019	0	$0.04456	0	0.00000	0	3,350	0	3,350	135.05	452,418	452,418	0.04948	0	0	0	0	11,778	150,000	0	161,778	290,640
10	2020	0	$0.04769	0	0.00000	0	3,350	0	3,350	140.45	470,508	470,508	0.05047	0	0	0	0	11,778	150,000	0	161,778	308,730
11	2021	0	$0.04800	0	0.00000	0	3,350	0	3,350	146.07	489,335	489,335	0.05148	0	0	0	0	11,778	150,000	0	161,778	327,557
12	2022	0	$0.04834	0	0.00000	0	3,350	0	3,350	151.91	508,899	508,899	0.05251	0	0	0	0	11,778	150,000	0	161,778	347,121
13	2023	0	$0.04871	0	0.00000	0	3,350	0	3,350	157.98	529,233	529,233	0.05356	0	0	0	0	11,778	150,000	0	161,778	367,455
14	2024	0	$0.04911	0	0.00000	0	3,350	0	3,350	164.30	550,405	550,405	0.05463	0	0	0	0	11,778	150,000	0	161,778	388,627
15	2025	0	$0.04954	0	0.00000	0	3,350	0	3,350	170.88	572,448	572,448	0.05572	0	0	0	0	11,778	150,000	0	161,778	410,670
16	2026	0	$0.05000	0	0.00000	0	3,350	0	3,350	177.71	595,329	595,329	0.05683	0	0	0	0	11,778	150,000	0	161,778	433,551
17	2027	0	$0.05050	0	0.00000	0	3,350	0	3,350	184.82	619,147	619,147	0.05797	0	0	0	0	11,778	150,000	0	161,778	457,369
18	2028	0	$0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05913	0	0	0	0	0	0	0	0	0
19	2029	0	$0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.06031	0	0	0	0	0	0	0	0	0
20	2030	0	$0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.06152	0	0	0	0	0	0	0	0	0
Total =		0							50,250			$7,159,289				0					$3,920,670	$3,238,619
											NPV =	$3,170,533									$2,391,565	778,968

Total NPV = $778,968
Benefit/Cost Ratio = 1.33

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0
2013	0	0	357,546	357,546	1,655,778	1,655,778	(1,298,232)
2014	0	0	371,850	371,850	161,778	161,778	210,072
2015	0	0	386,724	386,724	161,778	161,778	224,946
2016	0	0	402,168	402,168	161,778	161,778	240,390
2017	0	0	418,281	418,281	161,778	161,778	256,503
2018	0	0	434,998	434,998	161,778	161,778	273,220
2019	0	0	452,418	452,418	161,778	161,778	290,640
2020	0	0	470,508	470,508	161,778	161,778	308,730
2021	0	0	489,335	489,335	161,778	161,778	327,557
2022	0	0	508,899	508,899	161,778	161,778	347,121
2023	0	0	529,233	529,233	161,778	161,778	367,455
2024	0	0	550,405	550,405	161,778	161,778	388,627
2025	0	0	572,448	572,448	161,778	161,778	410,670
2026	0	0	595,329	595,329	161,778	161,778	433,551
2027	0	0	619,147	619,147	161,778	161,778	457,369
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$7,159,289		$3,920,670	$3,238,619
			NPV =	$3,170,533		$2,391,565	778,968

Total NPV =	$778,968
Benefit/Cost Ratio =	1.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits					Costs			
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Annual Benefits Less Costs (I)
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0	0	0
2013	0	0	357,546	119,945	477,491	1,655,778	(150,000)	1,505,778	(1,028,287)
2014	0	0	371,850	128,486	500,336	161,778	(150,000)	11,778	488,558
2015	0	0	386,724	137,634	524,358	161,778	(150,000)	11,778	512,580
2016	0	0	402,168	147,424	549,592	161,778	(150,000)	11,778	537,814
2017	0	0	418,281	157,931	576,212	161,778	(150,000)	11,778	564,434
2018	0	0	434,998	169,170	604,168	161,778	(150,000)	11,778	592,390
2019	0	0	452,418	181,223	633,641	161,778	(150,000)	11,778	621,863
2020	0	0	470,508	194,123	664,631	161,778	(150,000)	11,778	652,853
2021	0	0	489,335	207,948	697,283	161,778	(150,000)	11,778	685,505
2022	0	0	508,899	222,749	731,648	161,778	(105,000)	56,778	674,870
2023	0	0	529,233	238,599	767,832	161,778	(150,000)	11,778	756,054
2024	0	0	550,405	255,589	805,994	161,778	(150,000)	11,778	794,216
2025	0	0	572,448	273,800	846,248	161,778	(150,000)	11,778	834,470
2026	0	0	595,329	293,286	888,615	161,778	(150,000)	11,778	876,837
2027	0	0	619,147	314,170	933,317	161,778	(150,000)	11,778	921,539
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$10,201,366			$1,715,670	$8,485,696
				NPV =	$6,874,680			$1,526,977	5,347,703

Total NPV =	$5,347,703
Benefit/Cost Ratio =	4.50

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits													Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$0	$0.07570	$0.06041	0	0	0	$0	0	0	$0.000	$0.000	$0	$0	$0	$0	$0	$0	$0
2012	0	0.07943	0.06339	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2013	150,000	0.08335	0.06651	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2014	150,000	0.08746	0.06979	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2015	150,000	0.09177	0.07323	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2016	150,000	0.09629	0.07685	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2017	150,000	0.10104	0.08063	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2018	150,000	0.10602	0.08461	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2019	150,000	0.11125	0.08878	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2020	150,000	0.11674	0.09316	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2021	150,000	0.12249	0.09775	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2022	150,000	0.12854	0.10258	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2023	150,000	0.13487	0.10763	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2024	150,000	0.14152	0.11294	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2025	150,000	0.14850	0.11851	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2026	150,000	0.15582	0.12435	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2027	150,000	0.16351	0.13049	0	0	0	0	3,000	0	0.000	0.000	0	0	150,000	0	0	0	150,000
2028	0	0.17157	0.13692	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.18003	0.14367	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.18891	0.15076	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				0	0			45,000	0					$2,250,000			$0	$2,250,000
													NPV =	$975,494			$0	975,494

Total NPV = $975,494
Benefit/Cost Ratio = #DIV/0!

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Residential AC Cycling**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0
2013	0	357,546	357,546	1,655,778	(150,000)	1,505,778	(1,148,232)
2014	0	371,850	371,850	161,778	(150,000)	11,778	360,072
2015	0	386,724	386,724	161,778	(150,000)	11,778	374,946
2016	0	402,168	402,168	161,778	(150,000)	11,778	390,390
2017	0	418,281	418,281	161,778	(150,000)	11,778	406,503
2018	0	434,998	434,998	161,778	(150,000)	11,778	423,220
2019	0	452,418	452,418	161,778	(150,000)	11,778	440,640
2020	0	470,508	470,508	161,778	(150,000)	11,778	458,730
2021	0	489,335	489,335	161,778	(150,000)	11,778	477,557
2022	0	508,899	508,899	161,778	(105,000)	56,778	452,121
2023	0	529,233	529,233	161,778	(150,000)	11,778	517,455
2024	0	550,405	550,405	161,778	(150,000)	11,778	538,627
2025	0	572,448	572,448	161,778	(150,000)	11,778	560,670
2026	0	595,329	595,329	161,778	(150,000)	11,778	583,551
2027	0	619,147	619,147	161,778	(150,000)	11,778	607,369
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$7,159,289			$1,715,670	$5,443,619
		NPV =	$3,170,533			$1,343,496	1,827,038

Total NPV =	$1,827,038
Benefit/Cost Ratio =	2.36

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical Lighting**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$2,891	$4,253	$5,811
Incentive Costs =	44,400	59,200	74,000
Total Utility Project Costs =	$47,291	$63,453	$79,811
14) Direct Participant Costs ($/Part.) =	$5,000	$5,000	$5,000
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	18	18	18
16) Avg Summer kW/part. Saved =	5.200	5.200	5.200
16a) Avg Winter kW/part Saved =	5.200	5.200	5.200
17) Avg. Summer kWh/Part. Saved =	6,167	6,167	6,167
17a) Avg. Winter kWh/Part. Saved =	12,333	12,333	12,333
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	15	20	25
20) Incentive/Participant =	$2,960	$2,960	$2,960
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	92,505	123,340	154,175
Annual Winter Kwh Saved	184,995	246,660	308,325
23) Annual Summer KW Saved	78	104	130
Annual Winter KW Saved	78	104	130

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$890,819	4.11
Utility Cost Test	$1,005,511	6.86
Societal Test	$2,316,638	8.77
Participant Test	$679,599	3.44
Total Resource Cost Test	$895,240	4.18

Table 1
Ratepayer Impact Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	298,243	$0.02860	$8,530	$0.00000	$0	87	87	174	$98.68	$17,170	$25,700	$0.01770	92,505	184,995	277,500	$2,977	$2,891	$44,400	$50,268	($24,568)
2	2012	695,900	0.02988	20,793	0.00000	0	203	203	406	102.62	41,664	62,457	0.01805	215,845	431,655	647,500	7,084	4,253	59,200	70,537	(8,080)
3	2013	1,192,973	0.03195	38,115	0.00000	0	348	348	696	106.73	74,284	112,399	0.01841	370,020	739,980	1,110,000	12,386	5,811	74,000	92,197	20,202
4	2014	1,192,973	0.03348	39,941	0.00000	0	348	348	696	111.00	77,256	117,197	0.01878	370,020	739,980	1,110,000	12,635	0	0	12,635	104,562
5	2015	1,192,973	0.03688	43,997	0.00000	0	348	348	696	115.44	80,346	124,343	0.01916	370,020	739,980	1,110,000	12,891	0	0	12,891	111,452
6	2016	1,192,973	0.03720	44,379	0.00000	0	348	348	696	120.05	83,555	127,934	0.01954	370,020	739,980	1,110,000	13,146	0	0	13,146	114,788
7	2017	1,192,973	0.03911	46,657	0.00000	0	348	348	696	124.86	86,903	133,560	0.01993	370,020	739,980	1,110,000	13,409	0	0	13,409	120,151
8	2018	1,192,973	0.04251	50,713	0.00000	0	348	348	696	129.85	90,376	141,089	0.02033	370,020	739,980	1,110,000	13,678	0	0	13,678	127,411
9	2019	1,192,973	0.04456	53,159	0.00000	0	348	348	696	135.05	93,995	147,154	0.02073	370,020	739,980	1,110,000	13,947	0	0	13,947	133,207
10	2020	1,192,973	0.04769	56,893	0.00000	0	348	348	696	140.45	97,753	154,646	0.02115	370,020	739,980	1,110,000	14,230	0	0	14,230	140,416
11	2021	1,192,973	0.04800	57,263	0.00000	0	348	348	696	146.07	101,665	158,928	0.02157	370,020	739,980	1,110,000	14,512	0	0	14,512	144,416
12	2022	1,192,973	0.04834	57,668	0.00000	0	348	348	696	151.91	105,729	163,397	0.02200	370,020	739,980	1,110,000	14,802	0	0	14,802	148,595
13	2023	1,192,973	0.04871	58,110	0.00000	0	348	348	696	157.98	109,954	168,064	0.02244	370,020	739,980	1,110,000	15,098	0	0	15,098	152,966
14	2024	1,192,973	0.04911	58,587	0.00000	0	348	348	696	164.30	114,353	172,940	0.02289	370,020	739,980	1,110,000	15,400	0	0	15,400	157,540
15	2025	1,192,973	0.04954	59,100	0.00000	0	348	348	696	170.88	118,932	178,032	0.02335	370,020	739,980	1,110,000	15,710	0	0	15,710	162,322
16	2026	1,192,973	0.05000	59,649	0.00000	0	348	348	696	177.71	123,686	183,335	0.02382	370,020	739,980	1,110,000	16,026	0	0	16,026	167,309
17	2027	1,192,973	0.05050	60,245	0.00000	0	348	348	696	184.82	128,635	188,880	0.02429	370,020	739,980	1,110,000	16,342	0	0	16,342	172,538
18	2028	1,192,973	0.05103	60,877	0.00000	0	348	348	696	192.21	133,778	194,655	0.02478	370,020	739,980	1,110,000	16,672	0	0	16,672	177,983
19	2029	894,729	0.05160	46,168	0.00000	0	261	261	522	199.90	104,348	150,516	0.02528	277,515	554,985	832,500	12,756	0	0	12,756	137,760
20	2030	497,072	0.05220	25,947	0.00000	0	145	145	290	207.90	60,291	86,238	0.02578	154,175	308,325	462,500	7,227	0	0	7,227	79,011
Total =		21,473,512							12,528			$2,791,464				19,980,000				$451,483	$2,339,981
											NPV =	$1,177,122								$286,303	890,819

Total NPV = $890,819
Benefit/Cost Ratio = 4.11

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$8,530	$0	$17,170	$25,700	$47,291	$47,291	($21,591)
2012	20,793	0	41,664	62,457	63,453	63,453	(996)
2013	38,115	0	74,284	112,399	79,811	79,811	32,588
2014	39,941	0	77,256	117,197	0	0	117,197
2015	43,997	0	80,346	124,343	0	0	124,343
2016	44,379	0	83,555	127,934	0	0	127,934
2017	46,657	0	86,903	133,560	0	0	133,560
2018	50,713	0	90,376	141,089	0	0	141,089
2019	53,159	0	93,995	147,154	0	0	147,154
2020	56,893	0	97,753	154,646	0	0	154,646
2021	57,263	0	101,665	158,928	0	0	158,928
2022	57,668	0	105,729	163,397	0	0	163,397
2023	58,110	0	109,954	168,064	0	0	168,064
2024	58,587	0	114,353	172,940	0	0	172,940
2025	59,100	0	118,932	178,032	0	0	178,032
2026	59,649	0	123,686	183,335	0	0	183,335
2027	60,245	0	128,635	188,880	0	0	188,880
2028	60,877	0	133,778	194,655	0	0	194,655
2029	46,168	0	104,348	150,516	0	0	150,516
2030	25,947	0	60,291	86,238	0	0	86,238
Total =				$2,791,464		$190,555	$2,600,909
			NPV =	$1,177,122		$171,611	1,005,511

Total NPV =	$1,005,511
Benefit/Cost Ratio =	6.86

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$8,530	$0	$17,170	$8,127	$33,827	$47,291	$30,600	$77,891	($44,064)
2012	20,793	0	41,664	20,342	82,799	63,453	40,800	104,253	(21,454)
2013	38,115	0	74,284	37,706	150,105	79,811	51,000	130,811	19,294
2014	39,941	0	77,256	40,495	157,692	0	0	0	157,692
2015	43,997	0	80,346	44,253	168,596	0	0	0	168,596
2016	44,379	0	83,555	46,897	174,831	0	0	0	174,831
2017	46,657	0	86,903	50,428	183,988	0	0	0	183,988
2018	50,713	0	90,376	54,869	195,958	0	0	0	195,958
2019	53,159	0	93,995	58,945	206,099	0	0	0	206,099
2020	56,893	0	97,753	63,804	218,450	0	0	0	218,450
2021	57,263	0	101,665	67,538	226,466	0	0	0	226,466
2022	57,668	0	105,729	71,520	234,917	0	0	0	234,917
2023	58,110	0	109,954	75,770	243,834	0	0	0	243,834
2024	58,587	0	114,353	80,307	253,247	0	0	0	253,247
2025	59,100	0	118,932	85,152	263,184	0	0	0	263,184
2026	59,649	0	123,686	90,319	273,654	0	0	0	273,654
2027	60,245	0	128,635	95,842	284,722	0	0	0	284,722
2028	60,877	0	133,778	101,736	296,391	0	0	0	296,391
2029	46,168	0	104,348	81,027	231,543	0	0	0	231,543
2030	25,947	0	60,291	47,817	134,055	0	0	0	134,055
Total =					$4,014,358			$312,955	$3,701,403
				NPV =	$2,614,927			$298,289	2,316,638

Total NPV = $2,316,638
Benefit/Cost Ratio = 8.77

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$44,400	$0.04273	$0.03902	92,505	184,995	277,500	$11,171	78	78	$45.900	$67.320	$8,831	$0	$64,402	$76,583	$0	$76,583	($12,181)
2012	59,200	0.04483	0.04095	215,845	431,655	647,500	27,353	182	182	46.818	68.666	21,018	0	107,571	104,265	0	104,265	3,306
2013	74,000	0.04705	0.04297	370,020	739,980	1,110,000	49,206	312	312	47.754	70.040	36,752	0	159,958	133,081	0	133,081	26,877
2014	0	0.04937	0.04509	370,020	739,980	1,110,000	51,634	312	312	48.709	71.441	37,487	0	89,121	0	0	0	89,121
2015	0	0.05180	0.04731	370,020	739,980	1,110,000	54,175	312	312	49.684	72.869	38,237	0	92,412	0	0	0	92,412
2016	0	0.05435	0.04964	370,020	739,980	1,110,000	56,843	312	312	50.677	74.327	39,001	0	95,844	0	0	0	95,844
2017	0	0.05703	0.05209	370,020	739,980	1,110,000	59,648	312	312	51.691	75.813	39,781	0	99,429	0	0	0	99,429
2018	0	0.05985	0.05466	370,020	739,980	1,110,000	62,593	312	312	52.725	77.330	40,577	0	103,170	0	0	0	103,170
2019	0	0.06280	0.05735	370,020	739,980	1,110,000	65,675	312	312	53.779	78.876	41,388	0	107,063	0	0	0	107,063
2020	0	0.06589	0.06018	370,020	739,980	1,110,000	68,913	312	312	54.855	80.454	42,216	0	111,129	0	0	0	111,129
2021	0	0.06914	0.06315	370,020	739,980	1,110,000	72,313	312	312	55.952	82.063	43,061	0	115,374	0	0	0	115,374
2022	0	0.07255	0.06626	370,020	739,980	1,110,000	75,876	312	312	57.071	83.704	43,922	0	119,798	0	0	0	119,798
2023	0	0.07613	0.06953	370,020	739,980	1,110,000	79,620	312	312	58.212	85.378	44,800	0	124,420	0	0	0	124,420
2024	0	0.07988	0.07296	370,020	739,980	1,110,000	83,546	312	312	59.377	87.086	45,696	0	129,242	0	0	0	129,242
2025	0	0.08382	0.07656	370,020	739,980	1,110,000	87,668	312	312	60.564	88.827	46,610	0	134,278	0	0	0	134,278
2026	0	0.08796	0.08033	370,020	739,980	1,110,000	91,990	312	312	61.775	90.604	47,542	0	139,532	0	0	0	139,532
2027	0	0.09229	0.08429	370,020	739,980	1,110,000	96,522	312	312	63.011	92.416	48,493	0	145,015	0	0	0	145,015
2028	0	0.09684	0.08845	370,020	739,980	1,110,000	101,284	312	312	64.271	94.264	49,463	0	150,747	0	0	0	150,747
2029	0	0.10162	0.09281	277,515	554,985	832,500	79,709	234	234	65.557	96.150	37,839	0	117,548	0	0	0	117,548
2030	0	0.10663	0.09739	154,175	308,325	462,500	46,467	130	130	66.868	98.073	21,442	0	67,909	0	0	0	67,909
Total =				6,660,360	13,319,640			5,616	5,616					$2,273,962			$313,929	$1,960,033
													NPV =	$958,294			$278,695	679,599

Total NPV = $679,599
Benefit/Cost Ratio = 3.44

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical Lighting**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$8,530	$17,170	$25,700	$47,291	$30,600	$77,891	($52,191)
2012	20,793	41,664	62,457	63,453	40,800	104,253	(41,796)
2013	38,115	74,284	112,399	79,811	51,000	130,811	(18,412)
2014	39,941	77,256	117,197	0	0	0	117,197
2015	43,997	80,346	124,343	0	0	0	124,343
2016	44,379	83,555	127,934	0	0	0	127,934
2017	46,657	86,903	133,560	0	0	0	133,560
2018	50,713	90,376	141,089	0	0	0	141,089
2019	53,159	93,995	147,154	0	0	0	147,154
2020	56,893	97,753	154,646	0	0	0	154,646
2021	57,263	101,665	158,928	0	0	0	158,928
2022	57,668	105,729	163,397	0	0	0	163,397
2023	58,110	109,954	168,064	0	0	0	168,064
2024	58,587	114,353	172,940	0	0	0	172,940
2025	59,100	118,932	178,032	0	0	0	178,032
2026	59,649	123,686	183,335	0	0	0	183,335
2027	60,245	128,635	188,880	0	0	0	188,880
2028	60,877	133,778	194,655	0	0	0	194,655
2029	46,168	104,348	150,516	0	0	0	150,516
2030	25,947	60,291	86,238	0	0	0	86,238
		Total =	$2,791,464			$312,955	$2,478,509
		NPV =	$1,177,122			$281,883	895,240

Total NPV = $895,240
Benefit/Cost Ratio = 4.18

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$244	$404	$589
Incentive Costs =	3,750	5,625	7,500
Total Utility Project Costs =	$3,994	$6,029	$8,089
14) Direct Participant Costs ($/Part.) =	$1,400	$1,400	$1,400
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	0.465	0.465	0.465
16a) Avg Winter kW/part Saved =	0.465	0.465	0.465
17) Avg. Summer kWh/Part. Saved =	1,630	1,630	1,630
17a) Avg. Winter kWh/Part. Saved =	3,262	3,262	3,262
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	10	15	20
20) Incentive/Participant =	$375	$375	$375
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	16,300	24,450	32,600
Annual Winter Kwh Saved	32,620	48,930	65,240
23) Annual Summer KW Saved	5	7	9
Annual Winter KW Saved	5	7	9

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$94,604	3.40
Utility Cost Test	$117,736	8.26
Societal Test	$241,799	4.96
Participant Test	$77,201	2.33
Total Resource Cost Test	$76,396	2.33

Table 1
Ratepayer Impact Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	52,576	$0.02860	$1,504	$0.00000	$0	5	5	10	$98.68	$987	$2,491	$0.01770	16,300	32,620	48,920	$525	$244	$3,750	$4,519	($2,028)
2	2012	131,442	0.02988	3,927	0.00000	0	13	13	26	102.62	2,668	6,595	0.01805	40,750	81,550	122,300	1,338	404	5,625	7,367	(772)
3	2013	236,596	0.03195	7,559	0.00000	0	23	23	46	106.73	4,910	12,469	0.01841	73,350	146,790	220,140	2,456	589	7,500	10,545	1,924
4	2014	236,596	0.03348	7,921	0.00000	0	23	23	46	111.00	5,106	13,027	0.01878	73,350	146,790	220,140	2,506	0	0	2,506	10,521
5	2015	236,596	0.03688	8,726	0.00000	0	23	23	46	115.44	5,310	14,036	0.01916	73,350	146,790	220,140	2,557	0	0	2,557	11,479
6	2016	236,596	0.03720	8,801	0.00000	0	23	23	46	120.05	5,522	14,323	0.01954	73,350	146,790	220,140	2,607	0	0	2,607	11,716
7	2017	236,596	0.03911	9,253	0.00000	0	23	23	46	124.86	5,744	14,997	0.01993	73,350	146,790	220,140	2,659	0	0	2,659	12,338
8	2018	236,596	0.04251	10,058	0.00000	0	23	23	46	129.85	5,973	16,031	0.02033	73,350	146,790	220,140	2,713	0	0	2,713	13,318
9	2019	236,596	0.04456	10,543	0.00000	0	23	23	46	135.05	6,212	16,755	0.02073	73,350	146,790	220,140	2,766	0	0	2,766	13,989
10	2020	236,596	0.04769	11,283	0.00000	0	23	23	46	140.45	6,461	17,744	0.02115	73,350	146,790	220,140	2,822	0	0	2,822	14,922
11	2021	236,596	0.04800	11,357	0.00000	0	23	23	46	146.07	6,719	18,076	0.02157	73,350	146,790	220,140	2,878	0	0	2,878	15,198
12	2022	236,596	0.04834	11,437	0.00000	0	23	23	46	151.91	6,988	18,425	0.02200	73,350	146,790	220,140	2,936	0	0	2,936	15,489
13	2023	236,596	0.04871	11,525	0.00000	0	23	23	46	157.98	7,267	18,792	0.02244	73,350	146,790	220,140	2,994	0	0	2,994	15,798
14	2024	236,596	0.04911	11,619	0.00000	0	23	23	46	164.30	7,558	19,177	0.02289	73,350	146,790	220,140	3,054	0	0	3,054	16,123
15	2025	236,596	0.04954	11,721	0.00000	0	23	23	46	170.88	7,860	19,581	0.02335	73,350	146,790	220,140	3,116	0	0	3,116	16,465
16	2026	236,596	0.05000	11,830	0.00000	0	23	23	46	177.71	8,175	20,005	0.02382	73,350	146,790	220,140	3,178	0	0	3,178	16,827
17	2027	236,596	0.05050	11,948	0.00000	0	23	23	46	184.82	8,502	20,450	0.02429	73,350	146,790	220,140	3,241	0	0	3,241	17,209
18	2028	236,596	0.05103	12,073	0.00000	0	23	23	46	192.21	8,842	20,915	0.02478	73,350	146,790	220,140	3,306	0	0	3,306	17,609
19	2029	236,596	0.05160	12,208	0.00000	0	23	23	46	199.90	9,195	21,403	0.02528	73,350	146,790	220,140	3,373	0	0	3,373	18,030
20	2030	236,596	0.05220	12,350	0.00000	0	23	23	46	207.90	9,563	21,913	0.02578	73,350	146,790	220,140	3,440	0	0	3,440	18,473
Total =		4,442,746							864			$327,205				4,133,740				$72,577	$254,628
											NPV =	$133,963								$39,359	94,604

Total NPV =	$94,604
Benefit/Cost Ratio =	3.40

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$1,504	$0	$987	$2,491	$3,994	$3,994	($1,503)
2012	3,927	0	2,668	6,595	6,029	6,029	566
2013	7,559	0	4,910	12,469	8,089	8,089	4,380
2014	7,921	0	5,106	13,027	0	0	13,027
2015	8,726	0	5,310	14,036	0	0	14,036
2016	8,801	0	5,522	14,323	0	0	14,323
2017	9,253	0	5,744	14,997	0	0	14,997
2018	10,058	0	5,973	16,031	0	0	16,031
2019	10,543	0	6,212	16,755	0	0	16,755
2020	11,283	0	6,461	17,744	0	0	17,744
2021	11,357	0	6,719	18,076	0	0	18,076
2022	11,437	0	6,988	18,425	0	0	18,425
2023	11,525	0	7,267	18,792	0	0	18,792
2024	11,619	0	7,558	19,177	0	0	19,177
2025	11,721	0	7,860	19,581	0	0	19,581
2026	11,830	0	8,175	20,005	0	0	20,005
2027	11,948	0	8,502	20,450	0	0	20,450
2028	12,073	0	8,842	20,915	0	0	20,915
2029	12,208	0	9,195	21,403	0	0	21,403
2030	12,350	0	9,563	21,913	0	0	21,913
Total =				$327,205		$18,112	$309,093
			NPV =	$133,963		$16,227	117,736

Total NPV =	$117,736
Benefit/Cost Ratio =	8.26

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$1,504	$0	$987	$788	$3,279	$3,994	$10,250	$14,244	($10,965)
2012	3,927	0	2,668	2,148	8,743	6,029	15,375	21,404	(12,661)
2013	7,559	0	4,910	4,183	16,652	8,089	20,500	28,589	(11,937)
2014	7,921	0	5,106	4,501	17,528	0	0	0	17,528
2015	8,726	0	5,310	4,995	19,031	0	0	0	19,031
2016	8,801	0	5,522	5,250	19,573	0	0	0	19,573
2017	9,253	0	5,744	5,662	20,659	0	0	0	20,659
2018	10,058	0	5,973	6,234	22,265	0	0	0	22,265
2019	10,543	0	6,212	6,711	23,466	0	0	0	23,466
2020	11,283	0	6,461	7,321	25,065	0	0	0	25,065
2021	11,357	0	6,719	7,682	25,758	0	0	0	25,758
2022	11,437	0	6,988	8,065	26,490	0	0	0	26,490
2023	11,525	0	7,267	8,472	27,264	0	0	0	27,264
2024	11,619	0	7,558	8,905	28,082	0	0	0	28,082
2025	11,721	0	7,860	9,366	28,947	0	0	0	28,947
2026	11,830	0	8,175	9,855	29,860	0	0	0	29,860
2027	11,948	0	8,502	10,377	30,827	0	0	0	30,827
2028	12,073	0	8,842	10,931	31,846	0	0	0	31,846
2029	12,208	0	9,195	11,522	32,925	0	0	0	32,925
2030	12,350	0	9,563	12,150	34,063	0	0	0	34,063
Total =					$472,323			$64,237	$408,086
				NPV =	$302,887			$61,088	241,799

Total NPV = $241,799
Benefit/Cost Ratio = 4.96

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$3,750	$0.04273	$0.03902	16,300	32,620	48,920	$1,969	5	5	$45.900	$67.320	$566	$0	$6,285	$14,295	$0	$14,295	($8,010)
2012	5,625	0.04483	0.04095	40,750	81,550	122,300	5,166	12	12	46.818	68.666	1,386	0	12,177	21,896	0	21,896	(9,719)
2013	7,500	0.04705	0.04297	73,350	146,790	220,140	9,759	21	21	47.754	70.040	2,474	0	19,733	29,810	0	29,810	(10,077)
2014	0	0.04937	0.04509	73,350	146,790	220,140	10,240	21	21	48.709	71.441	2,523	0	12,763	0	0	0	12,763
2015	0	0.05180	0.04731	73,350	146,790	220,140	10,744	21	21	49.684	72.869	2,574	0	13,318	0	0	0	13,318
2016	0	0.05435	0.04964	73,350	146,790	220,140	11,273	21	21	50.677	74.327	2,625	0	13,898	0	0	0	13,898
2017	0	0.05703	0.05209	73,350	146,790	220,140	11,829	21	21	51.691	75.813	2,678	0	14,507	0	0	0	14,507
2018	0	0.05985	0.05466	73,350	146,790	220,140	12,414	21	21	52.725	77.330	2,731	0	15,145	0	0	0	15,145
2019	0	0.06280	0.05735	73,350	146,790	220,140	13,025	21	21	53.779	78.876	2,786	0	15,811	0	0	0	15,811
2020	0	0.06589	0.06018	73,350	146,790	220,140	13,667	21	21	54.855	80.454	2,841	0	16,508	0	0	0	16,508
2021	0	0.06914	0.06315	73,350	146,790	220,140	14,341	21	21	55.952	82.063	2,898	0	17,239	0	0	0	17,239
2022	0	0.07255	0.06626	73,350	146,790	220,140	15,048	21	21	57.071	83.704	2,956	0	18,004	0	0	0	18,004
2023	0	0.07613	0.06953	73,350	146,790	220,140	15,790	21	21	58.212	85.378	3,015	0	18,805	0	0	0	18,805
2024	0	0.07988	0.07296	73,350	146,790	220,140	16,569	21	21	59.377	87.086	3,076	0	19,645	0	0	0	19,645
2025	0	0.08382	0.07656	73,350	146,790	220,140	17,386	21	21	60.564	88.827	3,137	0	20,523	0	0	0	20,523
2026	0	0.08796	0.08033	73,350	146,790	220,140	18,244	21	21	61.775	90.604	3,200	0	21,444	0	0	0	21,444
2027	0	0.09229	0.08429	73,350	146,790	220,140	19,142	21	21	63.011	92.416	3,264	0	22,406	0	0	0	22,406
2028	0	0.09684	0.08845	73,350	146,790	220,140	20,087	21	21	64.271	94.264	3,329	0	23,416	0	0	0	23,416
2029	0	0.10162	0.09281	73,350	146,790	220,140	21,077	21	21	65.557	96.150	3,396	0	24,473	0	0	0	24,473
2030	0	0.10663	0.09739	73,350	146,790	220,140	22,117	21	21	66.868	98.073	3,464	0	25,581	0	0	0	25,581
Total =				1,377,350	2,756,390			395	395					$351,681			$66,001	$285,680
													NPV =	$135,453			$58,252	77,201

Total NPV =	$77,201
Benefit/Cost Ratio =	2.33

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Motors - Replacement**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$1,504	$987	$2,491	$3,994	$10,250	$14,244	($11,753)
2012	3,927	2,668	6,595	6,029	15,375	21,404	(14,809)
2013	7,559	4,910	12,469	8,089	20,500	28,589	(16,120)
2014	7,921	5,106	13,027	0	0	0	13,027
2015	8,726	5,310	14,036	0	0	0	14,036
2016	8,801	5,522	14,323	0	0	0	14,323
2017	9,253	5,744	14,997	0	0	0	14,997
2018	10,058	5,973	16,031	0	0	0	16,031
2019	10,543	6,212	16,755	0	0	0	16,755
2020	11,283	6,461	17,744	0	0	0	17,744
2021	11,357	6,719	18,076	0	0	0	18,076
2022	11,437	6,988	18,425	0	0	0	18,425
2023	11,525	7,267	18,792	0	0	0	18,792
2024	11,619	7,558	19,177	0	0	0	19,177
2025	11,721	7,860	19,581	0	0	0	19,581
2026	11,830	8,175	20,005	0	0	0	20,005
2027	11,948	8,502	20,450	0	0	0	20,450
2028	12,073	8,842	20,915	0	0	0	20,915
2029	12,208	9,195	21,403	0	0	0	21,403
2030	12,350	9,563	21,913	0	0	0	21,913
		Total =	$327,205			$64,237	$262,968
		NPV =	$133,963			$57,567	76,396

Total NPV =	$76,396
Benefit/Cost Ratio =	2.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$65	$108	$157
Incentive Costs =	1,000	1,500	2,000
Total Utility Project Costs =	$1,065	$1,608	$2,157
14) Direct Participant Costs ($/Part.) =	$201	$201	$201
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	0.113	0.113	0.113
16a) Avg Winter kW/part Saved =	0.113	0.113	0.113
17) Avg. Summer kWh/Part. Saved =	401	401	401
17a) Avg. Winter kWh/Part. Saved =	801	801	801
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	10	15	20
20) Incentive/Participant =	$100	$100	$100
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	4,010	6,015	8,020
Annual Winter Kwh Saved	8,010	12,015	16,020
23) Annual Summer KW Saved	1	2	2
Annual Winter KW Saved	1	2	2

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$23,563	3.35
Utility Cost Test	$29,248	7.76
Societal Test	$67,135	8.53
Participant Test	$25,063	4.00
Total Resource Cost Test	$25,174	4.00

Table 1
Ratepayer Impact Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	12,919	$0.02860	$369	$0.00000	$0	1	1	2	$98.68	$197	$566	$0.01770	4,010	8,010	12,020	$129	$65	$1,000	$1,194	($628)
2	2012	32,296	0.02988	965	0.00000	0	3	3	6	102.62	616	1,581	0.01805	10,025	20,025	30,050	329	108	1,500	1,937	(356)
3	2013	58,133	0.03195	1,857	0.00000	0	6	6	12	106.73	1,281	3,138	0.01841	18,045	36,045	54,090	604	157	2,000	2,761	377
4	2014	58,133	0.03348	1,946	0.00000	0	6	6	12	111.00	1,332	3,278	0.01878	18,045	36,045	54,090	616	0	0	616	2,662
5	2015	58,133	0.03688	2,144	0.00000	0	6	6	12	115.44	1,385	3,529	0.01916	18,045	36,045	54,090	628	0	0	628	2,901
6	2016	58,133	0.03720	2,163	0.00000	0	6	6	12	120.05	1,441	3,604	0.01954	18,045	36,045	54,090	641	0	0	641	2,963
7	2017	58,133	0.03911	2,274	0.00000	0	6	6	12	124.86	1,498	3,772	0.01993	18,045	36,045	54,090	653	0	0	653	3,119
8	2018	58,133	0.04251	2,471	0.00000	0	6	6	12	129.85	1,558	4,029	0.02033	18,045	36,045	54,090	667	0	0	667	3,362
9	2019	58,133	0.04456	2,590	0.00000	0	6	6	12	135.05	1,621	4,211	0.02073	18,045	36,045	54,090	680	0	0	680	3,531
10	2020	58,133	0.04769	2,772	0.00000	0	6	6	12	140.45	1,685	4,457	0.02115	18,045	36,045	54,090	693	0	0	693	3,764
11	2021	58,133	0.04800	2,790	0.00000	0	6	6	12	146.07	1,753	4,543	0.02157	18,045	36,045	54,090	707	0	0	707	3,836
12	2022	58,133	0.04834	2,810	0.00000	0	6	6	12	151.91	1,823	4,633	0.02200	18,045	36,045	54,090	721	0	0	721	3,912
13	2023	58,133	0.04871	2,832	0.00000	0	6	6	12	157.98	1,896	4,728	0.02244	18,045	36,045	54,090	736	0	0	736	3,992
14	2024	58,133	0.04911	2,855	0.00000	0	6	6	12	164.30	1,972	4,827	0.02289	18,045	36,045	54,090	750	0	0	750	4,077
15	2025	58,133	0.04954	2,880	0.00000	0	6	6	12	170.88	2,051	4,931	0.02335	18,045	36,045	54,090	766	0	0	766	4,165
16	2026	58,133	0.05000	2,907	0.00000	0	6	6	12	177.71	2,133	5,040	0.02382	18,045	36,045	54,090	781	0	0	781	4,259
17	2027	58,133	0.05050	2,936	0.00000	0	6	6	12	184.82	2,218	5,154	0.02429	18,045	36,045	54,090	796	0	0	796	4,358
18	2028	58,133	0.05103	2,967	0.00000	0	6	6	12	192.21	2,307	5,274	0.02478	18,045	36,045	54,090	812	0	0	812	4,462
19	2029	58,133	0.05160	3,000	0.00000	0	6	6	12	199.90	2,399	5,399	0.02528	18,045	36,045	54,090	829	0	0	829	4,570
20	2030	58,133	0.05220	3,035	0.00000	0	6	6	12	207.90	2,495	5,530	0.02578	18,045	36,045	54,090	845	0	0	845	4,685
Total =		1,091,609							224			$82,224				1,015,690				$18,213	$64,011
											NPV =	$33,575								$10,012	23,563

Total NPV = $23,563
Benefit/Cost Ratio = 3.35

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$369	$0	$197	$566	$1,065	$1,065	($499)
2012	965	0	616	1,581	1,608	1,608	(27)
2013	1,857	0	1,281	3,138	2,157	2,157	981
2014	1,946	0	1,332	3,278	0	0	3,278
2015	2,144	0	1,385	3,529	0	0	3,529
2016	2,163	0	1,441	3,604	0	0	3,604
2017	2,274	0	1,498	3,772	0	0	3,772
2018	2,471	0	1,558	4,029	0	0	4,029
2019	2,590	0	1,621	4,211	0	0	4,211
2020	2,772	0	1,685	4,457	0	0	4,457
2021	2,790	0	1,753	4,543	0	0	4,543
2022	2,810	0	1,823	4,633	0	0	4,633
2023	2,832	0	1,896	4,728	0	0	4,728
2024	2,855	0	1,972	4,827	0	0	4,827
2025	2,880	0	2,051	4,931	0	0	4,931
2026	2,907	0	2,133	5,040	0	0	5,040
2027	2,936	0	2,218	5,154	0	0	5,154
2028	2,967	0	2,307	5,274	0	0	5,274
2029	3,000	0	2,399	5,399	0	0	5,399
2030	3,035	0	2,495	5,530	0	0	5,530
Total =				$82,224		$4,830	$77,394
			NPV =	$33,575		$4,327	29,248

Total NPV =	$29,248
Benefit/Cost Ratio =	7.76

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$369	$0	$197	$179	$745	$1,065	$1,010	$2,075	($1,330)
2012	965	0	616	515	2,096	1,608	1,515	3,123	(1,027)
2013	1,857	0	1,281	1,053	4,191	2,157	2,020	4,177	14
2014	1,946	0	1,332	1,133	4,411	0	0	0	4,411
2015	2,144	0	1,385	1,256	4,785	0	0	0	4,785
2016	2,163	0	1,441	1,321	4,925	0	0	0	4,925
2017	2,274	0	1,498	1,424	5,196	0	0	0	5,196
2018	2,471	0	1,558	1,567	5,596	0	0	0	5,596
2019	2,590	0	1,621	1,687	5,898	0	0	0	5,898
2020	2,772	0	1,685	1,839	6,296	0	0	0	6,296
2021	2,790	0	1,753	1,931	6,474	0	0	0	6,474
2022	2,810	0	1,823	2,028	6,661	0	0	0	6,661
2023	2,832	0	1,896	2,132	6,860	0	0	0	6,860
2024	2,855	0	1,972	2,241	7,068	0	0	0	7,068
2025	2,880	0	2,051	2,358	7,289	0	0	0	7,289
2026	2,907	0	2,133	2,483	7,523	0	0	0	7,523
2027	2,936	0	2,218	2,615	7,769	0	0	0	7,769
2028	2,967	0	2,307	2,756	8,030	0	0	0	8,030
2029	3,000	0	2,399	2,906	8,305	0	0	0	8,305
2030	3,035	0	2,495	3,066	8,596	0	0	0	8,596
Total =					$118,714			$9,375	$109,339
				NPV =	$76,050			$8,915	67,135

Total NPV = $67,135
Benefit/Cost Ratio = 8.53

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,000	$0.04273	$0.03902	4,010	8,010	12,020	$484	1	1	$45.900	$67.320	$113	$0	$1,597	$2,052	$0	$2,052	($455)
2012	1,500	0.04483	0.04095	10,025	20,025	30,050	1,269	3	3	46.818	68.666	346	0	3,115	3,144	0	3,144	(29)
2013	2,000	0.04705	0.04297	18,045	36,045	54,090	2,398	5	5	47.754	70.040	589	0	4,987	4,280	0	4,280	707
2014	0	0.04937	0.04509	18,045	36,045	54,090	2,516	5	5	48.709	71.441	601	0	3,117	0	0	0	3,117
2015	0	0.05180	0.04731	18,045	36,045	54,090	2,640	5	5	49.684	72.869	613	0	3,253	0	0	0	3,253
2016	0	0.05435	0.04964	18,045	36,045	54,090	2,770	5	5	50.677	74.327	625	0	3,395	0	0	0	3,395
2017	0	0.05703	0.05209	18,045	36,045	54,090	2,907	5	5	51.691	75.813	638	0	3,545	0	0	0	3,545
2018	0	0.05985	0.05466	18,045	36,045	54,090	3,050	5	5	52.725	77.330	650	0	3,700	0	0	0	3,700
2019	0	0.06280	0.05735	18,045	36,045	54,090	3,200	5	5	53.779	78.876	663	0	3,863	0	0	0	3,863
2020	0	0.06589	0.06018	18,045	36,045	54,090	3,358	5	5	54.855	80.454	677	0	4,035	0	0	0	4,035
2021	0	0.06914	0.06315	18,045	36,045	54,090	3,524	5	5	55.952	82.063	690	0	4,214	0	0	0	4,214
2022	0	0.07255	0.06626	18,045	36,045	54,090	3,698	5	5	57.071	83.704	704	0	4,402	0	0	0	4,402
2023	0	0.07613	0.06953	18,045	36,045	54,090	3,880	5	5	58.212	85.378	718	0	4,598	0	0	0	4,598
2024	0	0.07988	0.07296	18,045	36,045	54,090	4,071	5	5	59.377	87.086	732	0	4,803	0	0	0	4,803
2025	0	0.08382	0.07656	18,045	36,045	54,090	4,272	5	5	60.564	88.827	747	0	5,019	0	0	0	5,019
2026	0	0.08796	0.08033	18,045	36,045	54,090	4,483	5	5	61.775	90.604	762	0	5,245	0	0	0	5,245
2027	0	0.09229	0.08429	18,045	36,045	54,090	4,704	5	5	63.011	92.416	777	0	5,481	0	0	0	5,481
2028	0	0.09684	0.08845	18,045	36,045	54,090	4,936	5	5	64.271	94.264	793	0	5,729	0	0	0	5,729
2029	0	0.10162	0.09281	18,045	36,045	54,090	5,179	5	5	65.557	96.150	809	0	5,988	0	0	0	5,988
2030	0	0.10663	0.09739	18,045	36,045	54,090	5,435	5	5	66.868	98.073	825	0	6,260	0	0	0	6,260
Total =				338,845	676,845			94	94					$86,346			$9,476	$76,870
													NPV =	$33,427			$8,363	25,063

Total NPV =	$25,063
Benefit/Cost Ratio =	4.00

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical Motors - New / on Failure**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$369	$197	$566	$1,065	$1,010	$2,075	($1,509)
2012	965	616	1,581	1,608	1,515	3,123	(1,542)
2013	1,857	1,281	3,138	2,157	2,020	4,177	(1,039)
2014	1,946	1,332	3,278	0	0	0	3,278
2015	2,144	1,385	3,529	0	0	0	3,529
2016	2,163	1,441	3,604	0	0	0	3,604
2017	2,274	1,498	3,772	0	0	0	3,772
2018	2,471	1,558	4,029	0	0	0	4,029
2019	2,590	1,621	4,211	0	0	0	4,211
2020	2,772	1,685	4,457	0	0	0	4,457
2021	2,790	1,753	4,543	0	0	0	4,543
2022	2,810	1,823	4,633	0	0	0	4,633
2023	2,832	1,896	4,728	0	0	0	4,728
2024	2,855	1,972	4,827	0	0	0	4,827
2025	2,880	2,051	4,931	0	0	0	4,931
2026	2,907	2,133	5,040	0	0	0	5,040
2027	2,936	2,218	5,154	0	0	0	5,154
2028	2,967	2,307	5,274	0	0	0	5,274
2029	3,000	2,399	5,399	0	0	0	5,399
2030	3,035	2,495	5,530	0	0	0	5,530
		Total =	$82,224			$9,375	$72,849
		NPV =	$33,575			$8,401	25,174

Total NPV =	$25,174
Benefit/Cost Ratio =	4.00

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$488	$808	$1,178
Incentive Costs =	7,500	11,250	15,000
Total Utility Project Costs =	$7,988	$12,058	$16,178
14) Direct Participant Costs ($/Part.) =	$2,500	$2,500	$2,500
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	4.400	4.400	4.400
16a) Avg Winter kW/part Saved =	4.400	4.400	4.400
17) Avg. Summer kWh/Part. Saved =	7,074	7,074	7,074
17a) Avg. Winter kWh/Part. Saved =	14,148	14,148	14,148
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	10	15	20
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	70,740	106,110	141,480
Annual Winter Kwh Saved	141,480	212,220	282,960
23) Annual Summer KW Saved	44	66	88
Annual Winter KW Saved	44	66	88

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$628,780	6.16
Utility Cost Test	$718,130	23.13
Societal Test	$1,442,989	14.20
Participant Test	$481,902	5.63
Total Resource Cost Test	$647,549	7.28

Table 1
Ratepayer Impact Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	228,084	$0.02860	$6,523	$0.00000	$0	49	49	98	$98.68	$9,671	$16,194	$0.01770	70,740	141,480	212,220	$2,277	$488	$7,500	$10,265	$5,929
2	2012	570,209	0.02988	17,038	0.00000	0	123	123	246	102.62	25,245	42,283	0.01805	176,850	353,700	530,550	5,805	808	11,250	17,863	24,420
3	2013	1,026,375	0.03195	32,793	0.00000	0	221	221	442	106.73	47,175	79,968	0.01841	318,330	636,660	954,990	10,657	1,178	15,000	26,835	53,133
4	2014	1,026,375	0.03348	34,363	0.00000	0	221	221	442	111.00	49,062	83,425	0.01878	318,330	636,660	954,990	10,871	0	0	10,871	72,554
5	2015	1,026,375	0.03688	37,853	0.00000	0	221	221	442	115.44	51,024	88,877	0.01916	318,330	636,660	954,990	11,091	0	0	11,091	77,786
6	2016	1,026,375	0.03720	38,181	0.00000	0	221	221	442	120.05	53,062	91,243	0.01954	318,330	636,660	954,990	11,311	0	0	11,311	79,932
7	2017	1,026,375	0.03911	40,142	0.00000	0	221	221	442	124.86	55,188	95,330	0.01993	318,330	636,660	954,990	11,536	0	0	11,536	83,794
8	2018	1,026,375	0.04251	43,631	0.00000	0	221	221	442	129.85	57,394	101,025	0.02033	318,330	636,660	954,990	11,768	0	0	11,768	89,257
9	2019	1,026,375	0.04456	45,735	0.00000	0	221	221	442	135.05	59,692	105,427	0.02073	318,330	636,660	954,990	11,999	0	0	11,999	93,428
10	2020	1,026,375	0.04769	48,948	0.00000	0	221	221	442	140.45	62,079	111,027	0.02115	318,330	636,660	954,990	12,243	0	0	12,243	98,784
11	2021	1,026,375	0.04800	49,266	0.00000	0	221	221	442	146.07	64,563	113,829	0.02157	318,330	636,660	954,990	12,486	0	0	12,486	101,343
12	2022	1,026,375	0.04834	49,615	0.00000	0	221	221	442	151.91	67,144	116,759	0.02200	318,330	636,660	954,990	12,735	0	0	12,735	104,024
13	2023	1,026,375	0.04871	49,995	0.00000	0	221	221	442	157.98	69,827	119,822	0.02244	318,330	636,660	954,990	12,989	0	0	12,989	106,833
14	2024	1,026,375	0.04911	50,405	0.00000	0	221	221	442	164.30	72,621	123,026	0.02289	318,330	636,660	954,990	13,250	0	0	13,250	109,776
15	2025	1,026,375	0.04954	50,847	0.00000	0	221	221	442	170.88	75,529	126,376	0.02335	318,330	636,660	954,990	13,516	0	0	13,516	112,860
16	2026	798,292	0.05000	39,915	0.00000	0	172	172	344	177.71	61,132	101,047	0.02382	247,590	495,180	742,770	10,724	0	0	10,724	90,323
17	2027	456,167	0.05050	23,036	0.00000	0	98	98	196	184.82	36,225	59,261	0.02429	141,480	282,960	424,440	6,249	0	0	6,249	53,012
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.02478	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.02528	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.02578	0	0	0	0	0	0	0	0
Total =		15,395,627							6,630			$1,574,919				14,324,850				$217,731	$1,357,188
											NPV =	$750,584								$121,804	628,780

Total NPV = $628,780
Benefit/Cost Ratio = 6.16

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$6,523	$0	$9,671	$16,194	$7,988	$7,988	$8,206
2012	17,038	0	25,245	42,283	12,058	12,058	30,225
2013	32,793	0	47,175	79,968	16,178	16,178	63,790
2014	34,363	0	49,062	83,425	0	0	83,425
2015	37,853	0	51,024	88,877	0	0	88,877
2016	38,181	0	53,062	91,243	0	0	91,243
2017	40,142	0	55,188	95,330	0	0	95,330
2018	43,631	0	57,394	101,025	0	0	101,025
2019	45,735	0	59,692	105,427	0	0	105,427
2020	48,948	0	62,079	111,027	0	0	111,027
2021	49,266	0	64,563	113,829	0	0	113,829
2022	49,615	0	67,144	116,759	0	0	116,759
2023	49,995	0	69,827	119,822	0	0	119,822
2024	50,405	0	72,621	123,026	0	0	123,026
2025	50,847	0	75,529	126,376	0	0	126,376
2026	39,915	0	61,132	101,047	0	0	101,047
2027	23,036	0	36,225	59,261	0	0	59,261
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$1,574,919		$36,224	$1,538,695
			NPV =	$750,584		$32,454	718,130

Total NPV =	$718,130
Benefit/Cost Ratio =	23.13

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$6,523	$0	$9,671	$5,121	$21,315	$7,988	$17,500	$25,488	($4,173)
2012	17,038	0	25,245	13,771	56,054	12,058	26,250	38,308	17,746
2013	32,793	0	47,175	26,827	106,795	16,178	35,000	51,178	55,617
2014	34,363	0	49,062	28,826	112,251	0	0	0	112,251
2015	37,853	0	51,024	31,631	120,508	0	0	0	120,508
2016	38,181	0	53,062	33,447	124,690	0	0	0	124,690
2017	40,142	0	55,188	35,994	131,324	0	0	0	131,324
2018	43,631	0	57,394	39,288	140,313	0	0	0	140,313
2019	45,735	0	59,692	42,230	147,657	0	0	0	147,657
2020	48,948	0	62,079	45,808	156,835	0	0	0	156,835
2021	49,266	0	64,563	48,373	162,202	0	0	0	162,202
2022	49,615	0	67,144	51,106	167,865	0	0	0	167,865
2023	49,995	0	69,827	54,021	173,843	0	0	0	173,843
2024	50,405	0	72,621	57,129	180,155	0	0	0	180,155
2025	50,847	0	75,529	60,445	186,821	0	0	0	186,821
2026	39,915	0	61,132	49,780	150,827	0	0	0	150,827
2027	23,036	0	36,225	30,070	89,331	0	0	0	89,331
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$2,228,786			$114,974	$2,113,812
				NPV =	$1,552,326			$109,337	1,442,989

Total NPV = $1,442,989
Benefit/Cost Ratio = 14.20

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$7,500	$0.04273	$0.03902	70,740	141,480	212,220	$8,543	44	44	$45.900	$67.320	$4,982	$0	$21,025	$25,528	$0	$25,528	($4,503)
2012	11,250	0.04483	0.04095	176,850	353,700	530,550	22,412	110	110	46.818	68.666	12,703	0	46,365	39,099	0	39,099	7,266
2013	15,000	0.04705	0.04297	318,330	636,660	954,990	42,335	198	198	47.754	70.040	23,323	0	80,658	53,232	0	53,232	27,426
2014	0	0.04937	0.04509	318,330	636,660	954,990	44,423	198	198	48.709	71.441	23,790	0	68,213	0	0	0	68,213
2015	0	0.05180	0.04731	318,330	636,660	954,990	46,610	198	198	49.684	72.869	24,266	0	70,876	0	0	0	70,876
2016	0	0.05435	0.04964	318,330	636,660	954,990	48,905	198	198	50.677	74.327	24,751	0	73,656	0	0	0	73,656
2017	0	0.05703	0.05209	318,330	636,660	954,990	51,318	198	198	51.691	75.813	25,246	0	76,564	0	0	0	76,564
2018	0	0.05985	0.05466	318,330	636,660	954,990	53,852	198	198	52.725	77.330	25,751	0	79,603	0	0	0	79,603
2019	0	0.06280	0.05735	318,330	636,660	954,990	56,504	198	198	53.779	78.876	26,266	0	82,770	0	0	0	82,770
2020	0	0.06589	0.06018	318,330	636,660	954,990	59,289	198	198	54.855	80.454	26,791	0	86,080	0	0	0	86,080
2021	0	0.06914	0.06315	318,330	636,660	954,990	62,214	198	198	55.952	82.063	27,327	0	89,541	0	0	0	89,541
2022	0	0.07255	0.06626	318,330	636,660	954,990	65,280	198	198	57.071	83.704	27,873	0	93,153	0	0	0	93,153
2023	0	0.07613	0.06953	318,330	636,660	954,990	68,501	198	198	58.212	85.378	28,431	0	96,932	0	0	0	96,932
2024	0	0.07988	0.07296	318,330	636,660	954,990	71,879	198	198	59.377	87.086	29,000	0	100,879	0	0	0	100,879
2025	0	0.08382	0.07656	318,330	636,660	954,990	75,425	198	198	60.564	88.827	29,579	0	105,004	0	0	0	105,004
2026	0	0.08796	0.08033	247,590	495,180	742,770	61,556	154	154	61.775	90.604	23,466	0	85,022	0	0	0	85,022
2027	0	0.09229	0.08429	141,480	282,960	424,440	36,908	88	88	63.011	92.416	13,678	0	50,586	0	0	0	50,586
2028	0	0.09684	0.08845	0	0	0	0	0	0	64.271	94.264	0	0	0	0	0	0	0
2029	0	0.10162	0.09281	0	0	0	0	0	0	65.557	96.150	0	0	0	0	0	0	0
2030	0	0.10663	0.09739	0	0	0	0	0	0	66.868	98.073	0	0	0	0	0	0	0
Total =				4,774,950	9,549,900			2,970	2,970					$1,306,927			$117,859	$1,189,068
													NPV =	$585,924			$104,022	481,902

Total NPV = $481,902
Benefit/Cost Ratio = 5.63

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Variable Speed Drives - VFD'S**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$6,523	$9,671	$16,194	$7,988	$17,500	$25,488	($9,294)
2012	17,038	25,245	42,283	12,058	26,250	38,308	3,975
2013	32,793	47,175	79,968	16,178	35,000	51,178	28,790
2014	34,363	49,062	83,425	0	0	0	83,425
2015	37,853	51,024	88,877	0	0	0	88,877
2016	38,181	53,062	91,243	0	0	0	91,243
2017	40,142	55,188	95,330	0	0	0	95,330
2018	43,631	57,394	101,025	0	0	0	101,025
2019	45,735	59,692	105,427	0	0	0	105,427
2020	48,948	62,079	111,027	0	0	0	111,027
2021	49,266	64,563	113,829	0	0	0	113,829
2022	49,615	67,144	116,759	0	0	0	116,759
2023	49,995	69,827	119,822	0	0	0	119,822
2024	50,405	72,621	123,026	0	0	0	123,026
2025	50,847	75,529	126,376	0	0	0	126,376
2026	39,915	61,132	101,047	0	0	0	101,047
2027	23,036	36,225	59,261	0	0	0	59,261
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$1,574,919			$114,974	$1,459,945
		NPV =	$750,584			$103,035	647,549

Total NPV =	$647,549
Benefit/Cost Ratio =	7.28

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$488	$539	$883
Incentive Costs =	7,500	7,500	11,250
Total Utility Project Costs =	$7,988	$8,039	$12,133
14) Direct Participant Costs ($/Part.) =	$1,035	$1,035	$1,035
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	2.430	2.430	2.430
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,593	1,593	1,593
17a) Avg. Winter kWh/Part. Saved =	3,262	3,262	3,262
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	10	10	15
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	15,930	15,930	23,895
Annual Winter Kwh Saved	32,620	32,620	48,930
23) Annual Summer KW Saved	24	24	36
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$108,884	3.63
Utility Cost Test	$124,876	5.91
Societal Test	$273,103	8.51
Participant Test	$88,417	3.62
Total Resource Cost Test	$115,868	4.37

Table 1
Ratepayer Impact Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	52,179	$0.02860	$1,492	$0.00000	$0	27	0	27	$98.68	$2,664	$4,156	$0.01770	15,930	32,620	48,550	$521	$488	$7,500	$8,509	($4,353)
2	2012	104,359	0.02988	3,118	0.00000	0	54	0	54	102.62	5,541	8,659	0.01805	31,860	65,240	97,100	1,062	539	7,500	9,101	(442)
3	2013	182,627	0.03195	5,835	0.00000	0	95	0	95	106.73	10,139	15,974	0.01841	55,755	114,170	169,925	1,896	883	11,250	14,029	1,945
4	2014	182,627	0.03348	6,114	0.00000	0	95	0	95	111.00	10,545	16,659	0.01878	55,755	114,170	169,925	1,934	0	0	1,934	14,725
5	2015	182,627	0.03688	6,735	0.00000	0	95	0	95	115.44	10,967	17,702	0.01916	55,755	114,170	169,925	1,973	0	0	1,973	15,729
6	2016	182,627	0.03720	6,794	0.00000	0	95	0	95	120.05	11,405	18,199	0.01954	55,755	114,170	169,925	2,013	0	0	2,013	16,186
7	2017	182,627	0.03911	7,143	0.00000	0	95	0	95	124.86	11,862	19,005	0.01993	55,755	114,170	169,925	2,053	0	0	2,053	16,952
8	2018	182,627	0.04251	7,763	0.00000	0	95	0	95	129.85	12,336	20,099	0.02033	55,755	114,170	169,925	2,094	0	0	2,094	18,005
9	2019	182,627	0.04456	8,138	0.00000	0	95	0	95	135.05	12,830	20,968	0.02073	55,755	114,170	169,925	2,135	0	0	2,135	18,833
10	2020	182,627	0.04769	8,709	0.00000	0	95	0	95	140.45	13,343	22,052	0.02115	55,755	114,170	169,925	2,178	0	0	2,178	19,874
11	2021	182,627	0.04800	8,766	0.00000	0	95	0	95	146.07	13,877	22,643	0.02157	55,755	114,170	169,925	2,222	0	0	2,222	20,421
12	2022	182,627	0.04834	8,828	0.00000	0	95	0	95	151.91	14,431	23,259	0.02200	55,755	114,170	169,925	2,266	0	0	2,266	20,993
13	2023	182,627	0.04871	8,896	0.00000	0	95	0	95	157.98	15,008	23,904	0.02244	55,755	114,170	169,925	2,311	0	0	2,311	21,593
14	2024	182,627	0.04911	8,969	0.00000	0	95	0	95	164.30	15,609	24,578	0.02289	55,755	114,170	169,925	2,358	0	0	2,358	22,220
15	2025	182,627	0.04954	9,047	0.00000	0	95	0	95	170.88	16,234	25,281	0.02335	55,755	114,170	169,925	2,405	0	0	2,405	22,876
16	2026	130,448	0.05000	6,522	0.00000	0	68	0	68	177.71	12,084	18,606	0.02382	39,825	81,550	121,375	1,752	0	0	1,752	16,854
17	2027	78,269	0.05050	3,953	0.00000	0	41	0	41	184.82	7,578	11,531	0.02429	23,895	48,930	72,825	1,072	0	0	1,072	10,459
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.02478	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.02528	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.02578	0	0	0	0	0	0	0	0
Total =		2,739,406							1,425			$313,275				2,548,875				$60,405	$252,870
											NPV =	$150,297								$41,413	108,884

Total NPV = $108,884
Benefit/Cost Ratio = 3.63

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$1,492	$0	$2,664	$4,156	$7,988	$7,988	($3,832)
2012	3,118	0	5,541	8,659	8,039	8,039	620
2013	5,835	0	10,139	15,974	12,133	12,133	3,841
2014	6,114	0	10,545	16,659	0	0	16,659
2015	6,735	0	10,967	17,702	0	0	17,702
2016	6,794	0	11,405	18,199	0	0	18,199
2017	7,143	0	11,862	19,005	0	0	19,005
2018	7,763	0	12,336	20,099	0	0	20,099
2019	8,138	0	12,830	20,968	0	0	20,968
2020	8,709	0	13,343	22,052	0	0	22,052
2021	8,766	0	13,877	22,643	0	0	22,643
2022	8,828	0	14,431	23,259	0	0	23,259
2023	8,896	0	15,008	23,904	0	0	23,904
2024	8,969	0	15,609	24,578	0	0	24,578
2025	9,047	0	16,234	25,281	0	0	25,281
2026	6,522	0	12,084	18,606	0	0	18,606
2027	3,953	0	7,578	11,531	0	0	11,531
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$313,275		$28,160	$285,115
			NPV =	$150,297		$25,421	124,876

Total NPV =	$124,876
Benefit/Cost Ratio =	5.91

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$1,492	$0	$2,664	$1,314	$5,470	$7,988	$2,850	$10,838	($5,368)
2012	3,118	0	5,541	2,820	11,479	8,039	2,850	10,889	590
2013	5,835	0	10,139	5,359	21,333	12,133	4,275	16,408	4,925
2014	6,114	0	10,545	5,756	22,415	0	0	0	22,415
2015	6,735	0	10,967	6,300	24,002	0	0	0	24,002
2016	6,794	0	11,405	6,671	24,870	0	0	0	24,870
2017	7,143	0	11,862	7,176	26,181	0	0	0	26,181
2018	7,763	0	12,336	7,816	27,915	0	0	0	27,915
2019	8,138	0	12,830	8,399	29,367	0	0	0	29,367
2020	8,709	0	13,343	9,098	31,150	0	0	0	31,150
2021	8,766	0	13,877	9,622	32,265	0	0	0	32,265
2022	8,828	0	14,431	10,181	33,440	0	0	0	33,440
2023	8,896	0	15,008	10,777	34,681	0	0	0	34,681
2024	8,969	0	15,609	11,413	35,991	0	0	0	35,991
2025	9,047	0	16,234	12,092	37,373	0	0	0	37,373
2026	6,522	0	12,084	9,166	27,772	0	0	0	27,772
2027	3,953	0	7,578	5,851	17,382	0	0	0	17,382
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$443,086			$38,135	$404,951
				NPV =	$309,487			$36,384	273,103

Total NPV = $273,103
Benefit/Cost Ratio = 8.51

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$7,500	$0.04273	$0.03902	15,930	32,620	48,550	$1,954	24	0	$45.900	$67.320	$1,102	$0	$10,556	$10,568	$0	$10,568	($12)
2012	7,500	0.04483	0.04095	31,860	65,240	97,100	4,100	49	0	46.818	68.666	2,294	0	13,894	10,791	0	10,791	3,103
2013	11,250	0.04705	0.04297	55,755	114,170	169,925	7,529	85	0	47.754	70.040	4,059	0	22,838	16,529	0	16,529	6,309
2014	0	0.04937	0.04509	55,755	114,170	169,925	7,901	85	0	48.709	71.441	4,140	0	12,041	0	0	0	12,041
2015	0	0.05180	0.04731	55,755	114,170	169,925	8,289	85	0	49.684	72.869	4,223	0	12,512	0	0	0	12,512
2016	0	0.05435	0.04964	55,755	114,170	169,925	8,698	85	0	50.677	74.327	4,308	0	13,006	0	0	0	13,006
2017	0	0.05703	0.05209	55,755	114,170	169,925	9,127	85	0	51.691	75.813	4,394	0	13,521	0	0	0	13,521
2018	0	0.05985	0.05466	55,755	114,170	169,925	9,577	85	0	52.725	77.330	4,482	0	14,059	0	0	0	14,059
2019	0	0.06280	0.05735	55,755	114,170	169,925	10,049	85	0	53.779	78.876	4,571	0	14,620	0	0	0	14,620
2020	0	0.06589	0.06018	55,755	114,170	169,925	10,544	85	0	54.855	80.454	4,663	0	15,207	0	0	0	15,207
2021	0	0.06914	0.06315	55,755	114,170	169,925	11,065	85	0	55.952	82.063	4,756	0	15,821	0	0	0	15,821
2022	0	0.07255	0.06626	55,755	114,170	169,925	11,610	85	0	57.071	83.704	4,851	0	16,461	0	0	0	16,461
2023	0	0.07613	0.06953	55,755	114,170	169,925	12,183	85	0	58.212	85.378	4,948	0	17,131	0	0	0	17,131
2024	0	0.07988	0.07296	55,755	114,170	169,925	12,784	85	0	59.377	87.086	5,047	0	17,831	0	0	0	17,831
2025	0	0.08382	0.07656	55,755	114,170	169,925	13,414	85	0	60.564	88.827	5,148	0	18,562	0	0	0	18,562
2026	0	0.08796	0.08033	39,825	81,550	121,375	10,054	61	0	61.775	90.604	3,768	0	13,822	0	0	0	13,822
2027	0	0.09229	0.08429	23,895	48,930	72,825	6,330	36	0	63.011	92.416	2,268	0	8,598	0	0	0	8,598
2028	0	0.09684	0.08845	0	0	0	0	0	0	64.271	94.264	0	0	0	0	0	0	0
2029	0	0.10162	0.09281	0	0	0	0	0	0	65.557	96.150	0	0	0	0	0	0	0
2030	0	0.10663	0.09739	0	0	0	0	0	0	66.868	98.073	0	0	0	0	0	0	0
Total =				836,325	1,712,550			1,275	0					$250,480			$37,888	$212,592
													NPV =	$122,142			$33,725	88,417

Total NPV =	$88,417
Benefit/Cost Ratio =	3.62

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial AC - Split Systems**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$1,492	$2,664	$4,156	$7,988	$2,850	$10,838	($6,682)
2012	3,118	5,541	8,659	8,039	2,850	10,889	(2,230)
2013	5,835	10,139	15,974	12,133	4,275	16,408	(434)
2014	6,114	10,545	16,659	0	0	0	16,659
2015	6,735	10,967	17,702	0	0	0	17,702
2016	6,794	11,405	18,199	0	0	0	18,199
2017	7,143	11,862	19,005	0	0	0	19,005
2018	7,763	12,336	20,099	0	0	0	20,099
2019	8,138	12,830	20,968	0	0	0	20,968
2020	8,709	13,343	22,052	0	0	0	22,052
2021	8,766	13,877	22,643	0	0	0	22,643
2022	8,828	14,431	23,259	0	0	0	23,259
2023	8,896	15,008	23,904	0	0	0	23,904
2024	8,969	15,609	24,578	0	0	0	24,578
2025	9,047	16,234	25,281	0	0	0	25,281
2026	6,522	12,084	18,606	0	0	0	18,606
2027	3,953	7,578	11,531	0	0	0	11,531
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$313,275			$38,135	$275,140
		NPV =	$150,297			$34,429	115,868

Total NPV =	$115,868
Benefit/Cost Ratio =	4.37

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$488	$808	$1,178
Incentive Costs =	7,500	11,250	15,000
Total Utility Project Costs =	$7,988	$12,058	$16,178
14) Direct Participant Costs ($/Part.) =	$1,246	$1,246	$1,246
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	2.790	2.790	2.790
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,806	1,806	1,806
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	10	15	20
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	18,060	27,090	36,120
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	28	42	56
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$124,848	4.12
Utility Cost Test	$132,453	5.08
Societal Test	$285,526	6.13
Participant Test	$58,430	2.13
Total Resource Cost Test	$112,448	3.14

Table 1
Ratepayer Impact Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	19,410	$0.02860	$555	$0.00000	$0	31	0	31	$98.68	$3,059	$3,614	$0.01770	18,060	0	18,060	$194	$488	$7,500	$8,182	($4,568)
2	2012	48,525	0.02988	1,450	0.00000	0	78	0	78	102.62	8,004	9,454	0.01805	45,150	0	45,150	494	808	11,250	12,552	(3,098)
3	2013	87,345	0.03195	2,791	0.00000	0	140	0	140	106.73	14,942	17,733	0.01841	81,270	0	81,270	907	1,178	15,000	17,085	648
4	2014	87,345	0.03348	2,924	0.00000	0	140	0	140	111.00	15,540	18,464	0.01878	81,270	0	81,270	925	0	0	925	17,539
5	2015	87,345	0.03688	3,221	0.00000	0	140	0	140	115.44	16,162	19,383	0.01916	81,270	0	81,270	944	0	0	944	18,439
6	2016	87,345	0.03720	3,249	0.00000	0	140	0	140	120.05	16,807	20,056	0.01954	81,270	0	81,270	963	0	0	963	19,093
7	2017	87,345	0.03911	3,416	0.00000	0	140	0	140	124.86	17,480	20,896	0.01993	81,270	0	81,270	982	0	0	982	19,914
8	2018	87,345	0.04251	3,713	0.00000	0	140	0	140	129.85	18,179	21,892	0.02033	81,270	0	81,270	1,001	0	0	1,001	20,891
9	2019	87,345	0.04456	3,892	0.00000	0	140	0	140	135.05	18,907	22,799	0.02073	81,270	0	81,270	1,021	0	0	1,021	21,778
10	2020	87,345	0.04769	4,165	0.00000	0	140	0	140	140.45	19,663	23,828	0.02115	81,270	0	81,270	1,042	0	0	1,042	22,786
11	2021	87,345	0.04800	4,193	0.00000	0	140	0	140	146.07	20,450	24,643	0.02157	81,270	0	81,270	1,063	0	0	1,063	23,580
12	2022	87,345	0.04834	4,222	0.00000	0	140	0	140	151.91	21,267	25,489	0.02200	81,270	0	81,270	1,084	0	0	1,084	24,405
13	2023	87,345	0.04871	4,255	0.00000	0	140	0	140	157.98	22,117	26,372	0.02244	81,270	0	81,270	1,105	0	0	1,105	25,267
14	2024	87,345	0.04911	4,290	0.00000	0	140	0	140	164.30	23,002	27,292	0.02289	81,270	0	81,270	1,128	0	0	1,128	26,164
15	2025	87,345	0.04954	4,327	0.00000	0	140	0	140	170.88	23,923	28,250	0.02335	81,270	0	81,270	1,150	0	0	1,150	27,100
16	2026	67,935	0.05000	3,397	0.00000	0	109	0	109	177.71	19,370	22,767	0.02382	63,210	0	63,210	913	0	0	913	21,854
17	2027	38,820	0.05050	1,960	0.00000	0	62	0	62	184.82	11,459	13,419	0.02429	36,120	0	36,120	532	0	0	532	12,887
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.02478	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.02528	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.02578	0	0	0	0	0	0	0	0
Total =		1,310,175							2,100			$346,351				1,219,050				$51,672	$294,679
											NPV =	$164,907								$40,059	124,848

Total NPV = $124,848
Benefit/Cost Ratio = 4.12

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$555	$0	$3,059	$3,614	$7,988	$7,988	($4,374)
2012	1,450	0	8,004	9,454	12,058	12,058	(2,604)
2013	2,791	0	14,942	17,733	16,178	16,178	1,555
2014	2,924	0	15,540	18,464	0	0	18,464
2015	3,221	0	16,162	19,383	0	0	19,383
2016	3,249	0	16,807	20,056	0	0	20,056
2017	3,416	0	17,480	20,896	0	0	20,896
2018	3,713	0	18,179	21,892	0	0	21,892
2019	3,892	0	18,907	22,799	0	0	22,799
2020	4,165	0	19,663	23,828	0	0	23,828
2021	4,193	0	20,450	24,643	0	0	24,643
2022	4,222	0	21,267	25,489	0	0	25,489
2023	4,255	0	22,117	26,372	0	0	26,372
2024	4,290	0	23,002	27,292	0	0	27,292
2025	4,327	0	23,923	28,250	0	0	28,250
2026	3,397	0	19,370	22,767	0	0	22,767
2027	1,960	0	11,459	13,419	0	0	13,419
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$346,351		$36,224	$310,127
			NPV =	$164,907		$32,454	132,453

Total NPV =	$132,453
Benefit/Cost Ratio =	5.08

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$555	$0	$3,059	$1,143	$4,757	$7,988	$4,960	$12,948	($8,191)
2012	1,450	0	8,004	3,079	12,533	12,058	7,440	19,498	(6,965)
2013	2,791	0	14,942	5,949	23,682	16,178	9,920	26,098	(2,416)
2014	2,924	0	15,540	6,380	24,844	0	0	0	24,844
2015	3,221	0	16,162	6,898	26,281	0	0	0	26,281
2016	3,249	0	16,807	7,352	27,408	0	0	0	27,408
2017	3,416	0	17,480	7,890	28,786	0	0	0	28,786
2018	3,713	0	18,179	8,514	30,406	0	0	0	30,406
2019	3,892	0	18,907	9,132	31,931	0	0	0	31,931
2020	4,165	0	19,663	9,831	33,659	0	0	0	33,659
2021	4,193	0	20,450	10,472	35,115	0	0	0	35,115
2022	4,222	0	21,267	11,157	36,646	0	0	0	36,646
2023	4,255	0	22,117	11,890	38,262	0	0	0	38,262
2024	4,290	0	23,002	12,673	39,965	0	0	0	39,965
2025	4,327	0	23,923	13,512	41,762	0	0	0	41,762
2026	3,397	0	19,370	11,216	33,983	0	0	0	33,983
2027	1,960	0	11,459	6,809	20,228	0	0	0	20,228
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$490,248			$58,544	$431,704
				NPV =	$341,197			$55,671	285,526

Total NPV =	$285,526
Benefit/Cost Ratio =	6.13

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$7,500	$0.04273	$0.03902	18,060	0	18,060	$772	28	0	$45.900	$67.320	$1,285	$0	$9,557	$12,723	$0	$12,723	($3,166)
2012	11,250	0.04483	0.04095	45,150	0	45,150	2,024	70	0	46.818	68.666	3,277	0	16,551	19,487	0	19,487	(2,936)
2013	15,000	0.04705	0.04297	81,270	0	81,270	3,824	126	0	47.754	70.040	6,017	0	24,841	26,531	0	26,531	(1,690)
2014	0	0.04937	0.04509	81,270	0	81,270	4,012	126	0	48.709	71.441	6,137	0	10,149	0	0	0	10,149
2015	0	0.05180	0.04731	81,270	0	81,270	4,210	126	0	49.684	72.869	6,260	0	10,470	0	0	0	10,470
2016	0	0.05435	0.04964	81,270	0	81,270	4,417	126	0	50.677	74.327	6,385	0	10,802	0	0	0	10,802
2017	0	0.05703	0.05209	81,270	0	81,270	4,635	126	0	51.691	75.813	6,513	0	11,148	0	0	0	11,148
2018	0	0.05985	0.05466	81,270	0	81,270	4,864	126	0	52.725	77.330	6,643	0	11,507	0	0	0	11,507
2019	0	0.06280	0.05735	81,270	0	81,270	5,104	126	0	53.779	78.876	6,776	0	11,880	0	0	0	11,880
2020	0	0.06589	0.06018	81,270	0	81,270	5,355	126	0	54.855	80.454	6,912	0	12,267	0	0	0	12,267
2021	0	0.06914	0.06315	81,270	0	81,270	5,619	126	0	55.952	82.063	7,050	0	12,669	0	0	0	12,669
2022	0	0.07255	0.06626	81,270	0	81,270	5,896	126	0	57.071	83.704	7,191	0	13,087	0	0	0	13,087
2023	0	0.07613	0.06953	81,270	0	81,270	6,187	126	0	58.212	85.378	7,335	0	13,522	0	0	0	13,522
2024	0	0.07988	0.07296	81,270	0	81,270	6,492	126	0	59.377	87.086	7,482	0	13,974	0	0	0	13,974
2025	0	0.08382	0.07656	81,270	0	81,270	6,812	126	0	60.564	88.827	7,631	0	14,443	0	0	0	14,443
2026	0	0.08796	0.08033	63,210	0	63,210	5,560	98	0	61.775	90.604	6,054	0	11,614	0	0	0	11,614
2027	0	0.09229	0.08429	36,120	0	36,120	3,334	56	0	63.011	92.416	3,529	0	6,863	0	0	0	6,863
2028	0	0.09684	0.08845	0	0	0	0	0	0	64.271	94.264	0	0	0	0	0	0	0
2029	0	0.10162	0.09281	0	0	0	0	0	0	65.557	96.150	0	0	0	0	0	0	0
2030	0	0.10663	0.09739	0	0	0	0	0	0	66.868	98.073	0	0	0	0	0	0	0
Total =				1,219,050	0			1,890	0					$215,344			$58,741	$156,603
													NPV =	$110,275			$51,845	58,430

Total NPV = $58,430
Benefit/Cost Ratio = 2.13

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical AC - Packaged Systems**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$555	$3,059	$3,614	$7,988	$4,960	$12,948	($9,334)
2012	1,450	8,004	9,454	12,058	7,440	19,498	(10,044)
2013	2,791	14,942	17,733	16,178	9,920	26,098	(8,365)
2014	2,924	15,540	18,464	0	0	0	18,464
2015	3,221	16,162	19,383	0	0	0	19,383
2016	3,249	16,807	20,056	0	0	0	20,056
2017	3,416	17,480	20,896	0	0	0	20,896
2018	3,713	18,179	21,892	0	0	0	21,892
2019	3,892	18,907	22,799	0	0	0	22,799
2020	4,165	19,663	23,828	0	0	0	23,828
2021	4,193	20,450	24,643	0	0	0	24,643
2022	4,222	21,267	25,489	0	0	0	25,489
2023	4,255	22,117	26,372	0	0	0	26,372
2024	4,290	23,002	27,292	0	0	0	27,292
2025	4,327	23,923	28,250	0	0	0	28,250
2026	3,397	19,370	22,767	0	0	0	22,767
2027	1,960	11,459	13,419	0	0	0	13,419
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$346,351			$58,544	$287,807
		NPV =	$164,907			$52,459	112,448

Total NPV =	$112,448
Benefit/Cost Ratio =	3.14

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$326	$359	$393
Incentive Costs =	5,000	5,000	5,000
Total Utility Project Costs =	$5,326	$5,359	$5,393
14) Direct Participant Costs ($/Part.) =	$1,997	$1,997	$1,997
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	4.950	4.950	4.950
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	4,315	4,315	4,315
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	2	2
20) Incentive/Participant =	$2,500	$2,500	$2,500
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	8,630	8,630	8,630
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	10	10	10
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$30,472	2.74
Utility Cost Test	$33,253	3.26
Societal Test	$95,742	8.64
Participant Test	$27,479	3.43
Total Resource Cost Test	$36,014	4.02

Table 1
Ratepayer Impact Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	9,275	$0.02860	$265	$0.00000	$0	11	0	11	$98.68	$1,085	$1,350	$0.01770	8,630	0	8,630	$93	$326	$5,000	$5,419	($4,069)
2	2012	18,550	0.02988	554	0.00000	0	22	0	22	102.62	2,258	2,812	0.01805	17,260	0	17,260	189	359	5,000	5,548	(2,736)
3	2013	27,825	0.03195	889	0.00000	0	33	0	33	106.73	3,522	4,411	0.01841	25,890	0	25,890	289	393	5,000	5,682	(1,271)
4	2014	27,825	0.03348	932	0.00000	0	33	0	33	111.00	3,663	4,595	0.01878	25,890	0	25,890	295	0	0	295	4,300
5	2015	27,825	0.03688	1,026	0.00000	0	33	0	33	115.44	3,810	4,836	0.01916	25,890	0	25,890	301	0	0	301	4,535
6	2016	27,825	0.03720	1,035	0.00000	0	33	0	33	120.05	3,962	4,997	0.01954	25,890	0	25,890	307	0	0	307	4,690
7	2017	27,825	0.03911	1,088	0.00000	0	33	0	33	124.86	4,120	5,208	0.01993	25,890	0	25,890	313	0	0	313	4,895
8	2018	27,825	0.04251	1,183	0.00000	0	33	0	33	129.85	4,285	5,468	0.02033	25,890	0	25,890	319	0	0	319	5,149
9	2019	27,825	0.04456	1,240	0.00000	0	33	0	33	135.05	4,457	5,697	0.02073	25,890	0	25,890	325	0	0	325	5,372
10	2020	27,825	0.04769	1,327	0.00000	0	33	0	33	140.45	4,635	5,962	0.02115	25,890	0	25,890	332	0	0	332	5,630
11	2021	27,825	0.04800	1,336	0.00000	0	33	0	33	146.07	4,820	6,156	0.02157	25,890	0	25,890	338	0	0	338	5,818
12	2022	27,825	0.04834	1,345	0.00000	0	33	0	33	151.91	5,013	6,358	0.02200	25,890	0	25,890	345	0	0	345	6,013
13	2023	27,825	0.04871	1,355	0.00000	0	33	0	33	157.98	5,213	6,568	0.02244	25,890	0	25,890	352	0	0	352	6,216
14	2024	27,825	0.04911	1,366	0.00000	0	33	0	33	164.30	5,422	6,788	0.02289	25,890	0	25,890	359	0	0	359	6,429
15	2025	27,825	0.04954	1,378	0.00000	0	33	0	33	170.88	5,639	7,017	0.02335	25,890	0	25,890	366	0	0	366	6,651
16	2026	27,825	0.05000	1,391	0.00000	0	33	0	33	177.71	5,864	7,255	0.02382	25,890	0	25,890	374	0	0	374	6,881
17	2027	27,825	0.05050	1,405	0.00000	0	33	0	33	184.82	6,099	7,504	0.02429	25,890	0	25,890	381	0	0	381	7,123
18	2028	27,825	0.05103	1,420	0.00000	0	33	0	33	192.21	6,343	7,763	0.02478	25,890	0	25,890	389	0	0	389	7,374
19	2029	27,825	0.05160	1,436	0.00000	0	33	0	33	199.90	6,597	8,033	0.02528	25,890	0	25,890	397	0	0	397	7,636
20	2030	27,825	0.05220	1,452	0.00000	0	33	0	33	207.90	6,861	8,313	0.02578	25,890	0	25,890	405	0	0	405	7,908
Total =		528,675							627			$117,091				491,910				$22,547	$94,544
											NPV =	$47,957								$17,485	30,472

Total NPV = $30,472
Benefit/Cost Ratio = 2.74

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$265	$0	$1,085	$1,350	$5,326	$5,326	($3,976)
2012	554	0	2,258	2,812	5,359	5,359	(2,547)
2013	889	0	3,522	4,411	5,393	5,393	(982)
2014	932	0	3,663	4,595	0	0	4,595
2015	1,026	0	3,810	4,836	0	0	4,836
2016	1,035	0	3,962	4,997	0	0	4,997
2017	1,088	0	4,120	5,208	0	0	5,208
2018	1,183	0	4,285	5,468	0	0	5,468
2019	1,240	0	4,457	5,697	0	0	5,697
2020	1,327	0	4,635	5,962	0	0	5,962
2021	1,336	0	4,820	6,156	0	0	6,156
2022	1,345	0	5,013	6,358	0	0	6,358
2023	1,355	0	5,213	6,568	0	0	6,568
2024	1,366	0	5,422	6,788	0	0	6,788
2025	1,378	0	5,639	7,017	0	0	7,017
2026	1,391	0	5,864	7,255	0	0	7,255
2027	1,405	0	6,099	7,504	0	0	7,504
2028	1,420	0	6,343	7,763	0	0	7,763
2029	1,436	0	6,597	8,033	0	0	8,033
2030	1,452	0	6,861	8,313	0	0	8,313
Total =				$117,091		$16,078	$101,013
			NPV =	$47,957		$14,704	33,253

Total NPV =	$33,253
Benefit/Cost Ratio =	3.26

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$265	$0	$1,085	$427	$1,777	$5,326	($1,006)	$4,320	($2,543)
2012	554	0	2,258	916	3,728	5,359	(1,006)	4,353	(625)
2013	889	0	3,522	1,480	5,891	5,393	(1,006)	4,387	1,504
2014	932	0	3,663	1,588	6,183	0	0	0	6,183
2015	1,026	0	3,810	1,721	6,557	0	0	0	6,557
2016	1,035	0	3,962	1,832	6,829	0	0	0	6,829
2017	1,088	0	4,120	1,966	7,174	0	0	0	7,174
2018	1,183	0	4,285	2,126	7,594	0	0	0	7,594
2019	1,240	0	4,457	2,282	7,979	0	0	0	7,979
2020	1,327	0	4,635	2,460	8,422	0	0	0	8,422
2021	1,336	0	4,820	2,616	8,772	0	0	0	8,772
2022	1,345	0	5,013	2,783	9,141	0	0	0	9,141
2023	1,355	0	5,213	2,961	9,529	0	0	0	9,529
2024	1,366	0	5,422	3,152	9,940	0	0	0	9,940
2025	1,378	0	5,639	3,356	10,373	0	0	0	10,373
2026	1,391	0	5,864	3,574	10,829	0	0	0	10,829
2027	1,405	0	6,099	3,808	11,312	0	0	0	11,312
2028	1,420	0	6,343	4,057	11,820	0	0	0	11,820
2029	1,436	0	6,597	4,324	12,357	0	0	0	12,357
2030	1,452	0	6,861	4,609	12,922	0	0	0	12,922
Total =					$169,129			$13,060	$156,069
				NPV =	$108,275			$12,533	95,742

Total NPV =	$95,742
Benefit/Cost Ratio =	8.64

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$5,000	$0.04273	$0.03902	8,630	0	8,630	$369	10	0	$45.900	$67.320	$459	$0	$5,828	$4,078	$0	$4,078	$1,750
2012	5,000	0.04483	0.04095	17,260	0	17,260	774	20	0	46.818	68.666	936	0	6,710	4,164	0	4,164	2,546
2013	5,000	0.04705	0.04297	25,890	0	25,890	1,218	30	0	47.754	70.040	1,433	0	7,651	4,252	0	4,252	3,399
2014	0	0.04937	0.04509	25,890	0	25,890	1,278	30	0	48.709	71.441	1,461	0	2,739	0	0	0	2,739
2015	0	0.05180	0.04731	25,890	0	25,890	1,341	30	0	49.684	72.869	1,491	0	2,832	0	0	0	2,832
2016	0	0.05435	0.04964	25,890	0	25,890	1,407	30	0	50.677	74.327	1,520	0	2,927	0	0	0	2,927
2017	0	0.05703	0.05209	25,890	0	25,890	1,477	30	0	51.691	75.813	1,551	0	3,028	0	0	0	3,028
2018	0	0.05985	0.05466	25,890	0	25,890	1,550	30	0	52.725	77.330	1,582	0	3,132	0	0	0	3,132
2019	0	0.06280	0.05735	25,890	0	25,890	1,626	30	0	53.779	78.876	1,613	0	3,239	0	0	0	3,239
2020	0	0.06589	0.06018	25,890	0	25,890	1,706	30	0	54.855	80.454	1,646	0	3,352	0	0	0	3,352
2021	0	0.06914	0.06315	25,890	0	25,890	1,790	30	0	55.952	82.063	1,679	0	3,469	0	0	0	3,469
2022	0	0.07255	0.06626	25,890	0	25,890	1,878	30	0	57.071	83.704	1,712	0	3,590	0	0	0	3,590
2023	0	0.07613	0.06953	25,890	0	25,890	1,971	30	0	58.212	85.378	1,746	0	3,717	0	0	0	3,717
2024	0	0.07988	0.07296	25,890	0	25,890	2,068	30	0	59.377	87.086	1,781	0	3,849	0	0	0	3,849
2025	0	0.08382	0.07656	25,890	0	25,890	2,170	30	0	60.564	88.827	1,817	0	3,987	0	0	0	3,987
2026	0	0.08796	0.08033	25,890	0	25,890	2,277	30	0	61.775	90.604	1,853	0	4,130	0	0	0	4,130
2027	0	0.09229	0.08429	25,890	0	25,890	2,389	30	0	63.011	92.416	1,890	0	4,279	0	0	0	4,279
2028	0	0.09684	0.08845	25,890	0	25,890	2,507	30	0	64.271	94.264	1,928	0	4,435	0	0	0	4,435
2029	0	0.10162	0.09281	25,890	0	25,890	2,631	30	0	65.557	96.150	1,967	0	4,598	0	0	0	4,598
2030	0	0.10663	0.09739	25,890	0	25,890	2,761	30	0	66.868	98.073	2,006	0	4,767	0	0	0	4,767
Total =				491,910	0			570	0					$82,259			$12,494	$69,765
													NPV =	$38,765			$11,286	27,479

Total NPV =	$27,479
Benefit/Cost Ratio =	3.43

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical AC - Water Cooled Chillers**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$265	$1,085	$1,350	$5,326	($1,006)	$4,320	($2,970)
2012	554	2,258	2,812	5,359	(1,006)	4,353	(1,541)
2013	889	3,522	4,411	5,393	(1,006)	4,387	24
2014	932	3,663	4,595	0	0	0	4,595
2015	1,026	3,810	4,836	0	0	0	4,836
2016	1,035	3,962	4,997	0	0	0	4,997
2017	1,088	4,120	5,208	0	0	0	5,208
2018	1,183	4,285	5,468	0	0	0	5,468
2019	1,240	4,457	5,697	0	0	0	5,697
2020	1,327	4,635	5,962	0	0	0	5,962
2021	1,336	4,820	6,156	0	0	0	6,156
2022	1,345	5,013	6,358	0	0	0	6,358
2023	1,355	5,213	6,568	0	0	0	6,568
2024	1,366	5,422	6,788	0	0	0	6,788
2025	1,378	5,639	7,017	0	0	0	7,017
2026	1,391	5,864	7,255	0	0	0	7,255
2027	1,405	6,099	7,504	0	0	0	7,504
2028	1,420	6,343	7,763	0	0	0	7,763
2029	1,436	6,597	8,033	0	0	0	8,033
2030	1,452	6,861	8,313	0	0	0	8,313
		Total =	$117,091			$13,060	$104,031
		NPV =	$47,957			$11,943	36,014

Total NPV =	$36,014
Benefit/Cost Ratio =	4.02

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$326	$359	$393
Incentive Costs =	5,000	5,000	5,000
Total Utility Project Costs =	$5,326	$5,359	$5,393
14) Direct Participant Costs ($/Part.) =	$7,276	$7,276	$7,276
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	11.250	11.250	11.250
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	2,762	2,762	2,762
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	2	2
20) Incentive/Participant =	$2,500	$2,500	$2,500
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	5,524	5,524	5,524
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	23	23	23
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$76,543	5.64
Utility Cost Test	$78,322	6.33
Societal Test	$167,500	4.90
Participant Test	$9,011	1.22
Total Resource Cost Test	$52,105	2.27

Table 1
Ratepayer Impact Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	5,937	$0.02860	$170	$0.00000	$0	25	0	25	$98.68	$2,467	$2,637	$0.01770	5,524	0	5,524	$59	$326	$5,000	$5,385	($2,748)
2	2012	11,874	0.02988	355	0.00000	0	50	0	50	102.62	5,131	5,486	0.01805	11,048	0	11,048	121	359	5,000	5,480	6
3	2013	17,811	0.03195	569	0.00000	0	75	0	75	106.73	8,005	8,574	0.01841	16,572	0	16,572	185	393	5,000	5,578	2,996
4	2014	17,811	0.03348	596	0.00000	0	75	0	75	111.00	8,325	8,921	0.01878	16,572	0	16,572	189	0	0	189	8,732
5	2015	17,811	0.03688	657	0.00000	0	75	0	75	115.44	8,658	9,315	0.01916	16,572	0	16,572	192	0	0	192	9,123
6	2016	17,811	0.03720	663	0.00000	0	75	0	75	120.05	9,004	9,667	0.01954	16,572	0	16,572	196	0	0	196	9,471
7	2017	17,811	0.03911	697	0.00000	0	75	0	75	124.86	9,365	10,062	0.01993	16,572	0	16,572	200	0	0	200	9,862
8	2018	17,811	0.04251	757	0.00000	0	75	0	75	129.85	9,739	10,496	0.02033	16,572	0	16,572	204	0	0	204	10,292
9	2019	17,811	0.04456	794	0.00000	0	75	0	75	135.05	10,129	10,923	0.02073	16,572	0	16,572	208	0	0	208	10,715
10	2020	17,811	0.04769	849	0.00000	0	75	0	75	140.45	10,534	11,383	0.02115	16,572	0	16,572	212	0	0	212	11,171
11	2021	17,811	0.04800	855	0.00000	0	75	0	75	146.07	10,955	11,810	0.02157	16,572	0	16,572	217	0	0	217	11,593
12	2022	17,811	0.04834	861	0.00000	0	75	0	75	151.91	11,393	12,254	0.02200	16,572	0	16,572	221	0	0	221	12,033
13	2023	17,811	0.04871	868	0.00000	0	75	0	75	157.98	11,849	12,717	0.02244	16,572	0	16,572	225	0	0	225	12,492
14	2024	17,811	0.04911	875	0.00000	0	75	0	75	164.30	12,323	13,198	0.02289	16,572	0	16,572	230	0	0	230	12,968
15	2025	17,811	0.04954	882	0.00000	0	75	0	75	170.88	12,816	13,698	0.02335	16,572	0	16,572	235	0	0	235	13,463
16	2026	17,811	0.05000	891	0.00000	0	75	0	75	177.71	13,328	14,219	0.02382	16,572	0	16,572	239	0	0	239	13,980
17	2027	17,811	0.05050	899	0.00000	0	75	0	75	184.82	13,862	14,761	0.02429	16,572	0	16,572	244	0	0	244	14,517
18	2028	17,811	0.05103	909	0.00000	0	75	0	75	192.21	14,416	15,325	0.02478	16,572	0	16,572	249	0	0	249	15,076
19	2029	17,811	0.05160	919	0.00000	0	75	0	75	199.90	14,993	15,912	0.02528	16,572	0	16,572	254	0	0	254	15,658
20	2030	17,811	0.05220	930	0.00000	0	75	0	75	207.90	15,593	16,523	0.02578	16,572	0	16,572	259	0	0	259	16,264
Total =		338,409							1,425			$227,881				314,868				$20,217	$207,664
											NPV =	$93,026								$16,483	76,543

Total NPV = $76,543
Benefit/Cost Ratio = 5.64

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$170	$0	$2,467	$2,637	$5,326	$5,326	($2,689)
2012	355	0	5,131	5,486	5,359	5,359	127
2013	569	0	8,005	8,574	5,393	5,393	3,181
2014	596	0	8,325	8,921	0	0	8,921
2015	657	0	8,658	9,315	0	0	9,315
2016	663	0	9,004	9,667	0	0	9,667
2017	697	0	9,365	10,062	0	0	10,062
2018	757	0	9,739	10,496	0	0	10,496
2019	794	0	10,129	10,923	0	0	10,923
2020	849	0	10,534	11,383	0	0	11,383
2021	855	0	10,955	11,810	0	0	11,810
2022	861	0	11,393	12,254	0	0	12,254
2023	868	0	11,849	12,717	0	0	12,717
2024	875	0	12,323	13,198	0	0	13,198
2025	882	0	12,816	13,698	0	0	13,698
2026	891	0	13,328	14,219	0	0	14,219
2027	899	0	13,862	14,761	0	0	14,761
2028	909	0	14,416	15,325	0	0	15,325
2029	919	0	14,993	15,912	0	0	15,912
2030	930	0	15,593	16,523	0	0	16,523
Total =				$227,881		$16,078	$211,803
			NPV =	$93,026		$14,704	78,322

Total NPV =	$78,322
Benefit/Cost Ratio =	6.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$170	$0	$2,467	$834	$3,471	$5,326	$9,552	$14,878	($11,407)
2012	355	0	5,131	1,787	7,273	5,359	9,552	14,911	(7,638)
2013	569	0	8,005	2,876	11,450	5,393	9,552	14,945	(3,495)
2014	596	0	8,325	3,082	12,003	0	0	0	12,003
2015	657	0	8,658	3,315	12,630	0	0	0	12,630
2016	663	0	9,004	3,544	13,211	0	0	0	13,211
2017	697	0	9,365	3,799	13,861	0	0	0	13,861
2018	757	0	9,739	4,082	14,578	0	0	0	14,578
2019	794	0	10,129	4,375	15,298	0	0	0	15,298
2020	849	0	10,534	4,696	16,079	0	0	0	16,079
2021	855	0	10,955	5,019	16,829	0	0	0	16,829
2022	861	0	11,393	5,364	17,618	0	0	0	17,618
2023	868	0	11,849	5,733	18,450	0	0	0	18,450
2024	875	0	12,323	6,129	19,327	0	0	0	19,327
2025	882	0	12,816	6,552	20,250	0	0	0	20,250
2026	891	0	13,328	7,005	21,224	0	0	0	21,224
2027	899	0	13,862	7,490	22,251	0	0	0	22,251
2028	909	0	14,416	8,010	23,335	0	0	0	23,335
2029	919	0	14,993	8,566	24,478	0	0	0	24,478
2030	930	0	15,593	9,162	25,685	0	0	0	25,685
Total =					$329,301			$44,734	$284,567
				NPV =	$210,436			$42,936	167,500

Total NPV =	$167,500
Benefit/Cost Ratio =	4.90

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$5,000	$0.04273	$0.03902	5,524	0	5,524	$236	23	0	$45.900	$67.320	$1,056	$0	$6,292	$14,859	$0	$14,859	($8,567)
2012	5,000	0.04483	0.04095	11,048	0	11,048	495	45	0	46.818	68.666	2,107	0	7,602	15,173	0	15,173	(7,571)
2013	5,000	0.04705	0.04297	16,572	0	16,572	780	68	0	47.754	70.040	3,247	0	9,027	15,493	0	15,493	(6,466)
2014	0	0.04937	0.04509	16,572	0	16,572	818	68	0	48.709	71.441	3,312	0	4,130	0	0	0	4,130
2015	0	0.05180	0.04731	16,572	0	16,572	858	68	0	49.684	72.869	3,379	0	4,237	0	0	0	4,237
2016	0	0.05435	0.04964	16,572	0	16,572	901	68	0	50.677	74.327	3,446	0	4,347	0	0	0	4,347
2017	0	0.05703	0.05209	16,572	0	16,572	945	68	0	51.691	75.813	3,515	0	4,460	0	0	0	4,460
2018	0	0.05985	0.05466	16,572	0	16,572	992	68	0	52.725	77.330	3,585	0	4,577	0	0	0	4,577
2019	0	0.06280	0.05735	16,572	0	16,572	1,041	68	0	53.779	78.876	3,657	0	4,698	0	0	0	4,698
2020	0	0.06589	0.06018	16,572	0	16,572	1,092	68	0	54.855	80.454	3,730	0	4,822	0	0	0	4,822
2021	0	0.06914	0.06315	16,572	0	16,572	1,146	68	0	55.952	82.063	3,805	0	4,951	0	0	0	4,951
2022	0	0.07255	0.06626	16,572	0	16,572	1,202	68	0	57.071	83.704	3,881	0	5,083	0	0	0	5,083
2023	0	0.07613	0.06953	16,572	0	16,572	1,262	68	0	58.212	85.378	3,958	0	5,220	0	0	0	5,220
2024	0	0.07988	0.07296	16,572	0	16,572	1,324	68	0	59.377	87.086	4,038	0	5,362	0	0	0	5,362
2025	0	0.08382	0.07656	16,572	0	16,572	1,389	68	0	60.564	88.827	4,118	0	5,507	0	0	0	5,507
2026	0	0.08796	0.08033	16,572	0	16,572	1,458	68	0	61.775	90.604	4,201	0	5,659	0	0	0	5,659
2027	0	0.09229	0.08429	16,572	0	16,572	1,529	68	0	63.011	92.416	4,285	0	5,814	0	0	0	5,814
2028	0	0.09684	0.08845	16,572	0	16,572	1,605	68	0	64.271	94.264	4,370	0	5,975	0	0	0	5,975
2029	0	0.10162	0.09281	16,572	0	16,572	1,684	68	0	65.557	96.150	4,458	0	6,142	0	0	0	6,142
2030	0	0.10663	0.09739	16,572	0	16,572	1,767	68	0	66.868	98.073	4,547	0	6,314	0	0	0	6,314
Total =				314,868	0			1,292	0					$110,219			$45,525	$64,694
													NPV =	$50,135			$41,124	9,011

Total NPV = $9,011
Benefit/Cost Ratio = 1.22

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial AC - Centrifugal Chillers**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$170	$2,467	$2,637	$5,326	$9,552	$14,878	($12,241)
2012	355	5,131	5,486	5,359	9,552	14,911	(9,425)
2013	569	8,005	8,574	5,393	9,552	14,945	(6,371)
2014	596	8,325	8,921	0	0	0	8,921
2015	657	8,658	9,315	0	0	0	9,315
2016	663	9,004	9,667	0	0	0	9,667
2017	697	9,365	10,062	0	0	0	10,062
2018	757	9,739	10,496	0	0	0	10,496
2019	794	10,129	10,923	0	0	0	10,923
2020	849	10,534	11,383	0	0	0	11,383
2021	855	10,955	11,810	0	0	0	11,810
2022	861	11,393	12,254	0	0	0	12,254
2023	868	11,849	12,717	0	0	0	12,717
2024	875	12,323	13,198	0	0	0	13,198
2025	882	12,816	13,698	0	0	0	13,698
2026	891	13,328	14,219	0	0	0	14,219
2027	899	13,862	14,761	0	0	0	14,761
2028	909	14,416	15,325	0	0	0	15,325
2029	919	14,993	15,912	0	0	0	15,912
2030	930	15,593	16,523	0	0	0	16,523
		Total =	$227,881			$44,734	$183,147
		NPV =	$93,026			$40,921	52,105

Total NPV = $52,105
Benefit/Cost Ratio = 2.27

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$3,256	$5,029	$7,852
Incentive Costs =	50,000	70,000	100,000
Total Utility Project Costs =	$53,256	$75,029	$107,852
14) Direct Participant Costs ($/Part.) =	$20,000	$20,000	$20,000
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	10	10	10
16) Avg Summer kW/part. Saved =	15.000	15.000	15.000
16a) Avg Winter kW/part Saved =	15.000	15.000	15.000
17) Avg. Summer kWh/Part. Saved =	50,000	50,000	50,000
17a) Avg. Winter kWh/Part. Saved =	50,000	50,000	50,000
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	5	7	10
20) Incentive/Participant =	$10,000	$10,000	$10,000
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	250,000	350,000	500,000
Annual Winter Kwh Saved	250,000	350,000	500,000
23) Annual Summer KW Saved	75	105	150
Annual Winter KW Saved	75	105	150

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$722,588	2.95
Utility Cost Test	$882,491	5.17
Societal Test	$1,555,567	4.59
Participant Test	$688,643	2.69
Total Resource Cost Test	$685,394	2.68

Table 1
Ratepayer Impact Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	537,376	$0.02860	$15,369	$0.00000	$0	84	84	168	$98.68	$16,578	$31,947	$0.01770	250,000	250,000	500,000	$5,364	$3,256	$50,000	$58,620	($26,673)
2	2012	1,289,700	0.02988	38,536	0.00000	0	201	201	402	102.62	41,253	79,789	0.01805	600,000	600,000	1,200,000	13,129	5,029	70,000	88,158	(8,369)
3	2013	2,364,450	0.03195	75,544	0.00000	0	368	368	736	106.73	78,553	154,097	0.01841	1,100,000	1,100,000	2,200,000	24,549	7,852	100,000	132,401	21,696
4	2014	2,364,450	0.03348	79,162	0.00000	0	368	368	736	111.00	81,696	160,858	0.01878	1,100,000	1,100,000	2,200,000	25,043	0	0	25,043	135,815
5	2015	2,364,450	0.03688	87,201	0.00000	0	368	368	736	115.44	84,964	172,165	0.01916	1,100,000	1,100,000	2,200,000	25,549	0	0	25,549	146,616
6	2016	2,364,450	0.03720	87,958	0.00000	0	368	368	736	120.05	88,357	176,315	0.01954	1,100,000	1,100,000	2,200,000	26,056	0	0	26,056	150,259
7	2017	2,364,450	0.03911	92,474	0.00000	0	368	368	736	124.86	91,897	184,371	0.01993	1,100,000	1,100,000	2,200,000	26,576	0	0	26,576	157,795
8	2018	2,364,450	0.04251	100,513	0.00000	0	368	368	736	129.85	95,570	196,083	0.02033	1,100,000	1,100,000	2,200,000	27,110	0	0	27,110	168,973
9	2019	2,364,450	0.04456	105,360	0.00000	0	368	368	736	135.05	99,397	204,757	0.02073	1,100,000	1,100,000	2,200,000	27,643	0	0	27,643	177,114
10	2020	2,364,450	0.04769	112,761	0.00000	0	368	368	736	140.45	103,371	216,132	0.02115	1,100,000	1,100,000	2,200,000	28,203	0	0	28,203	187,929
11	2021	1,827,076	0.04800	87,700	0.00000	0	285	285	570	146.07	83,260	170,960	0.02157	850,000	850,000	1,700,000	22,226	0	0	22,226	148,734
12	2022	1,074,750	0.04834	51,953	0.00000	0	167	167	334	151.91	50,738	102,691	0.02200	500,000	500,000	1,000,000	13,335	0	0	13,335	89,356
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.02244	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.02289	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.02335	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.02382	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.02429	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.02478	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.02528	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.02578	0	0	0	0	0	0	0	0
Total =		23,644,502							7,362			$1,850,165				22,000,000				$500,920	$1,349,245
											NPV =	$1,093,967								$371,379	722,588

Total NPV = $722,588
Benefit/Cost Ratio = 2.95

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$15,369	$0	$16,578	$31,947	$53,256	$53,256	($21,309)
2012	38,536	0	41,253	79,789	75,029	75,029	4,760
2013	75,544	0	78,553	154,097	107,852	107,852	46,245
2014	79,162	0	81,696	160,858	0	0	160,858
2015	87,201	0	84,964	172,165	0	0	172,165
2016	87,958	0	88,357	176,315	0	0	176,315
2017	92,474	0	91,897	184,371	0	0	184,371
2018	100,513	0	95,570	196,083	0	0	196,083
2019	105,360	0	99,397	204,757	0	0	204,757
2020	112,761	0	103,371	216,132	0	0	216,132
2021	87,700	0	83,260	170,960	0	0	170,960
2022	51,953	0	50,738	102,691	0	0	102,691
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$1,850,165		$236,137	$1,614,028
			NPV =	$1,093,967		$211,476	882,491

Total NPV =	$882,491
Benefit/Cost Ratio =	5.17

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits					Costs			
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Annual Benefits Less Costs (I)
2011	$15,369	$0	$16,578	$10,102	$42,049	$53,256	$50,000	$103,256	($61,207)
2012	38,536	0	41,253	25,987	105,776	75,029	70,000	145,029	(39,253)
2013	75,544	0	78,553	51,694	205,791	107,852	100,000	207,852	(2,061)
2014	79,162	0	81,696	55,581	216,439	0	0	0	216,439
2015	87,201	0	84,964	61,273	233,438	0	0	0	233,438
2016	87,958	0	88,357	64,633	240,948	0	0	0	240,948
2017	92,474	0	91,897	69,613	253,984	0	0	0	253,984
2018	100,513	0	95,570	76,256	272,339	0	0	0	272,339
2019	105,360	0	99,397	82,019	286,776	0	0	0	286,776
2020	112,761	0	103,371	89,172	305,304	0	0	0	305,304
2021	87,700	0	83,260	72,651	243,611	0	0	0	243,611
2022	51,953	0	50,738	44,949	147,640	0	0	0	147,640
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$2,554,095			$456,137	$2,097,958
				NPV =	$1,989,240			$433,673	1,555,567

Total NPV = $1,555,567
Benefit/Cost Ratio = 4.59

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$50,000	$0.04273	$0.03902	250,000	250,000	500,000	$20,438	75	75	$45.900	$67.320	$8,492	$0	$78,930	$102,110	$0	$102,110	($23,180)
2012	70,000	0.04483	0.04095	600,000	600,000	1,200,000	51,468	180	180	46.818	68.666	20,787	0	142,255	145,970	0	145,970	(3,715)
2013	100,000	0.04705	0.04297	1,100,000	1,100,000	2,200,000	99,022	330	330	47.754	70.040	38,872	0	237,894	212,929	0	212,929	24,965
2014	0	0.04937	0.04509	1,100,000	1,100,000	2,200,000	103,906	330	330	48.709	71.441	39,649	0	143,555	0	0	0	143,555
2015	0	0.05180	0.04731	1,100,000	1,100,000	2,200,000	109,021	330	330	49.684	72.869	40,443	0	149,464	0	0	0	149,464
2016	0	0.05435	0.04964	1,100,000	1,100,000	2,200,000	114,389	330	330	50.677	74.327	41,251	0	155,640	0	0	0	155,640
2017	0	0.05703	0.05209	1,100,000	1,100,000	2,200,000	120,032	330	330	51.691	75.813	42,076	0	162,108	0	0	0	162,108
2018	0	0.05985	0.05466	1,100,000	1,100,000	2,200,000	125,961	330	330	52.725	77.330	42,918	0	168,879	0	0	0	168,879
2019	0	0.06280	0.05735	1,100,000	1,100,000	2,200,000	132,165	330	330	53.779	78.876	43,776	0	175,941	0	0	0	175,941
2020	0	0.06589	0.06018	1,100,000	1,100,000	2,200,000	138,677	330	330	54.855	80.454	44,652	0	183,329	0	0	0	183,329
2021	0	0.06914	0.06315	850,000	850,000	1,700,000	112,447	255	255	55.952	82.063	35,194	0	147,641	0	0	0	147,641
2022	0	0.07255	0.06626	500,000	500,000	1,000,000	69,405	150	150	57.071	83.704	21,116	0	90,521	0	0	0	90,521
2023	0	0.07613	0.06953	0	0	0	0	0	0	58.212	85.378	0	0	0	0	0	0	0
2024	0	0.07988	0.07296	0	0	0	0	0	0	59.377	87.086	0	0	0	0	0	0	0
2025	0	0.08382	0.07656	0	0	0	0	0	0	60.564	88.827	0	0	0	0	0	0	0
2026	0	0.08796	0.08033	0	0	0	0	0	0	61.775	90.604	0	0	0	0	0	0	0
2027	0	0.09229	0.08429	0	0	0	0	0	0	63.011	92.416	0	0	0	0	0	0	0
2028	0	0.09684	0.08845	0	0	0	0	0	0	64.271	94.264	0	0	0	0	0	0	0
2029	0	0.10162	0.09281	0	0	0	0	0	0	65.557	96.150	0	0	0	0	0	0	0
2030	0	0.10663	0.09739	0	0	0	0	0	0	66.868	98.073	0	0	0	0	0	0	0
Total =				11,000,000	11,000,000			3,300	3,300					$1,836,157			$461,009	$1,375,148
													NPV =	$1,095,333			$406,691	688,643

Total NPV =	$688,643
Benefit/Cost Ratio =	2.69

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Partnership Program (Custom)**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$15,369	$16,578	$31,947	$53,256	$50,000	$103,256	($71,309)
2012	38,536	41,253	79,789	75,029	70,000	145,029	(65,240)
2013	75,544	78,553	154,097	107,852	100,000	207,852	(53,755)
2014	79,162	81,696	160,858	0	0	0	160,858
2015	87,201	84,964	172,165	0	0	0	172,165
2016	87,958	88,357	176,315	0	0	0	176,315
2017	92,474	91,897	184,371	0	0	0	184,371
2018	100,513	95,570	196,083	0	0	0	196,083
2019	105,360	99,397	204,757	0	0	0	204,757
2020	112,761	103,371	216,132	0	0	0	216,132
2021	87,700	83,260	170,960	0	0	0	170,960
2022	51,953	50,738	102,691	0	0	0	102,691
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$1,850,165			$456,137	$1,394,028
		NPV =	$1,093,967			$408,573	685,394

Total NPV =	$685,394
Benefit/Cost Ratio =	2.68

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
NORTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.04072
Retail Rate Winter ($/kWh) =	$0.03719
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00830
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$45.00
3a) Retail Winter Demand Rate ($/kW/season) =	$66.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.01735
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$0	$0	$0
Incentive Costs =	0	0	0
Direct Program Costs =	0	207,144	414,288
Total Utility Project Costs =	$0	$207,144	$414,288
14) Direct Participant Costs ($/Part.) =	$0	$0	$0
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	10	10	10
16) Avg Summer kW/part. Saved =	400.000	400.000	400.000
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	10,000	10,000	10,000
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	0	9	18
20) Incentive/Participant =	$0	$0	$0
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	90,000	180,000
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	3,600	7,200
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$5,022,222	2.34
Utility Cost Test	$5,022,222	2.34
Societal Test	$11,317,656	3.26
Participant Test	$3,124,794	#DIV/0!
Total Resource Cost Test	$5,022,222	2.34

Table 1
Ratepayer Impact Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Direct Program Costs (O)	Costs: Total Project Costs (P)	Annual Benefits Less Costs (Q)
1	2011	0	$0.02860	$0	$0.00000	$0	0	0	0	$98.68	$0	$0	$0.01770	0	0	0	$0	$0	$0	$0	$0	$0
2	2012	96,728	0.02988	2,890	0.00000	0	4,019	0	4,019	102.62	412,430	415,320	0.01805	90,000	0	90,000	985	0	0	207,144	208,129	207,191
3	2013	290,183	0.03195	9,271	0.00000	0	12,058	0	12,058	106.73	1,286,950	1,296,221	0.01841	270,000	0	270,000	3,013	0	0	621,432	624,445	671,776
4	2014	290,183	0.03348	9,715	0.00000	0	12,058	0	12,058	111.00	1,338,438	1,348,153	0.01878	270,000	0	270,000	3,073	0	0	621,432	624,505	723,648
5	2015	290,183	0.03688	10,702	0.00000	0	12,058	0	12,058	115.44	1,391,976	1,402,678	0.01916	270,000	0	270,000	3,136	0	0	621,432	624,568	778,110
6	2016	290,183	0.03720	10,795	0.00000	0	12,058	0	12,058	120.05	1,447,563	1,458,358	0.01954	270,000	0	270,000	3,198	0	0	621,432	624,630	833,728
7	2017	290,183	0.03911	11,349	0.00000	0	12,058	0	12,058	124.86	1,505,562	1,516,911	0.01993	270,000	0	270,000	3,262	0	0	621,432	624,694	892,217
8	2018	290,183	0.04251	12,336	0.00000	0	12,058	0	12,058	129.85	1,565,731	1,578,067	0.02033	270,000	0	270,000	3,327	0	0	621,432	624,759	953,308
9	2019	290,183	0.04456	12,931	0.00000	0	12,058	0	12,058	135.05	1,628,433	1,641,364	0.02073	270,000	0	270,000	3,393	0	0	621,432	624,825	1,016,539
10	2020	290,183	0.04769	13,839	0.00000	0	12,058	0	12,058	140.45	1,693,546	1,707,385	0.02115	270,000	0	270,000	3,461	0	0	621,432	624,893	1,082,492
11	2021	290,183	0.04800	13,929	0.00000	0	12,058	0	12,058	146.07	1,761,312	1,775,241	0.02157	270,000	0	270,000	3,530	0	0	621,432	624,962	1,150,279
12	2022	193,455	0.04834	9,352	0.00000	0	8,039	0	8,039	151.91	1,221,204	1,230,556	0.02200	180,000	0	180,000	2,400	0	0	621,432	623,832	606,724
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.02244	0	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.02289	0	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.02335	0	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.02382	0	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.02429	0	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.02478	0	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.02528	0	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.02578	0	0	0	0	0	0	0	0	0
Total =		2,901,830							120,580			$15,370,254				2,700,000					$6,454,242	$8,916,012
											NPV =	$8,772,989									$3,750,767	5,022,222

Total NPV = $5,022,222
Benefit/Cost Ratio = 2.34

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	2,890	0	412,430	415,320	208,129	208,129	207,191
2013	9,271	0	1,286,950	1,296,221	624,445	624,445	671,776
2014	9,715	0	1,338,438	1,348,153	624,505	624,505	723,648
2015	10,702	0	1,391,976	1,402,678	624,568	624,568	778,110
2016	10,795	0	1,447,563	1,458,358	624,630	624,630	833,728
2017	11,349	0	1,505,562	1,516,911	624,694	624,694	892,217
2018	12,336	0	1,565,731	1,578,067	624,759	624,759	953,308
2019	12,931	0	1,628,433	1,641,364	624,825	624,825	1,016,539
2020	13,839	0	1,693,546	1,707,385	624,893	624,893	1,082,492
2021	13,929	0	1,761,312	1,775,241	624,962	624,962	1,150,279
2022	9,352	0	1,221,204	1,230,556	623,832	623,832	606,724
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$15,370,254		$6,454,242	$8,916,012
			NPV =	$8,772,989		$3,750,767	5,022,222

Total NPV =	$5,022,222
Benefit/Cost Ratio =	2.34

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	2,890	0	412,430	135,268	550,588	208,129	0	208,129	342,459
2013	9,271	0	1,286,950	434,840	1,731,061	624,445	0	624,445	1,106,616
2014	9,715	0	1,338,438	465,829	1,813,982	624,505	0	624,505	1,189,477
2015	10,702	0	1,391,976	499,209	1,901,887	624,568	0	624,568	1,277,319
2016	10,795	0	1,447,563	534,596	1,992,954	624,630	0	624,630	1,368,324
2017	11,349	0	1,505,562	572,742	2,089,653	624,694	0	624,694	1,464,959
2018	12,336	0	1,565,731	613,708	2,191,775	624,759	0	624,759	1,567,016
2019	12,931	0	1,628,433	657,474	2,298,838	624,825	0	624,825	1,674,013
2020	13,839	0	1,693,546	704,437	2,411,822	624,893	0	624,893	1,786,929
2021	13,929	0	1,761,312	754,406	2,529,647	624,962	0	624,962	1,904,685
2022	9,352	0	1,221,204	538,625	1,769,181	623,832	0	623,832	1,145,349
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$21,281,388			$6,454,242	$14,827,146
				NPV =	$16,319,850			$5,002,194	11,317,656

Total NPV = $11,317,656
Benefit/Cost Ratio = 3.26

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits														Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$0	$0.04273	$0.03902	0	0	0	$0	0	0	$45.900	$67.320	$0	$0	$0	$0	$0	$0	$0
2012	0	0.04483	0.04095	90,000	0	90,000	4,035	3,600	0	46.818	68.666	168,545	0	172,580	0	0	0	172,580
2013	0	0.04705	0.04297	270,000	0	270,000	12,704	10,800	0	47.754	70.040	515,743	0	528,447	0	0	0	528,447
2014	0	0.04937	0.04509	270,000	0	270,000	13,330	10,800	0	48.709	71.441	526,057	0	539,387	0	0	0	539,387
2015	0	0.05180	0.04731	270,000	0	270,000	13,986	10,800	0	49.684	72.869	536,587	0	550,573	0	0	0	550,573
2016	0	0.05435	0.04964	270,000	0	270,000	14,675	10,800	0	50.677	74.327	547,312	0	561,987	0	0	0	561,987
2017	0	0.05703	0.05209	270,000	0	270,000	15,398	10,800	0	51.691	75.813	558,263	0	573,661	0	0	0	573,661
2018	0	0.05985	0.05466	270,000	0	270,000	16,160	10,800	0	52.725	77.330	569,430	0	585,590	0	0	0	585,590
2019	0	0.06280	0.05735	270,000	0	270,000	16,956	10,800	0	53.779	78.876	580,813	0	597,769	0	0	0	597,769
2020	0	0.06589	0.06018	270,000	0	270,000	17,790	10,800	0	54.855	80.454	592,434	0	610,224	0	0	0	610,224
2021	0	0.06914	0.06315	270,000	0	270,000	18,668	10,800	0	55.952	82.063	604,282	0	622,950	0	0	0	622,950
2022	0	0.07255	0.06626	180,000	0	180,000	13,059	7,200	0	57.071	83.704	410,911	0	423,970	0	0	0	423,970
2023	0	0.07613	0.06953	0	0	0	0	0	0	58.212	85.378	0	0	0	0	0	0	0
2024	0	0.07988	0.07296	0	0	0	0	0	0	59.377	87.086	0	0	0	0	0	0	0
2025	0	0.08382	0.07656	0	0	0	0	0	0	60.564	88.827	0	0	0	0	0	0	0
2026	0	0.08796	0.08033	0	0	0	0	0	0	61.775	90.604	0	0	0	0	0	0	0
2027	0	0.09229	0.08429	0	0	0	0	0	0	63.011	92.416	0	0	0	0	0	0	0
2028	0	0.09684	0.08845	0	0	0	0	0	0	64.271	94.264	0	0	0	0	0	0	0
2029	0	0.10162	0.09281	0	0	0	0	0	0	65.557	96.150	0	0	0	0	0	0	0
2030	0	0.10663	0.09739	0	0	0	0	0	0	66.868	98.073	0	0	0	0	0	0	0
Total =				2,700,000	0			108,000	0					$5,767,138			$0	$5,767,138
													NPV =	$3,124,794			$0	3,124,794

Total NPV = $3,124,794
Benefit/Cost Ratio = #DIV/0!

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Demand Response Program**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	2,890	412,430	415,320	208,129	0	208,129	207,191
2013	9,271	1,286,950	1,296,221	624,445	0	624,445	671,776
2014	9,715	1,338,438	1,348,153	624,505	0	624,505	723,648
2015	10,702	1,391,976	1,402,678	624,568	0	624,568	778,110
2016	10,795	1,447,563	1,458,358	624,630	0	624,630	833,728
2017	11,349	1,505,562	1,516,911	624,694	0	624,694	892,217
2018	12,336	1,565,731	1,578,067	624,759	0	624,759	953,308
2019	12,931	1,628,433	1,641,364	624,825	0	624,825	1,016,539
2020	13,839	1,693,546	1,707,385	624,893	0	624,893	1,082,492
2021	13,929	1,761,312	1,775,241	624,962	0	624,962	1,150,279
2022	9,352	1,221,204	1,230,556	623,832	0	623,832	606,724
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$15,370,254			$6,454,242	$8,916,012
		NPV =	$8,772,989			$3,750,767	5,022,222

Total NPV =	$5,022,222
Benefit/Cost Ratio =	2.34

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	
Retail Rate Winter ($/kWh) =	
Retail Escalation Rate =	
1a) Power Supply Cost Adjustment	
Fuel Escalation Rate =	
2) Avg. System Marginal Energy Cost ($/kWh) =	
Escalation Rate =	
3) Retail Summer Demand Rate ($/kW/season) =	
3a) Retail Winter Demand Rate ($/kW/season) =	
Escalation Rate =	
4) Electric Margin ($/kWh) =	
Escalation Rate =	
5) System Peak Shaving Demand Cost ($/kW/yr)	
Reserve Capacity=	
Escalation Rate =	
6) System Variable O&M ($/kWh) =	
Escalation Rate =	
7) Environmental Damage Factor =	
Escalation Rate =	
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$1,317	$2,321	$4,160
Incentive Costs =	$30,495	$38,355	$60,975
Total Utility Project Costs =	$31,812	$40,676	$65,135
14) Direct Participant Costs ($/Part.) =			
Escalation Rate =			
14a) Other Participant Costs (Annual $/Part.) =			
Escalation Rate =			
14b) Other Participant Savings (Annual $/Part.) =			
Escalation Rate =			
15) Project Life (Years) =			
16) Avg Summer kW/part. Saved =			
16a) Avg Winter kW/part Saved =			
17) Avg. Summer kWh/Part. Saved =			
17a) Avg. Winter kWh/Part. Saved =			
18a) System Demand Line Loss Factor			
18b) System Energy Line Loss Factor			
19) Number of Participants =	32	97	340
20) Incentive/Participant =			
21) Effective Federal & State Income Tax Rate =			
22) Annual Summer Kwh Saved	92,422	125,870	164,016
Annual Winter Kwh Saved	93,885	124,429	153,158
23) Annual Summer KW Saved	62	480	1,103
Annual Winter KW Saved	29	41	51

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$1,475,316	5.38
Utility Cost Test	$1,622,034	9.53
Societal Test	$2,695,017	4.07
Participant Test	$615,178	4.00
Total Resource Cost Test	$1,098,675	2.54

Table 1
Ratepayer Impact Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

		Benefits											Costs					Annual
t	Year	Summer kWh Requirements Reduction (A1)	Winter kWh Requirements Reduction (A2)	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Total Energy Reduction (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Project Costs (O)	Benefits Less Costs (P)
1	2011	99,331	100,904	200,235		$5,727		$0	107		$10,558	$16,285		186,307	$4,414	$1,317	$30,495	$36,226	($19,941)
2	2012	234,610	234,634	469,244		14,021		0	687		70,500	84,521		436,606	10,598	2,321	38,355	51,274	33,247
3	2013	410,887	399,240	810,127		25,887		0	1,979		211,219	237,106		753,780	18,789	4,160	60,975	83,924	153,182
4	2014	410,887	399,240	810,127		27,123		0	1,979		219,669	246,792		753,780	19,167	682	10,000	29,849	216,943
5	2015	410,887	399,240	810,127		29,877		0	1,979		228,457	258,334		753,780	19,547	682	10,000	30,229	228,105
6	2016	409,673	399,240	808,913		30,089		0	1,977		237,339	267,428		752,650	19,895	682	10,000	30,577	236,851
7	2017	407,851	399,240	807,091		31,564		0	1,975		246,597	278,161		750,955	20,221	682	10,000	30,903	247,258
8	2018	405,422	399,240	804,662		34,206		0	1,971		255,934	290,140		748,695	20,532	682	10,000	31,214	258,926
9	2019	405,422	399,240	804,662		35,856		0	1,971		266,184	302,040		748,695	20,939	682	10,000	31,621	270,419
10	2020	405,259	399,240	804,499		38,368		0	1,970		276,688	315,056		748,543	21,351	682	10,000	32,033	283,023
11	2021	351,357	345,502	696,859		33,450		0	1,936		282,792	316,242		648,391	18,960	682	10,000	29,642	286,600
12	2022	286,709	291,765	578,474		27,964		0	1,457		221,335	249,299		538,239	16,176	682	10,000	26,858	222,441
13	2023	211,476	238,027	449,503		21,897		0	530		83,731	105,628		418,239	12,989	682	10,000	23,671	81,957
14	2024	211,476	238,027	449,503		22,075		0	530		87,079	109,154		418,239	13,246	682	10,000	23,928	85,226
15	2025	205,214	236,944	442,158		21,905		0	525		89,713	111,618		411,405	13,180	682	10,000	23,862	87,756
16	2026	177,577	220,654	398,231		19,911		0	492		87,433	107,344		370,533	11,933	682	10,000	22,615	84,729
17	2027	129,843	189,160	319,003		16,110		0	442		81,690	97,800		296,816	9,400	682	10,000	20,082	77,718
18	2028	102,195	158,749	260,944		13,316		0	179		34,405	47,721		242,795	7,844	0	0	7,844	39,877
19	2029	88,939	132,239	221,178		11,413		0	155		30,984	42,397		205,795	6,782	0	0	6,782	35,615
20	2030	69,055	92,474	161,529		8,432		0	121		25,155	33,587		150,295	5,052	0	0	5,052	28,535
Total =				11,107,069					22,962			$3,516,653		10,334,538				$578,186	$2,938,467
											NPV =	$1,812,084						$336,768	1,475,316

Total NPV = $1,475,316
Benefit/Cost Ratio = 5.38

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated

(K = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M = Program Admin Costs (13)
(N = Incentive/Participant (20) x Number of Participants (19)
(O = (L) + (M) + (N)
(P = (I) - (O)

Table 2
Utility Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$5,727	$0	$10,558	$16,285	$31,812	$31,812	($15,527)
2012	14,021	0	70,500	84,521	40,676	40,676	43,845
2013	25,887	0	211,219	237,106	65,135	65,135	171,971
2014	27,123	0	219,669	246,792	10,682	10,682	236,110
2015	29,877	0	228,457	258,334	10,682	10,682	247,652
2016	30,089	0	237,339	267,428	10,682	10,682	256,746
2017	31,564	0	246,597	278,161	10,682	10,682	267,479
2018	34,206	0	255,934	290,140	10,682	10,682	279,458
2019	35,856	0	266,184	302,040	10,682	10,682	291,358
2020	38,368	0	276,688	315,056	10,682	10,682	304,374
2021	33,450	0	282,792	316,242	10,682	10,682	305,560
2022	27,964	0	221,335	249,299	10,682	10,682	238,617
2023	21,897	0	83,731	105,628	10,682	10,682	94,946
2024	22,075	0	87,079	109,154	10,682	10,682	98,472
2025	21,905	0	89,713	111,618	10,682	10,682	100,936
2026	19,911	0	87,433	107,344	10,682	10,682	96,662
2027	16,110	0	81,690	97,800	10,682	10,682	87,118
2028	13,316	0	34,405	47,721	0	0	47,721
2029	11,413	0	30,984	42,397	0	0	42,397
2030	8,432	0	25,155	33,587	0	0	33,587
Total =				$3,516,653		$287,171	$3,229,482
			NPV =	$1,812,084		$190,050	1,622,034

Total NPV =	$1,622,034
Benefit/Cost Ratio =	9.53

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$5,727	$0	$10,558	$5,150	$21,435	$31,812	$25,903	$57,715	($36,280)
2012	14,021	0	70,500	27,529	112,050	63,927	33,075	97,002	15,048
2013	25,887	0	211,219	79,540	316,646	234,503	32,136	266,639	50,007
2014	27,123	0	219,669	85,273	332,065	80,465	(10,000)	70,465	261,600
2015	29,877	0	228,457	91,941	350,275	80,479	(10,000)	70,479	279,796
2016	30,089	0	237,339	98,034	365,462	80,494	(10,000)	70,494	294,968
2017	31,564	0	246,597	105,025	383,186	80,510	(10,000)	70,510	312,676
2018	34,206	0	255,934	112,834	402,974	80,525	(10,000)	70,525	332,449
2019	35,856	0	266,184	120,987	423,027	80,541	(10,000)	70,541	352,486
2020	38,368	0	276,688	129,988	445,044	80,557	(10,000)	70,557	374,487
2021	33,450	0	282,792	134,389	450,631	80,574	(10,000)	70,574	380,057
2022	27,964	0	221,335	109,122	358,421	80,304	(7,000)	73,304	285,117
2023	21,897	0	83,731	47,621	153,249	10,682	(10,000)	682	152,567
2024	22,075	0	87,079	50,686	159,840	10,682	(10,000)	682	159,158
2025	21,905	0	89,713	53,386	165,004	10,682	(10,000)	682	164,322
2026	19,911	0	87,433	52,883	160,227	10,682	(10,000)	682	159,545
2027	16,110	0	81,690	49,626	147,426	10,682	(10,000)	682	146,744
2028	13,316	0	34,405	24,942	72,663	0	0	0	72,663
2029	11,413	0	30,984	22,824	65,221	0	0	0	65,221
2030	8,432	0	25,155	18,623	52,210	0	0	0	52,210
Total =					$4,937,056			$1,062,215	$3,874,841
				NPV =	$3,572,136			$877,119	2,695,017

Total NPV =	$2,695,017
Benefit/Cost Ratio =	4.07

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

	Benefits												Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$30,495			186,307	$11,478	62	29			$2,325	$0	$44,298	$57,589	$0	$57,589	($13,291)
2012	38,355			436,606	28,332	544	70			13,859	0	80,546	74,474	0	74,474	6,072
2013	60,975			753,780	51,585	1,650	123			35,211	0	147,771	99,130	0	99,130	48,641
2014	10,000			753,780	54,124	1,650	123			35,917	0	100,041	0	0	0	100,041
2015	10,000			753,780	56,797	1,650	123			36,633	0	103,430	0	0	0	103,430
2016	10,000			752,650	59,469	1,649	123			37,369	0	106,838	0	0	0	106,838
2017	10,000			750,955	62,200	1,646	123			38,114	0	110,314	0	0	0	110,314
2018	10,000			748,695	64,995	1,643	123			38,875	0	113,870	0	0	0	113,870
2019	10,000			748,695	68,200	1,643	123			39,655	0	117,855	0	0	0	117,855
2020	10,000			748,543	71,543	1,642	123			40,445	0	121,988	0	0	0	121,988
2021	10,000			648,391	65,261	1,627	108			40,135	0	115,396	0	0	0	115,396
2022	10,000			538,239	57,157	1,212	93			29,650	0	96,807	0	0	0	96,807
2023	10,000			418,239	47,037	397	78			8,384	0	65,421	0	0	0	65,421
2024	10,000			418,239	49,357	397	78			8,551	0	67,908	0	0	0	67,908
2025	10,000			411,405	50,638	392	78			8,722	0	69,360	0	0	0	69,360
2026	10,000			370,533	47,363	368	74			8,265	0	65,628	0	0	0	65,628
2027	10,000			296,816	38,780	332	65			7,337	0	56,117	0	0	0	56,117
2028	0			242,795	33,286	105	56			6,198	0	39,484	0	0	0	39,484
2029	0			205,795	29,605	95	46			5,448	0	35,053	0	0	0	35,053
2030	0			150,295	22,687	92	30			4,517	0	27,204	0	0	0	27,204
Total =						18,796	1,789					$1,685,329			$231,193	$1,454,136
											NPV =	$820,440			$205,262	615,178

Total NPV = $615,178
Benefit/Cost Ratio = 4.00

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Total Program with Demand Response**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$5,727	$10,558	$16,285	$31,812	$25,903	$57,715	($41,430)
2012	14,021	70,500	84,521	63,927	33,075	97,002	(12,481)
2013	25,887	211,219	237,106	234,503	32,136	266,639	(29,533)
2014	27,123	219,669	246,792	80,465	(10,000)	70,465	176,327
2015	29,877	228,457	258,334	80,479	(10,000)	70,479	187,855
2016	30,089	237,339	267,428	80,494	(10,000)	70,494	196,934
2017	31,564	246,597	278,161	80,510	(10,000)	70,510	207,651
2018	34,206	255,934	290,140	80,525	(10,000)	70,525	219,615
2019	35,856	266,184	302,040	80,541	(10,000)	70,541	231,499
2020	38,368	276,688	315,056	80,557	(10,000)	70,557	244,499
2021	33,450	282,792	316,242	80,574	(10,000)	70,574	245,668
2022	27,964	221,335	249,299	80,304	(7,000)	73,304	175,995
2023	21,897	83,731	105,628	10,682	(10,000)	682	104,946
2024	22,075	87,079	109,154	10,682	(10,000)	682	108,472
2025	21,905	89,713	111,618	10,682	(10,000)	682	110,936
2026	19,911	87,433	107,344	10,682	(10,000)	682	106,662
2027	16,110	81,690	97,800	10,682	(10,000)	682	97,118
2028	13,316	34,405	47,721	0	0	0	47,721
2029	11,413	30,984	42,397	0	0	0	42,397
2030	8,432	25,155	33,587	0	0	0	33,587
		Total =	$3,516,653			$1,062,215	$2,454,438
		NPV =	$1,812,084			$713,409	1,098,675

Total NPV =	$1,098,675
Benefit/Cost Ratio =	2.54

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Total Program with Demand Response**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =
Retail Rate Winter ($/kWh) =
Retail Escalation Rate =
1a) Power Supply Cost Adjustment
Fuel Escalation Rate =

2) Avg. System Marginal Energy Cost ($/kWh) =
Escalation Rate =

3) Retail Summer Demand Rate ($/kW/season) =
3a) Retail Winter Demand Rate ($/kW/season) =
Escalation Rate =

4) Electric Margin ($/kWh) =
Escalation Rate =

5) System Peak Shaving Demand Cost ($/kW/yr)
Reserve Capacity=
Escalation Rate =

6) System Variable O&M ($/kWh) =
Escalation Rate =

7) Environmental Damage Factor =
Escalation Rate =

8) Participant Discount Rate = 10.94%

9) Utility Discount Rate = 9.61%

10) Societal Discount Rate = 4.24%

11) General Input Data Year = 2,010

12) Project Analysis Year 1 = 2,011
Project Analysis Year 2 = 2,012
Project Analysis Year 3 = 2,013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$1,317	$2,321	$3,478
Incentive Costs =	$30,495	$38,355	$50,975
Total Utility Project Costs =	$31,812	$40,676	$54,453
14) Direct Participant Costs ($/Part.) =			
Escalation Rate =			
14a) Other Participant Costs (Annual $/Part.) =			
Escalation Rate =			
14b) Other Participant Savings (Annual $/Part.) =			
Escalation Rate =			
15) Project Life (Years) =			
16) Avg Summer kW/part. Saved =			
16a) Avg Winter kW/part Saved =			
17) Avg. Summer kWh/Part. Saved =			
17a) Avg. Winter kWh/Part. Saved =			
18a) System Demand Line Loss Factor			
18b) System Energy Line Loss Factor			
19) Number of Participants =	32	96	138
20) Incentive/Participant =			
21) Effective Federal & State Income Tax Rate =			
22) Annual Summer Kwh Saved	92,422	115,870	144,016
Annual Winter Kwh Saved	93,885	124,429	153,158
23) Annual Summer KW Saved	62	80	103
Annual Winter KW Saved	29	41	51

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$369,656	2.44
Utility Cost Test	$511,835	5.48
Societal Test	$1,083,539	5.99
Participant Test	$386,868	2.88
Total Resource Cost Test	$420,685	3.05

Table 1
Ratepayer Impact Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

		Benefits														Costs							Annual
t	Year	Summer kWh Requirements Reduction (A1)	Winter kWh Requirements Reduction (A2)	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Total Energy Reduction (K)	Lost Margin (L)	Program Admin Costs (M)	Incentive Costs (N)	Total Project Costs (O)	Benefits Less Costs (P)
1	2011	$99,331	$100,904	200,235		$5,727		$0	$72	$35	107		$10,558	$16,285		$92,422	$93,885	186,307	$4,414	$1,317	$30,495	$36,226	($19,941)
2	2012	223,862	234,634	458,496		13,700		0	161	79	240		24,629	38,329		208,292	218,314	426,606	10,363	2,321	38,355	51,039	(12,710)
3	2013	378,644	399,240	777,884		24,857		0	279	137	416		44,400	69,257		352,308	371,472	723,780	18,069	3,478	50,975	72,522	(3,265)
4	2014	378,644	399,240	777,884		26,044		0	279	137	416		46,176	72,220		352,308	371,472	723,780	18,432	0	0	18,432	53,788
5	2015	378,644	399,240	777,884		28,688		0	279	137	416		48,024	76,712		352,308	371,472	723,780	18,798	0	0	18,798	57,914
6	2016	377,430	399,240	776,670		28,890		0	277	137	414		49,701	78,591		351,178	371,472	722,650	19,131	0	0	19,131	59,460
7	2017	375,608	399,240	774,848		30,303		0	275	137	412		51,441	81,744		349,483	371,472	720,955	19,441	0	0	19,441	62,303
8	2018	373,179	399,240	772,419		32,835		0	271	137	408		52,978	85,813		347,223	371,472	718,695	19,737	0	0	19,737	66,076
9	2019	373,179	399,240	772,419		34,419		0	271	137	408		55,101	89,520		347,223	371,472	718,695	20,128	0	0	20,128	69,392
10	2020	373,016	399,240	772,256		36,830		0	270	137	407		57,165	93,995		347,071	371,472	718,543	20,524	0	0	20,524	73,471
11	2021	319,114	345,502	664,616		31,902		0	253	120	373		54,484	86,386		296,919	321,472	618,391	18,116	0	0	18,116	68,270
12	2022	265,214	291,765	556,979		26,925		0	237	104	341		51,803	78,728		246,767	271,472	518,239	15,602	0	0	15,602	63,126
13	2023	211,476	238,027	449,503		21,897		0	220	87	307		48,501	70,398		196,767	221,472	418,239	12,989	0	0	12,989	57,409
14	2024	211,476	238,027	449,503		22,075		0	220	87	307		50,440	72,515		196,767	221,472	418,239	13,246	0	0	13,246	59,269
15	2025	205,214	236,944	442,158		21,905		0	215	87	302		51,607	73,512		190,941	220,464	411,405	13,180	0	0	13,180	60,332
16	2026	177,577	220,654	398,231		19,911		0	187	82	269		47,804	67,715		165,225	205,308	370,533	11,933	0	0	11,933	55,782
17	2027	129,843	189,160	319,003		16,110		0	147	72	219		40,475	56,585		120,812	176,004	296,816	9,400	0	0	9,400	47,185
18	2028	102,195	158,749	260,944		13,316		0	117	62	179		34,405	47,721		95,087	147,708	242,795	7,844	0	0	7,844	39,877
19	2029	88,939	132,239	221,178		11,413		0	105	50	155		30,984	42,397		82,753	123,042	205,795	6,782	0	0	6,782	35,615
20	2030	69,055	92,474	161,529		8,432		0	88	33	121		25,155	33,587		64,252	86,043	150,295	5,052	0	0	5,052	28,535
Total =				10,784,639							6,217			$1,332,010				10,034,538				$410,122	$921,888
													NPV =	$626,080								$256,424	369,656

Total NPV = $369,656
Benefit/Cost Ratio = 2.44

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M = Program Admin Costs (13)
(N = Incentive/Participant (20) x Number of Participants (19)
(O = (L) + (M) + (N)
(P = (I) - (O)

Table 2
Utility Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$5,727	$0	$10,558	$16,285	$31,812	$31,812	($15,527)
2012	13,700	0	24,629	38,329	40,676	40,676	(2,347)
2013	24,857	0	44,400	69,257	54,453	54,453	14,804
2014	26,044	0	46,176	72,220	0	0	72,220
2015	28,688	0	48,024	76,712	0	0	76,712
2016	28,890	0	49,701	78,591	0	0	78,591
2017	30,303	0	51,441	81,744	0	0	81,744
2018	32,835	0	52,978	85,813	0	0	85,813
2019	34,419	0	55,101	89,520	0	0	89,520
2020	36,830	0	57,165	93,995	0	0	93,995
2021	31,902	0	54,484	86,386	0	0	86,386
2022	26,925	0	51,803	78,728	0	0	78,728
2023	21,897	0	48,501	70,398	0	0	70,398
2024	22,075	0	50,440	72,515	0	0	72,515
2025	21,905	0	51,607	73,512	0	0	73,512
2026	19,911	0	47,804	67,715	0	0	67,715
2027	16,110	0	40,475	56,585	0	0	56,585
2028	13,316	0	34,405	47,721	0	0	47,721
2029	11,413	0	30,984	42,397	0	0	42,397
2030	8,432	0	25,155	33,587	0	0	33,587
Total =				$1,332,010		$126,941	$1,205,069
			NPV =	$626,080		$114,245	511,835

Total NPV =	$511,835
Benefit/Cost Ratio =	5.48

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$5,727	$0	$10,558	$5,150	$21,435	$31,812	$25,903	$57,715	($36,280)
2012	13,700	0	24,629	12,484	50,813	40,676	33,075	73,751	(22,938)
2013	24,857	0	44,400	23,233	92,490	54,453	42,136	96,589	(4,099)
2014	26,044	0	46,176	24,953	97,173	0	0	0	97,173
2015	28,688	0	48,024	27,302	104,014	0	0	0	104,014
2016	28,890	0	49,701	28,811	107,402	0	0	0	107,402
2017	30,303	0	51,441	30,864	112,608	0	0	0	112,608
2018	32,835	0	52,978	33,372	119,185	0	0	0	119,185
2019	34,419	0	55,101	35,859	125,379	0	0	0	125,379
2020	36,830	0	57,165	38,782	132,777	0	0	0	132,777
2021	31,902	0	54,484	36,709	123,095	0	0	0	123,095
2022	26,925	0	51,803	34,461	113,189	0	0	0	113,189
2023	21,897	0	48,501	31,738	102,136	0	0	0	102,136
2024	22,075	0	50,440	33,672	106,187	0	0	0	106,187
2025	21,905	0	51,607	35,160	108,672	0	0	0	108,672
2026	19,911	0	47,804	33,360	101,075	0	0	0	101,075
2027	16,110	0	40,475	28,713	85,298	0	0	0	85,298
2028	13,316	0	34,405	24,942	72,663	0	0	0	72,663
2029	11,413	0	30,984	22,824	65,221	0	0	0	65,221
2030	8,432	0	25,155	18,623	52,210	0	0	0	52,210
Total =					$1,893,022			$228,055	$1,664,967
				NPV =	$1,300,896			$217,357	1,083,539

Total NPV =	$1,083,539
Benefit/Cost Ratio =	5.99

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Total Program without Demand Response**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$30,495			$92,422	$93,885	186,307	$11,478	62	29			$2,325	$0	$44,298	$57,589	$0	$57,589	($13,291)
2012	38,355			208,292	218,314	426,606	27,696	144	70			5,536	0	71,587	74,474	0	74,474	(2,887)
2013	50,975			352,308	371,472	723,780	49,584	250	123			9,742	0	110,301	99,130	0	99,130	11,171
2014	0			352,308	371,472	723,780	52,025	250	123			9,938	0	61,963	0	0	0	61,963
2015	0			352,308	371,472	723,780	54,594	250	123			10,135	0	64,729	0	0	0	64,729
2016	0			351,178	371,472	722,650	57,157	249	123			10,341	0	67,498	0	0	0	67,498
2017	0			349,483	371,472	720,955	59,775	246	123			10,545	0	70,320	0	0	0	70,320
2018	0			347,223	371,472	718,695	62,450	243	123			10,755	0	73,205	0	0	0	73,205
2019	0			347,223	371,472	718,695	65,530	243	123			10,973	0	76,503	0	0	0	76,503
2020	0			347,071	371,472	718,543	68,741	242	123			11,189	0	79,930	0	0	0	79,930
2021	0			296,919	321,472	618,391	62,321	227	108			10,295	0	72,616	0	0	0	72,616
2022	0			246,767	271,472	518,239	55,100	212	93			9,358	0	64,458	0	0	0	64,458
2023	0			196,767	221,472	418,239	47,037	197	78			8,384	0	55,421	0	0	0	55,421
2024	0			196,767	221,472	418,239	49,357	197	78			8,551	0	57,908	0	0	0	57,908
2025	0			190,941	220,464	411,405	50,638	192	78			8,722	0	59,360	0	0	0	59,360
2026	0			165,225	205,308	370,533	47,363	168	74			8,265	0	55,628	0	0	0	55,628
2027	0			120,812	176,004	296,816	38,780	132	65			7,337	0	46,117	0	0	0	46,117
2028	0			95,087	147,708	242,795	33,286	105	56			6,198	0	39,484	0	0	0	39,484
2029	0			82,753	123,042	205,795	29,605	95	46			5,448	0	35,053	0	0	0	35,053
2030	0			64,252	86,043	150,295	22,687	92	30			4,517	0	27,204	0	0	0	27,204
Total =				4,756,106	5,278,432			3,796	1,789					$1,233,583			$231,193	$1,002,390
													NPV =	$592,131			$205,262	386,868

Total NPV = $386,868
Benefit/Cost Ratio = 2.88

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Total Program without Demand Response**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$5,727	$10,558	$16,285	$31,812	$25,903	$57,715	($41,430)
2012	13,700	24,629	38,329	40,676	33,075	73,751	(35,422)
2013	24,857	44,400	69,257	54,453	42,136	96,589	(27,332)
2014	26,044	46,176	72,220	0	0	0	72,220
2015	28,688	48,024	76,712	0	0	0	76,712
2016	28,890	49,701	78,591	0	0	0	78,591
2017	30,303	51,441	81,744	0	0	0	81,744
2018	32,835	52,978	85,813	0	0	0	85,813
2019	34,419	55,101	89,520	0	0	0	89,520
2020	36,830	57,165	93,995	0	0	0	93,995
2021	31,902	54,484	86,386	0	0	0	86,386
2022	26,925	51,803	78,728	0	0	0	78,728
2023	21,897	48,501	70,398	0	0	0	70,398
2024	22,075	50,440	72,515	0	0	0	72,515
2025	21,905	51,607	73,512	0	0	0	73,512
2026	19,911	47,804	67,715	0	0	0	67,715
2027	16,110	40,475	56,585	0	0	0	56,585
2028	13,316	34,405	47,721	0	0	0	47,721
2029	11,413	30,984	42,397	0	0	0	42,397
2030	8,432	25,155	33,587	0	0	0	33,587
		Total =	$1,332,010			$228,055	$1,103,955
		NPV =	$626,080			$205,395	420,685

Total NPV =	$420,685
Benefit/Cost Ratio =	3.05

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.08258
Retail Rate Winter ($/kWh) =	$0.07878
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.05979
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$26	$91	$205
Incentive Costs =	600	1,500	3,000
Total Utility Project Costs =	$626	$1,591	$3,205
14) Direct Participant Costs ($/Part.) =	$520	$520	$520
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
			NA
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.690	0.690	0.690
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	908	908	908
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	5	10
20) Incentive/Participant =	$300	$300	$300
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	1,816	4,540	9,080
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	1	3	7
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$7,513	1.80
Utility Cost Test	$12,214	3.57
Societal Test	$26,102	4.03
Participant Test	$8,714	2.09
Total Resource Cost Test	$8,939	2.11

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	1,952	$0.02860	$56	$0.00000	$0	2	0	2	$98.68	$197	$253	$0.06099	1,816	0	1,816	$67	$26	$600	$693	($440)
2	2012	6,831	0.02988	204	0.00000	0	5	0	5	102.62	513	717	0.06221	6,356	0	6,356	240	91	1,500	1,831	(1,114)
3	2013	16,590	0.03195	530	0.00000	0	13	0	13	106.73	1,387	1,917	0.06345	15,436	0	15,436	594	205	3,000	3,799	(1,882)
4	2014	16,590	0.03348	555	0.00000	0	13	0	13	111.00	1,443	1,998	0.06472	15,436	0	15,436	606	0	0	606	1,392
5	2015	16,590	0.03688	612	0.00000	0	13	0	13	115.44	1,501	2,113	0.06601	15,436	0	15,436	618	0	0	618	1,495
6	2016	16,590	0.03720	617	0.00000	0	13	0	13	120.05	1,561	2,178	0.06733	15,436	0	15,436	630	0	0	630	1,548
7	2017	16,590	0.03911	649	0.00000	0	13	0	13	124.86	1,623	2,272	0.06868	15,436	0	15,436	643	0	0	643	1,629
8	2018	16,590	0.04251	705	0.00000	0	13	0	13	129.85	1,688	2,393	0.07005	15,436	0	15,436	655	0	0	655	1,738
9	2019	16,590	0.04456	739	0.00000	0	13	0	13	135.05	1,756	2,495	0.07145	15,436	0	15,436	668	0	0	668	1,827
10	2020	16,590	0.04769	791	0.00000	0	13	0	13	140.45	1,826	2,617	0.07288	15,436	0	15,436	682	0	0	682	1,935
11	2021	16,590	0.04800	796	0.00000	0	13	0	13	146.07	1,899	2,695	0.07434	15,436	0	15,436	696	0	0	696	1,999
12	2022	16,590	0.04834	802	0.00000	0	13	0	13	151.91	1,975	2,777	0.07583	15,436	0	15,436	709	0	0	709	2,068
13	2023	16,590	0.04871	808	0.00000	0	13	0	13	157.98	2,054	2,862	0.07734	15,436	0	15,436	724	0	0	724	2,138
14	2024	16,590	0.04911	815	0.00000	0	13	0	13	164.30	2,136	2,951	0.07889	15,436	0	15,436	738	0	0	738	2,213
15	2025	14,638	0.04954	725	0.00000	0	12	0	12	170.88	2,051	2,776	0.08047	13,620	0	13,620	664	0	0	664	2,112
16	2026	9,759	0.05000	488	0.00000	0	8	0	8	177.71	1,422	1,910	0.08208	9,080	0	9,080	452	0	0	452	1,458
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.08372	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.08539	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.08710	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.08884	0	0	0	0	0	0	0	0
Total =		232,260							183			$34,924				216,104				$14,808	$20,116
											NPV =	$16,959								$9,446	7,513

Total NPV = $7,513
Benefit/Cost Ratio = 1.80

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$56	$0	$197	$253	$626	$626	($373)
2012	204	0	513	717	1,591	1,591	(874)
2013	530	0	1,387	1,917	3,205	3,205	(1,288)
2014	555	0	1,443	1,998	0	0	1,998
2015	612	0	1,501	2,113	0	0	2,113
2016	617	0	1,561	2,178	0	0	2,178
2017	649	0	1,623	2,272	0	0	2,272
2018	705	0	1,688	2,393	0	0	2,393
2019	739	0	1,756	2,495	0	0	2,495
2020	791	0	1,826	2,617	0	0	2,617
2021	796	0	1,899	2,695	0	0	2,695
2022	802	0	1,975	2,777	0	0	2,777
2023	808	0	2,054	2,862	0	0	2,862
2024	815	0	2,136	2,951	0	0	2,951
2025	725	0	2,051	2,776	0	0	2,776
2026	488	0	1,422	1,910	0	0	1,910
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$34,924		$5,422	$29,502
			NPV =	$16,959		$4,745	12,214

Total NPV =	$12,214
Benefit/Cost Ratio =	3.57

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$56	$0	$197	$80	$333	$626	$440	$1,066	($733)
2012	204	0	513	234	951	1,591	1,100	2,691	(1,740)
2013	530	0	1,387	643	2,560	3,205	2,200	5,405	(2,845)
2014	555	0	1,443	690	2,688	0	0	0	2,688
2015	612	0	1,501	752	2,865	0	0	0	2,865
2016	617	0	1,561	798	2,976	0	0	0	2,976
2017	649	0	1,623	858	3,130	0	0	0	3,130
2018	705	0	1,688	931	3,324	0	0	0	3,324
2019	739	0	1,756	999	3,494	0	0	0	3,494
2020	791	0	1,826	1,080	3,697	0	0	0	3,697
2021	796	0	1,899	1,145	3,840	0	0	0	3,840
2022	802	0	1,975	1,216	3,993	0	0	0	3,993
2023	808	0	2,054	1,290	4,152	0	0	0	4,152
2024	815	0	2,136	1,370	4,321	0	0	0	4,321
2025	725	0	2,051	1,328	4,104	0	0	0	4,104
2026	488	0	1,422	941	2,851	0	0	0	2,851
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$49,279			$9,162	$40,117
				NPV =	$34,724			$8,622	26,102

Total NPV = $26,102
Benefit/Cost Ratio = 4.03

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 1 (14.5 SEER)**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$600	$0.08665	$0.08266	1,816	0	1,816	$157	1	0	$0.000	$0.000	$0	$0	$757	$1,062	$0	$1,062	($305)
2012	1,500	0.09092	0.08674	6,356	0	6,356	578	5	0	0.000	0.000	0	0	2,078	2,711	0	2,711	(633)
2013	3,000	0.09541	0.09102	15,436	0	15,436	1,473	12	0	0.000	0.000	0	0	4,473	5,536	0	5,536	(1,063)
2014	0	0.10011	0.09551	15,436	0	15,436	1,545	12	0	0.000	0.000	0	0	1,545	0	0	0	1,545
2015	0	0.10505	0.10022	15,436	0	15,436	1,622	12	0	0.000	0.000	0	0	1,622	0	0	0	1,622
2016	0	0.11023	0.10516	15,436	0	15,436	1,702	12	0	0.000	0.000	0	0	1,702	0	0	0	1,702
2017	0	0.11566	0.11034	15,436	0	15,436	1,785	12	0	0.000	0.000	0	0	1,785	0	0	0	1,785
2018	0	0.12137	0.11578	15,436	0	15,436	1,873	12	0	0.000	0.000	0	0	1,873	0	0	0	1,873
2019	0	0.12735	0.12149	15,436	0	15,436	1,966	12	0	0.000	0.000	0	0	1,966	0	0	0	1,966
2020	0	0.13363	0.12748	15,436	0	15,436	2,063	12	0	0.000	0.000	0	0	2,063	0	0	0	2,063
2021	0	0.14022	0.13377	15,436	0	15,436	2,164	12	0	0.000	0.000	0	0	2,164	0	0	0	2,164
2022	0	0.14714	0.14037	15,436	0	15,436	2,271	12	0	0.000	0.000	0	0	2,271	0	0	0	2,271
2023	0	0.15439	0.14729	15,436	0	15,436	2,383	12	0	0.000	0.000	0	0	2,383	0	0	0	2,383
2024	0	0.16200	0.15455	15,436	0	15,436	2,501	12	0	0.000	0.000	0	0	2,501	0	0	0	2,501
2025	0	0.16999	0.16217	13,620	0	13,620	2,315	10	0	0.000	0.000	0	0	2,315	0	0	0	2,315
2026	0	0.17838	0.17017	9,080	0	9,080	1,620	7	0	0.000	0.000	0	0	1,620	0	0	0	1,620
2027	0	0.18717	0.17856	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19640	0.18736	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20609	0.19660	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21625	0.20630	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				216,104	0			167	0					$33,118			$9,309	$23,809
													NPV =	$16,717			$8,004	8,714

Total NPV =	$8,714
Benefit/Cost Ratio =	2.09

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 1 (14.5 SEER)**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$56	$197	$253	$626	$440	$1,066	($813)
2012	204	513	717	1,591	1,100	2,691	(1,974)
2013	530	1,387	1,917	3,205	2,200	5,405	(3,488)
2014	555	1,443	1,998	0	0	0	1,998
2015	612	1,501	2,113	0	0	0	2,113
2016	617	1,561	2,178	0	0	0	2,178
2017	649	1,623	2,272	0	0	0	2,272
2018	705	1,688	2,393	0	0	0	2,393
2019	739	1,756	2,495	0	0	0	2,495
2020	791	1,826	2,617	0	0	0	2,617
2021	796	1,899	2,695	0	0	0	2,695
2022	802	1,975	2,777	0	0	0	2,777
2023	808	2,054	2,862	0	0	0	2,862
2024	815	2,136	2,951	0	0	0	2,951
2025	725	2,051	2,776	0	0	0	2,776
2026	488	1,422	1,910	0	0	0	1,910
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$34,924			$9,162	$25,762
		NPV =	$16,959			$8,020	8,939

Total NPV = $8,939
Benefit/Cost Ratio = 2.11

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 2 (16 SEER)**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08258
Retail Rate Winter ($/kWh) =	$0.07878
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.05979
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$52	$182	$409
Incentive Costs =	1,200	3,000	6,000
Total Utility Project Costs =	$1,252	$3,182	$6,409
14) Direct Participant Costs ($/Part.) =	$1,037	$1,037	$1,037
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.567	0.567	0.567
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,098	1,098	1,098
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	5	10
20) Incentive/Participant =	$600	$600	$600
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	2,196	5,490	10,980
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	1	3	6
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$747	1.05
Utility Cost Test	$6,431	1.68
Societal Test	$15,371	1.89
Participant Test	$7,726	1.48
Total Resource Cost Test	($74)	1.00

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,360	$0.02860	$67	$0.00000	$0	1	0	1	$98.68	$99	$166	$0.06099	2,196	0	2,196	$81	$52	$1,200	$1,333	($1,167)
2	2012	8,261	0.02988	247	0.00000	0	4	0	4	102.62	410	657	0.06221	7,686	0	7,686	290	182	3,000	3,472	(2,815)
3	2013	20,061	0.03195	641	0.00000	0	11	0	11	106.73	1,174	1,815	0.06345	18,666	0	18,666	718	409	6,000	7,127	(5,312)
4	2014	20,061	0.03348	672	0.00000	0	11	0	11	111.00	1,221	1,893	0.06472	18,666	0	18,666	732	0	0	732	1,161
5	2015	20,061	0.03688	740	0.00000	0	11	0	11	115.44	1,270	2,010	0.06601	18,666	0	18,666	747	0	0	747	1,263
6	2016	20,061	0.03720	746	0.00000	0	11	0	11	120.05	1,321	2,067	0.06733	18,666	0	18,666	762	0	0	762	1,305
7	2017	20,061	0.03911	785	0.00000	0	11	0	11	124.86	1,373	2,158	0.06868	18,666	0	18,666	777	0	0	777	1,381
8	2018	20,061	0.04251	853	0.00000	0	11	0	11	129.85	1,428	2,281	0.07005	18,666	0	18,666	793	0	0	793	1,488
9	2019	20,061	0.04456	894	0.00000	0	11	0	11	135.05	1,486	2,380	0.07145	18,666	0	18,666	808	0	0	808	1,572
10	2020	20,061	0.04769	957	0.00000	0	11	0	11	140.45	1,545	2,502	0.07288	18,666	0	18,666	825	0	0	825	1,677
11	2021	20,061	0.04800	963	0.00000	0	11	0	11	146.07	1,607	2,570	0.07434	18,666	0	18,666	841	0	0	841	1,729
12	2022	20,061	0.04834	970	0.00000	0	11	0	11	151.91	1,671	2,641	0.07583	18,666	0	18,666	858	0	0	858	1,783
13	2023	20,061	0.04871	977	0.00000	0	11	0	11	157.98	1,738	2,715	0.07734	18,666	0	18,666	875	0	0	875	1,840
14	2024	20,061	0.04911	985	0.00000	0	11	0	11	164.30	1,807	2,792	0.07889	18,666	0	18,666	893	0	0	893	1,899
15	2025	17,701	0.04954	877	0.00000	0	9	0	9	170.88	1,538	2,415	0.08047	16,470	0	16,470	803	0	0	803	1,612
16	2026	11,801	0.05000	590	0.00000	0	6	0	6	177.71	1,066	1,656	0.08208	10,980	0	10,980	546	0	0	546	1,110
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.08372	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.08539	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.08710	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.08884	0	0	0	0	0	0	0	0
Total =		280,855							152			$32,718				261,324				$22,192	$10,526
											NPV =	$15,920								$15,173	747

Total NPV = $747
Benefit/Cost Ratio = 1.05

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$67	$0	$99	$166	$1,252	$1,252	($1,086)
2012	247	0	410	657	3,182	3,182	(2,525)
2013	641	0	1,174	1,815	6,409	6,409	(4,594)
2014	672	0	1,221	1,893	0	0	1,893
2015	740	0	1,270	2,010	0	0	2,010
2016	746	0	1,321	2,067	0	0	2,067
2017	785	0	1,373	2,158	0	0	2,158
2018	853	0	1,428	2,281	0	0	2,281
2019	894	0	1,486	2,380	0	0	2,380
2020	957	0	1,545	2,502	0	0	2,502
2021	963	0	1,607	2,570	0	0	2,570
2022	970	0	1,671	2,641	0	0	2,641
2023	977	0	1,738	2,715	0	0	2,715
2024	985	0	1,807	2,792	0	0	2,792
2025	877	0	1,538	2,415	0	0	2,415
2026	590	0	1,066	1,656	0	0	1,656
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$32,718		$10,843	$21,875
			NPV =	$15,920		$9,489	6,431

Total NPV =	$6,431
Benefit/Cost Ratio =	1.68

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$67	$0	$99	$52	$218	$1,252	$874	$2,126	($1,908)
2012	247	0	410	214	871	3,182	2,185	5,367	(4,496)
2013	641	0	1,174	609	2,424	6,409	4,370	10,779	(8,355)
2014	672	0	1,221	654	2,547	0	0	0	2,547
2015	740	0	1,270	715	2,725	0	0	0	2,725
2016	746	0	1,321	758	2,825	0	0	0	2,825
2017	785	0	1,373	815	2,973	0	0	0	2,973
2018	853	0	1,428	887	3,168	0	0	0	3,168
2019	894	0	1,486	953	3,333	0	0	0	3,333
2020	957	0	1,545	1,032	3,534	0	0	0	3,534
2021	963	0	1,607	1,092	3,662	0	0	0	3,662
2022	970	0	1,671	1,156	3,797	0	0	0	3,797
2023	977	0	1,738	1,224	3,939	0	0	0	3,939
2024	985	0	1,807	1,297	4,089	0	0	0	4,089
2025	877	0	1,538	1,155	3,570	0	0	0	3,570
2026	590	0	1,066	816	2,472	0	0	0	2,472
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$46,147			$18,272	$27,875
				NPV =	$32,566			$17,195	15,371

Total NPV = $15,371
Benefit/Cost Ratio = 1.89

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,200	$0.08665	$0.08266	2,196	0	2,196	$190	1	0	$0.000	$0.000	$0	$0	$1,390	$2,118	$0	$2,118	($728)
2012	3,000	0.09092	0.08674	7,686	0	7,686	699	4	0	0.000	0.000	0	0	3,699	5,406	0	5,406	(1,707)
2013	6,000	0.09541	0.09102	18,666	0	18,666	1,781	10	0	0.000	0.000	0	0	7,781	11,040	0	11,040	(3,259)
2014	0	0.10011	0.09551	18,666	0	18,666	1,869	10	0	0.000	0.000	0	0	1,869	0	0	0	1,869
2015	0	0.10505	0.10022	18,666	0	18,666	1,961	10	0	0.000	0.000	0	0	1,961	0	0	0	1,961
2016	0	0.11023	0.10516	18,666	0	18,666	2,058	10	0	0.000	0.000	0	0	2,058	0	0	0	2,058
2017	0	0.11566	0.11034	18,666	0	18,666	2,159	10	0	0.000	0.000	0	0	2,159	0	0	0	2,159
2018	0	0.12137	0.11578	18,666	0	18,666	2,265	10	0	0.000	0.000	0	0	2,265	0	0	0	2,265
2019	0	0.12735	0.12149	18,666	0	18,666	2,377	10	0	0.000	0.000	0	0	2,377	0	0	0	2,377
2020	0	0.13363	0.12748	18,666	0	18,666	2,494	10	0	0.000	0.000	0	0	2,494	0	0	0	2,494
2021	0	0.14022	0.13377	18,666	0	18,666	2,617	10	0	0.000	0.000	0	0	2,617	0	0	0	2,617
2022	0	0.14714	0.14037	18,666	0	18,666	2,747	10	0	0.000	0.000	0	0	2,747	0	0	0	2,747
2023	0	0.15439	0.14729	18,666	0	18,666	2,882	10	0	0.000	0.000	0	0	2,882	0	0	0	2,882
2024	0	0.16200	0.15455	18,666	0	18,666	3,024	10	0	0.000	0.000	0	0	3,024	0	0	0	3,024
2025	0	0.16999	0.16217	16,470	0	16,470	2,800	9	0	0.000	0.000	0	0	2,800	0	0	0	2,800
2026	0	0.17838	0.17017	10,980	0	10,980	1,959	6	0	0.000	0.000	0	0	1,959	0	0	0	1,959
2027	0	0.18717	0.17856	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19640	0.18736	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20609	0.19660	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21625	0.20630	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				261,324	0			140	0					$44,082			$18,564	$25,518
													NPV =	$23,687			$15,961	7,726

Total NPV =	$7,726
Benefit/Cost Ratio =	1.48

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 2 (16 SEER) - Replacement**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$67	$99	$166	$1,252	$874	$2,126	($1,960)
2012	247	410	657	3,182	2,185	5,367	(4,710)
2013	641	1,174	1,815	6,409	4,370	10,779	(8,964)
2014	672	1,221	1,893	0	0	0	1,893
2015	740	1,270	2,010	0	0	0	2,010
2016	746	1,321	2,067	0	0	0	2,067
2017	785	1,373	2,158	0	0	0	2,158
2018	853	1,428	2,281	0	0	0	2,281
2019	894	1,486	2,380	0	0	0	2,380
2020	957	1,545	2,502	0	0	0	2,502
2021	963	1,607	2,570	0	0	0	2,570
2022	970	1,671	2,641	0	0	0	2,641
2023	977	1,738	2,715	0	0	0	2,715
2024	985	1,807	2,792	0	0	0	2,792
2025	877	1,538	2,415	0	0	0	2,415
2026	590	1,066	1,656	0	0	0	1,656
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$32,718			$18,272	$14,446
		NPV =	$15,920			$15,994	(74)

Total NPV = ($74)
Benefit/Cost Ratio = 1.00

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08258
Retail Rate Winter ($/kWh) =	$0.07878
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.05979
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$52	$73	$82
Incentive Costs =	1,200	1,200	1,200
Total Utility Project Costs =	$1,252	$1,273	$1,282
14) Direct Participant Costs ($/Part.) =	$1,037	$1,037	$1,037
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.567	0.567	0.567
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	422	422	422
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	2	2
20) Incentive/Participant =	$600	$600	$600
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	844	844	844
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	1	1	1
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$345	1.08
Utility Cost Test	$1,142	1.33
Societal Test	$3,032	1.49
Participant Test	($529)	0.91
Total Resource Cost Test	($1,257)	0.79

Table 1
Ratepayer Impact Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	907	$0.02860	$26	$0.00000	$0	1	0	1	$98.68	$99	$125	$0.06099	844	0	844	$31	$52	$1,200	$1,283	($1,158)
2	2012	1,814	0.02988	54	0.00000	0	3	0	3	102.62	308	362	0.06221	1,688	0	1,688	64	73	1,200	1,337	(975)
3	2013	2,721	0.03195	87	0.00000	0	4	0	4	106.73	427	514	0.06345	2,532	0	2,532	97	82	1,200	1,379	(865)
4	2014	2,721	0.03348	91	0.00000	0	4	0	4	111.00	444	535	0.06472	2,532	0	2,532	99	0	0	99	436
5	2015	2,721	0.03688	100	0.00000	0	4	0	4	115.44	462	562	0.06601	2,532	0	2,532	101	0	0	101	461
6	2016	2,721	0.03720	101	0.00000	0	4	0	4	120.05	480	581	0.06733	2,532	0	2,532	103	0	0	103	478
7	2017	2,721	0.03911	106	0.00000	0	4	0	4	124.86	499	605	0.06868	2,532	0	2,532	105	0	0	105	500
8	2018	2,721	0.04251	116	0.00000	0	4	0	4	129.85	519	635	0.07005	2,532	0	2,532	108	0	0	108	527
9	2019	2,721	0.04456	121	0.00000	0	4	0	4	135.05	540	661	0.07145	2,532	0	2,532	110	0	0	110	551
10	2020	2,721	0.04769	130	0.00000	0	4	0	4	140.45	562	692	0.07288	2,532	0	2,532	112	0	0	112	580
11	2021	2,721	0.04800	131	0.00000	0	4	0	4	146.07	584	715	0.07434	2,532	0	2,532	114	0	0	114	601
12	2022	2,721	0.04834	132	0.00000	0	4	0	4	151.91	608	740	0.07583	2,532	0	2,532	116	0	0	116	624
13	2023	2,721	0.04871	133	0.00000	0	4	0	4	157.98	632	765	0.07734	2,532	0	2,532	119	0	0	119	646
14	2024	2,721	0.04911	134	0.00000	0	4	0	4	164.30	657	791	0.07889	2,532	0	2,532	121	0	0	121	670
15	2025	1,814	0.04954	90	0.00000	0	3	0	3	170.88	513	603	0.08047	1,688	0	1,688	82	0	0	82	521
16	2026	907	0.05000	45	0.00000	0	1	0	1	177.71	178	223	0.08208	844	0	844	42	0	0	42	181
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.08372	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.08539	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.08710	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.08884	0	0	0	0	0	0	0	0
Total =		38,094							56			$9,109				35,448				$5,331	$3,778
											NPV =	$4,622								$4,277	345

Total NPV = $345
Benefit/Cost Ratio = 1.08

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits				Costs		
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Annual Benefits Less Costs (G)
2011	$26	$0	$99	$125	$1,252	$1,252	($1,127)
2012	54	0	308	362	1,273	1,273	(911)
2013	87	0	427	514	1,282	1,282	(768)
2014	91	0	444	535	0	0	535
2015	100	0	462	562	0	0	562
2016	101	0	480	581	0	0	581
2017	106	0	499	605	0	0	605
2018	116	0	519	635	0	0	635
2019	121	0	540	661	0	0	661
2020	130	0	562	692	0	0	692
2021	131	0	584	715	0	0	715
2022	132	0	608	740	0	0	740
2023	133	0	632	765	0	0	765
2024	134	0	657	791	0	0	791
2025	90	0	513	603	0	0	603
2026	45	0	178	223	0	0	223
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$9,109		$3,807	$5,302
			NPV =	$4,622		$3,480	1,142

Total NPV =	$1,142
Benefit/Cost Ratio =	1.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$26	$0	$99	$40	$165	$1,252	$874	$2,126	($1,961)
2012	54	0	308	118	480	1,273	874	2,147	(1,667)
2013	87	0	427	172	686	1,282	874	2,156	(1,470)
2014	91	0	444	185	720	0	0	0	720
2015	100	0	462	200	762	0	0	0	762
2016	101	0	480	213	794	0	0	0	794
2017	106	0	499	228	833	0	0	0	833
2018	116	0	519	247	882	0	0	0	882
2019	121	0	540	265	926	0	0	0	926
2020	130	0	562	286	978	0	0	0	978
2021	131	0	584	304	1,019	0	0	0	1,019
2022	132	0	608	324	1,064	0	0	0	1,064
2023	133	0	632	345	1,110	0	0	0	1,110
2024	134	0	657	367	1,158	0	0	0	1,158
2025	90	0	513	288	891	0	0	0	891
2026	45	0	178	110	333	0	0	0	333
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$12,801			$6,429	$6,372
				NPV =	$9,202			$6,170	3,032

Total NPV =	$3,032
Benefit/Cost Ratio =	1.49

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Central Air Conditioning Tier 2 - New**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,200	$0.08665	$0.08266	844	0	844	$73	1	0	$0.000	$0.000	$0	$0	$1,273	$2,118	$0	$2,118	($845)
2012	1,200	0.09092	0.08674	1,688	0	1,688	153	2	0	0.000	0.000	0	0	1,353	2,162	0	2,162	(809)
2013	1,200	0.09541	0.09102	2,532	0	2,532	242	3	0	0.000	0.000	0	0	1,442	2,208	0	2,208	(766)
2014	0	0.10011	0.09551	2,532	0	2,532	253	3	0	0.000	0.000	0	0	253	0	0	0	253
2015	0	0.10505	0.10022	2,532	0	2,532	266	3	0	0.000	0.000	0	0	266	0	0	0	266
2016	0	0.11023	0.10516	2,532	0	2,532	279	3	0	0.000	0.000	0	0	279	0	0	0	279
2017	0	0.11566	0.11034	2,532	0	2,532	293	3	0	0.000	0.000	0	0	293	0	0	0	293
2018	0	0.12137	0.11578	2,532	0	2,532	307	3	0	0.000	0.000	0	0	307	0	0	0	307
2019	0	0.12735	0.12149	2,532	0	2,532	322	3	0	0.000	0.000	0	0	322	0	0	0	322
2020	0	0.13363	0.12748	2,532	0	2,532	338	3	0	0.000	0.000	0	0	338	0	0	0	338
2021	0	0.14022	0.13377	2,532	0	2,532	355	3	0	0.000	0.000	0	0	355	0	0	0	355
2022	0	0.14714	0.14037	2,532	0	2,532	373	3	0	0.000	0.000	0	0	373	0	0	0	373
2023	0	0.15439	0.14729	2,532	0	2,532	391	3	0	0.000	0.000	0	0	391	0	0	0	391
2024	0	0.16200	0.15455	2,532	0	2,532	410	3	0	0.000	0.000	0	0	410	0	0	0	410
2025	0	0.16999	0.16217	1,688	0	1,688	287	2	0	0.000	0.000	0	0	287	0	0	0	287
2026	0	0.17838	0.17017	844	0	844	151	1	0	0.000	0.000	0	0	151	0	0	0	151
2027	0	0.18717	0.17856	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19640	0.18736	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20609	0.19660	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21625	0.20630	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				35,448	0			42	0					$8,093			$6,488	$1,605
													NPV =	$5,332			$5,861	(529)

Total NPV = ($529)
Benefit/Cost Ratio = 0.91

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Central Air Conditioning Tier 2 - New**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$26	$99	$125	$1,252	$874	$2,126	($2,001)
2012	54	308	362	1,273	874	2,147	(1,785)
2013	87	427	514	1,282	874	2,156	(1,642)
2014	91	444	535	0	0	0	535
2015	100	462	562	0	0	0	562
2016	101	480	581	0	0	0	581
2017	106	499	605	0	0	0	605
2018	116	519	635	0	0	0	635
2019	121	540	661	0	0	0	661
2020	130	562	692	0	0	0	692
2021	131	584	715	0	0	0	715
2022	132	608	740	0	0	0	740
2023	133	632	765	0	0	0	765
2024	134	657	791	0	0	0	791
2025	90	513	603	0	0	0	603
2026	45	178	223	0	0	0	223
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$9,109			$6,429	$2,680
		NPV =	$4,622			$5,879	(1,257)

Total NPV =	($1,257)
Benefit/Cost Ratio =	0.79

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Window AC Units**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.08258
Retail Rate Winter ($/kWh) =	$0.07878
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.05979
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$4	$6	$7
Incentive Costs =	100	100	100
Total Utility Project Costs =	$104	$106	$107
14) Direct Participant Costs ($/Part.) =	$75	$75	$75
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	9	9	9
16) Avg Summer kW/part. Saved =	0.108	0.108	0.108
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	76	76	76
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	2	2
20) Incentive/Participant =	$50	$50	$50
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	152	152	152
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	0	0
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$242	1.61
Utility Cost Test	$350	2.21
Societal Test	$672	2.50
Participant Test	$121	1.28
Total Resource Cost Test	$213	1.50

Table 1
Ratepayer Impact Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	163	$0.02860	$5	$0.00000	$0	0	0	0	$98.68	$0	$5	$0.06099	152	0	152	$6	$4	$100	$110	($105)
2	2012	327	0.02988	10	0.00000	0	0	0	0	102.62	0	10	0.06221	304	0	304	11	6	100	117	(107)
3	2013	490	0.03195	16	0.00000	0	1	0	1	106.73	107	123	0.06345	456	0	456	18	7	100	125	(2)
4	2014	490	0.03348	16	0.00000	0	1	0	1	111.00	111	127	0.06472	456	0	456	18	0	0	18	109
5	2015	490	0.03688	18	0.00000	0	1	0	1	115.44	115	133	0.06601	456	0	456	18	0	0	18	115
6	2016	490	0.03720	18	0.00000	0	1	0	1	120.05	120	138	0.06733	456	0	456	19	0	0	19	119
7	2017	490	0.03911	19	0.00000	0	1	0	1	124.86	125	144	0.06868	456	0	456	19	0	0	19	125
8	2018	490	0.04251	21	0.00000	0	1	0	1	129.85	130	151	0.07005	456	0	456	19	0	0	19	132
9	2019	490	0.04456	22	0.00000	0	1	0	1	135.05	135	157	0.07145	456	0	456	20	0	0	20	137
10	2020	327	0.04769	16	0.00000	0	0	0	0	140.45	0	16	0.07288	304	0	304	13	0	0	13	3
11	2021	163	0.04800	8	0.00000	0	0	0	0	146.07	0	8	0.07434	152	0	152	7	0	0	7	1
12	2022	0	0.04834	0	0.00000	0	0	0	0	151.91	0	0	0.07583	0	0	0	0	0	0	0	0
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.07734	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.07889	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.08047	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.08208	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.08372	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.08539	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.08710	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.08884	0	0	0	0	0	0	0	0
Total =		4,410							7			$1,012				4,104				$485	$527
											NPV =	$640								$398	242

Total NPV = $242
Benefit/Cost Ratio = 1.61

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$5	$0	$0	$5	$104	$104	($99)
2012	10	0	0	10	106	106	(96)
2013	16	0	107	123	107	107	16
2014	16	0	111	127	0	0	127
2015	18	0	115	133	0	0	133
2016	18	0	120	138	0	0	138
2017	19	0	125	144	0	0	144
2018	21	0	130	151	0	0	151
2019	22	0	135	157	0	0	157
2020	16	0	0	16	0	0	16
2021	8	0	0	8	0	0	8
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$1,012		$317	$695
			NPV =	$640		$290	350

Total NPV =	$350
Benefit/Cost Ratio =	2.21

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$5	$0	$0	$2	$7	$104	$50	$154	($147)
2012	10	0	0	3	13	106	50	156	(143)
2013	16	0	107	41	164	107	50	157	7
2014	16	0	111	44	171	0	0	0	171
2015	18	0	115	47	180	0	0	0	180
2016	18	0	120	51	189	0	0	0	189
2017	19	0	125	54	198	0	0	0	198
2018	21	0	130	59	210	0	0	0	210
2019	22	0	135	63	220	0	0	0	220
2020	16	0	0	7	23	0	0	0	23
2021	8	0	0	3	11	0	0	0	11
2022	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$1,386			$467	$919
				NPV =	$1,120			$448	672

Total NPV = $672
Benefit/Cost Ratio = 2.50

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Window AC Units**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$100	$0.08665	$0.08266	152	0	152	$13	0	0	$0.000	$0.000	$0	$0	$113	$153	$0	$153	($40)
2012	100	0.09092	0.08674	304	0	304	28	0	0	0.000	0.000	0	0	128	156	0	156	(28)
2013	100	0.09541	0.09102	456	0	456	44	1	0	0.000	0.000	0	0	144	160	0	160	(16)
2014	0	0.10011	0.09551	456	0	456	46	1	0	0.000	0.000	0	0	46	0	0	0	46
2015	0	0.10505	0.10022	456	0	456	48	1	0	0.000	0.000	0	0	48	0	0	0	48
2016	0	0.11023	0.10516	456	0	456	50	1	0	0.000	0.000	0	0	50	0	0	0	50
2017	0	0.11566	0.11034	456	0	456	53	1	0	0.000	0.000	0	0	53	0	0	0	53
2018	0	0.12137	0.11578	456	0	456	55	1	0	0.000	0.000	0	0	55	0	0	0	55
2019	0	0.12735	0.12149	456	0	456	58	1	0	0.000	0.000	0	0	58	0	0	0	58
2020	0	0.13363	0.12748	304	0	304	41	0	0	0.000	0.000	0	0	41	0	0	0	41
2021	0	0.14022	0.13377	152	0	152	21	0	0	0.000	0.000	0	0	21	0	0	0	21
2022	0	0.14714	0.14037	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.15439	0.14729	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.16200	0.15455	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.16999	0.16217	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.17838	0.17017	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.18717	0.17856	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19640	0.18736	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20609	0.19660	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21625	0.20630	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				4,104	0			7	0					$757			$469	$288
													NPV =	$544			$424	121

Total NPV = $121
Benefit/Cost Ratio = 1.28

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Window AC Units**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$5	$0	$5	$104	$50	$154	($149)
2012	10	0	10	106	50	156	(146)
2013	16	107	123	107	50	157	(34)
2014	16	111	127	0	0	0	127
2015	18	115	133	0	0	0	133
2016	18	120	138	0	0	0	138
2017	19	125	144	0	0	0	144
2018	21	130	151	0	0	0	151
2019	22	135	157	0	0	0	157
2020	16	0	16	0	0	0	16
2021	8	0	8	0	0	0	8
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$1,012			$467	$545
		NPV =	$640			$427	213

Total NPV =	$213
Benefit/Cost Ratio =	1.50

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **AC Tune-up**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.08258
Retail Rate Winter ($/kWh) =	$0.07878
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.05979
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$19	$41	$61
Incentive Costs =	450	675	900
Total Utility Project Costs =	$469	$716	$961
14) Direct Participant Costs ($/Part.) =	$45	$45	$45
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	5	5	5
16) Avg Summer kW/part. Saved =	0.162	0.162	0.162
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	113	113	113
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	10	15	20
20) Incentive/Participant =	$45	$45	$45
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	1,130	1,695	2,260
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	2	2	3
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$1,457	1.55
Utility Cost Test	$2,208	2.15
Societal Test	$4,476	3.19
Participant Test	$1,766	1.94
Total Resource Cost Test	$2,208	2.15

Table 1
Ratepayer Impact Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	1,214	$0.02860	$35	$0.00000	$0	2	0	2	$98.68	$197	$232	$0.06099	1,130	0	1,130	$42	$19	$450	$511	($279)
2	2012	3,036	0.02988	91	0.00000	0	5	0	5	102.62	513	604	0.06221	2,825	0	2,825	107	41	675	823	(219)
3	2013	5,465	0.03195	175	0.00000	0	8	0	8	106.73	854	1,029	0.06345	5,085	0	5,085	196	61	900	1,157	(128)
4	2014	5,465	0.03348	183	0.00000	0	8	0	8	111.00	888	1,071	0.06472	5,085	0	5,085	199	0	0	199	872
5	2015	5,465	0.03688	202	0.00000	0	8	0	8	115.44	924	1,126	0.06601	5,085	0	5,085	203	0	0	203	923
6	2016	4,251	0.03720	158	0.00000	0	6	0	6	120.05	720	878	0.06733	3,955	0	3,955	161	0	0	161	717
7	2017	2,429	0.03911	95	0.00000	0	4	0	4	124.86	499	594	0.06868	2,260	0	2,260	94	0	0	94	500
8	2018	0	0.04251	0	0.00000	0	0	0	0	129.85	0	0	0.07005	0	0	0	0	0	0	0	0
9	2019	0	0.04456	0	0.00000	0	0	0	0	135.05	0	0	0.07145	0	0	0	0	0	0	0	0
10	2020	0	0.04769	0	0.00000	0	0	0	0	140.45	0	0	0.07288	0	0	0	0	0	0	0	0
11	2021	0	0.04800	0	0.00000	0	0	0	0	146.07	0	0	0.07434	0	0	0	0	0	0	0	0
12	2022	0	0.04834	0	0.00000	0	0	0	0	151.91	0	0	0.07583	0	0	0	0	0	0	0	0
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.07734	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.07889	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.08047	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.08208	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.08372	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.08539	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.08710	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.08884	0	0	0	0	0	0	0	0
Total =		27,325							41			$5,534				25,425				$3,148	$2,386
											NPV =	$4,130								$2,673	1,457

Total NPV = $1,457
Benefit/Cost Ratio = 1.55

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$35	$0	$197	$232	$469	$469	($237)
2012	91	0	513	604	716	716	(112)
2013	175	0	854	1,029	961	961	68
2014	183	0	888	1,071	0	0	1,071
2015	202	0	924	1,126	0	0	1,126
2016	158	0	720	878	0	0	878
2017	95	0	499	594	0	0	594
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$5,534		$2,146	$3,388
			NPV =	$4,130		$1,922	2,208

Total NPV =	$2,208
Benefit/Cost Ratio =	2.15

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$35	$0	$197	$73	$305	$469	$0	$469	($164)
2012	91	0	513	197	801	716	0	716	85
2013	175	0	854	345	1,374	961	0	961	413
2014	183	0	888	370	1,441	0	0	0	1,441
2015	202	0	924	401	1,527	0	0	0	1,527
2016	158	0	720	322	1,200	0	0	0	1,200
2017	95	0	499	224	818	0	0	0	818
2018	0	0	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$7,466			$2,146	$5,320
				NPV =	$6,516			$2,040	4,476

Total NPV = $4,476
Benefit/Cost Ratio = 3.19

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **AC Tune-up**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$450	$0.08665	$0.08266	1,130	0	1,130	$98	2	0	$0.000	$0.000	$0	$0	$548	$459	$0	$459	$89
2012	675	0.09092	0.08674	2,825	0	2,825	257	4	0	0.000	0.000	0	0	932	704	0	704	228
2013	900	0.09541	0.09102	5,085	0	5,085	485	7	0	0.000	0.000	0	0	1,385	958	0	958	427
2014	0	0.10011	0.09551	5,085	0	5,085	509	7	0	0.000	0.000	0	0	509	0	0	0	509
2015	0	0.10505	0.10022	5,085	0	5,085	534	7	0	0.000	0.000	0	0	534	0	0	0	534
2016	0	0.11023	0.10516	3,955	0	3,955	436	6	0	0.000	0.000	0	0	436	0	0	0	436
2017	0	0.11566	0.11034	2,260	0	2,260	261	3	0	0.000	0.000	0	0	261	0	0	0	261
2018	0	0.12137	0.11578	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2019	0	0.12735	0.12149	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2020	0	0.13363	0.12748	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2021	0	0.14022	0.13377	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2022	0	0.14714	0.14037	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2023	0	0.15439	0.14729	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2024	0	0.16200	0.15455	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2025	0	0.16999	0.16217	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2026	0	0.17838	0.17017	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2027	0	0.18717	0.17856	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19640	0.18736	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20609	0.19660	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21625	0.20630	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				25,425	0			36	0					$4,605			$2,121	$2,484
													NPV =	$3,638			$1,872	1,766

Total NPV = $1,766
Benefit/Cost Ratio = 1.94

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **AC Tune-up**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$35	$197	$232	$469	$0	$469	($237)
2012	91	513	604	716	0	716	(112)
2013	175	854	1,029	961	0	961	68
2014	183	888	1,071	0	0	0	1,071
2015	202	924	1,126	0	0	0	1,126
2016	158	720	878	0	0	0	878
2017	95	499	594	0	0	0	594
2018	0	0	0	0	0	0	0
2019	0	0	0	0	0	0	0
2020	0	0	0	0	0	0	0
2021	0	0	0	0	0	0	0
2022	0	0	0	0	0	0	0
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$5,534			$2,146	$3,388
		NPV =	$4,130			$1,922	2,208

Total NPV =	$2,208
Benefit/Cost Ratio =	2.15

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **New Construction Bundle**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.08258
Retail Rate Winter ($/kWh) =	$0.07878
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.05979
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$78	$109	$123
Incentive Costs =	1,800	1,800	1,800
Total Utility Project Costs =	$1,878	$1,909	$1,923
14) Direct Participant Costs ($/Part.) =	$1,337	$1,337	$1,337
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	14	14	14
16) Avg Summer kW/part. Saved =	0.630	0.630	0.630
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	485	485	485
17a) Avg. Winter kWh/Part. Saved =	504	504	504
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	2	2
20) Incentive/Participant =	$900	$900	$900
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	970	970	970
Annual Winter Kwh Saved	1,008	1,008	1,008
23) Annual Summer KW Saved	1	1	1
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	($1,380)	0.81
Utility Cost Test	$489	1.09
Societal Test	$3,371	1.42
Participant Test	$2,081	1.28
Total Resource Cost Test	($1,910)	0.75

Table 1
Ratepayer Impact Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,126	$0.02860	$61	$0.00000	$0	1	0	1	$98.68	$99	$160	$0.06099	970	1,008	1,978	$73	$78	$1,800	$1,951	($1,791)
2	2012	4,252	0.02988	127	0.00000	0	3	0	3	102.62	308	435	0.06221	1,940	2,016	3,956	149	109	1,800	2,058	(1,623)
3	2013	6,378	0.03195	204	0.00000	0	4	0	4	106.73	427	631	0.06345	2,910	3,024	5,934	228	123	1,800	2,151	(1,520)
4	2014	6,378	0.03348	214	0.00000	0	4	0	4	111.00	444	658	0.06472	2,910	3,024	5,934	233	0	0	233	425
5	2015	6,378	0.03688	235	0.00000	0	4	0	4	115.44	462	697	0.06601	2,910	3,024	5,934	237	0	0	237	460
6	2016	6,378	0.03720	237	0.00000	0	4	0	4	120.05	480	717	0.06733	2,910	3,024	5,934	242	0	0	242	475
7	2017	6,378	0.03911	249	0.00000	0	4	0	4	124.86	499	748	0.06868	2,910	3,024	5,934	247	0	0	247	501
8	2018	6,378	0.04251	271	0.00000	0	4	0	4	129.85	519	790	0.07005	2,910	3,024	5,934	252	0	0	252	538
9	2019	6,378	0.04456	284	0.00000	0	4	0	4	135.05	540	824	0.07145	2,910	3,024	5,934	257	0	0	257	567
10	2020	6,378	0.04769	304	0.00000	0	4	0	4	140.45	562	866	0.07288	2,910	3,024	5,934	262	0	0	262	604
11	2021	6,378	0.04800	306	0.00000	0	4	0	4	146.07	584	890	0.07434	2,910	3,024	5,934	267	0	0	267	623
12	2022	6,378	0.04834	308	0.00000	0	4	0	4	151.91	608	916	0.07583	2,910	3,024	5,934	273	0	0	273	643
13	2023	6,378	0.04871	311	0.00000	0	4	0	4	157.98	632	943	0.07734	2,910	3,024	5,934	278	0	0	278	665
14	2024	6,378	0.04911	313	0.00000	0	4	0	4	164.30	657	970	0.07889	2,910	3,024	5,934	284	0	0	284	686
15	2025	4,252	0.04954	211	0.00000	0	3	0	3	170.88	513	724	0.08047	1,940	2,016	3,956	193	0	0	193	531
16	2026	2,126	0.05000	106	0.00000	0	1	0	1	177.71	178	284	0.08208	970	1,008	1,978	98	0	0	98	186
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.08372	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.08539	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.08710	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.08884	0	0	0	0	0	0	0	0
Total =		89,292							56			$11,253				83,076				$9,283	$1,970
											NPV =	$5,709								$7,089	(1,380)

Total NPV = ($1,380)
Benefit/Cost Ratio = 0.81

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$61	$0	$99	$160	$1,878	$1,878	($1,718)
2012	127	0	308	435	1,909	1,909	(1,474)
2013	204	0	427	631	1,923	1,923	(1,292)
2014	214	0	444	658	0	0	658
2015	235	0	462	697	0	0	697
2016	237	0	480	717	0	0	717
2017	249	0	499	748	0	0	748
2018	271	0	519	790	0	0	790
2019	284	0	540	824	0	0	824
2020	304	0	562	866	0	0	866
2021	306	0	584	890	0	0	890
2022	308	0	608	916	0	0	916
2023	311	0	632	943	0	0	943
2024	313	0	657	970	0	0	970
2025	211	0	513	724	0	0	724
2026	106	0	178	284	0	0	284
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$11,253		$5,710	$5,543
			NPV =	$5,709		$5,220	489

Total NPV =	$489
Benefit/Cost Ratio =	1.09

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$61	$0	$99	$51	$211	$1,878	$874	$2,752	($2,541)
2012	127	0	308	142	577	1,909	874	2,783	(2,206)
2013	204	0	427	212	843	1,923	874	2,797	(1,954)
2014	214	0	444	227	885	0	0	0	885
2015	235	0	462	248	945	0	0	0	945
2016	237	0	480	263	980	0	0	0	980
2017	249	0	499	282	1,030	0	0	0	1,030
2018	271	0	519	307	1,097	0	0	0	1,097
2019	284	0	540	330	1,154	0	0	0	1,154
2020	304	0	562	357	1,223	0	0	0	1,223
2021	306	0	584	378	1,268	0	0	0	1,268
2022	308	0	608	401	1,317	0	0	0	1,317
2023	311	0	632	425	1,368	0	0	0	1,368
2024	313	0	657	450	1,420	0	0	0	1,420
2025	211	0	513	346	1,070	0	0	0	1,070
2026	106	0	178	140	424	0	0	0	424
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$15,812			$8,332	$7,480
				NPV =	$11,367			$7,996	3,371

Total NPV = $3,371
Benefit/Cost Ratio = 1.42

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **New Construction Bundle**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,800	$0.08665	$0.08266	970	1,008	1,978	$167	1	0	$0.000	$0.000	$0	$0	$1,967	$2,730	$0	$2,730	($763)
2012	1,800	0.09092	0.08674	1,940	2,016	3,956	351	3	0	0.000	0.000	0	0	2,151	2,788	0	2,788	(637)
2013	1,800	0.09541	0.09102	2,910	3,024	5,934	553	4	0	0.000	0.000	0	0	2,353	2,847	0	2,847	(494)
2014	0	0.10011	0.09551	2,910	3,024	5,934	580	4	0	0.000	0.000	0	0	580	0	0	0	580
2015	0	0.10505	0.10022	2,910	3,024	5,934	609	4	0	0.000	0.000	0	0	609	0	0	0	609
2016	0	0.11023	0.10516	2,910	3,024	5,934	639	4	0	0.000	0.000	0	0	639	0	0	0	639
2017	0	0.11566	0.11034	2,910	3,024	5,934	670	4	0	0.000	0.000	0	0	670	0	0	0	670
2018	0	0.12137	0.11578	2,910	3,024	5,934	703	4	0	0.000	0.000	0	0	703	0	0	0	703
2019	0	0.12735	0.12149	2,910	3,024	5,934	738	4	0	0.000	0.000	0	0	738	0	0	0	738
2020	0	0.13363	0.12748	2,910	3,024	5,934	774	4	0	0.000	0.000	0	0	774	0	0	0	774
2021	0	0.14022	0.13377	2,910	3,024	5,934	813	4	0	0.000	0.000	0	0	813	0	0	0	813
2022	0	0.14714	0.14037	2,910	3,024	5,934	853	4	0	0.000	0.000	0	0	853	0	0	0	853
2023	0	0.15439	0.14729	2,910	3,024	5,934	895	4	0	0.000	0.000	0	0	895	0	0	0	895
2024	0	0.16200	0.15455	2,910	3,024	5,934	939	4	0	0.000	0.000	0	0	939	0	0	0	939
2025	0	0.16999	0.16217	1,940	2,016	3,956	657	3	0	0.000	0.000	0	0	657	0	0	0	657
2026	0	0.17838	0.17017	970	1,008	1,978	345	1	0	0.000	0.000	0	0	345	0	0	0	345
2027	0	0.18717	0.17856	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2028	0	0.19640	0.18736	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20609	0.19660	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21625	0.20630	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				40,740	42,336			56	0					$15,686			$8,365	$7,321
													NPV =	$9,637			$7,556	2,081

Total NPV = $2,081
Benefit/Cost Ratio = 1.28

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **New Construction Bundle**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$61	$99	$160	$1,878	$874	$2,752	($2,592)
2012	127	308	435	1,909	874	2,783	(2,348)
2013	204	427	631	1,923	874	2,797	(2,166)
2014	214	444	658	0	0	0	658
2015	235	462	697	0	0	0	697
2016	237	480	717	0	0	0	717
2017	249	499	748	0	0	0	748
2018	271	519	790	0	0	0	790
2019	284	540	824	0	0	0	824
2020	304	562	866	0	0	0	866
2021	306	584	890	0	0	0	890
2022	308	608	916	0	0	0	916
2023	311	632	943	0	0	0	943
2024	313	657	970	0	0	0	970
2025	211	513	724	0	0	0	724
2026	106	178	284	0	0	0	284
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$11,253			$8,332	$2,921
		NPV =	$5,709			$7,619	(1,910)

Total NPV = ($1,910)
Benefit/Cost Ratio = 0.75

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.08258
Retail Rate Winter ($/kWh) =	$0.07878
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$0.00
3a) Retail Winter Demand Rate ($/kW/season) =	$0.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.05979
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$0	$0	$682
Incentive Costs =	0	0	10,000
Direct Program Costs =	0	0	99,600
Total Utility Project Costs =	$0	$0	$110,282
14) Direct Participant Costs ($/Part.) =	$0	$0	$0
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	1.000	1.000	1.000
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	0	0	0
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	0	0	200
20) Incentive/Participant =	$50	$50	$50
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	0	0
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	0	200
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$52,349	1.33
Utility Cost Test	$52,349	1.33
Societal Test	$356,912	4.54
Participant Test	$65,033	#DIV/0!
Total Resource Cost Test	$122,220	2.38

Table 1
Ratepayer Impact Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Direct Program Costs (O)	Costs: Total Project Costs (P)	Annual Benefits Less Costs (Q)
1	2011	0	$0.02860	$0	$0.00000	$0	0	0	0	$98.68	$0	$0	$0.06099	0	0	0	$0	$0	$0	$0	$0	$0
2	2012	0	0.02988	0	0.00000	0	0	0	0	102.62	0	0	0.06221	0	0	0	0	0	0	0	0	0
3	2013	0	0.03195	0	0.00000	0	223	0	223	106.73	23,801	23,801	0.06345	0	0	0	0	682	10,000	99,600	110,282	(86,481)
4	2014	0	0.03348	0	0.00000	0	223	0	223	111.00	24,753	24,753	0.06472	0	0	0	0	682	10,000	0	10,682	14,071
5	2015	0	0.03688	0	0.00000	0	223	0	223	115.44	25,743	25,743	0.06601	0	0	0	0	682	10,000	0	10,682	15,061
6	2016	0	0.03720	0	0.00000	0	223	0	223	120.05	26,771	26,771	0.06733	0	0	0	0	682	10,000	0	10,682	16,089
7	2017	0	0.03911	0	0.00000	0	223	0	223	124.86	27,844	27,844	0.06868	0	0	0	0	682	10,000	0	10,682	17,162
8	2018	0	0.04251	0	0.00000	0	223	0	223	129.85	28,957	28,957	0.07005	0	0	0	0	682	10,000	0	10,682	18,275
9	2019	0	0.04456	0	0.00000	0	223	0	223	135.05	30,116	30,116	0.07145	0	0	0	0	682	10,000	0	10,682	19,434
10	2020	0	0.04769	0	0.00000	0	223	0	223	140.45	31,320	31,320	0.07288	0	0	0	0	682	10,000	0	10,682	20,638
11	2021	0	0.04800	0	0.00000	0	223	0	223	146.07	32,574	32,574	0.07434	0	0	0	0	682	10,000	0	10,682	21,892
12	2022	0	0.04834	0	0.00000	0	223	0	223	151.91	33,876	33,876	0.07583	0	0	0	0	682	10,000	0	10,682	23,194
13	2023	0	0.04871	0	0.00000	0	223	0	223	157.98	35,230	35,230	0.07734	0	0	0	0	682	10,000	0	10,682	24,548
14	2024	0	0.04911	0	0.00000	0	223	0	223	164.30	36,639	36,639	0.07889	0	0	0	0	682	10,000	0	10,682	25,957
15	2025	0	0.04954	0	0.00000	0	223	0	223	170.88	38,106	38,106	0.08047	0	0	0	0	682	10,000	0	10,682	27,424
16	2026	0	0.05000	0	0.00000	0	223	0	223	177.71	39,629	39,629	0.08208	0	0	0	0	682	10,000	0	10,682	28,947
17	2027	0	0.05050	0	0.00000	0	223	0	223	184.82	41,215	41,215	0.08372	0	0	0	0	682	10,000	0	10,682	30,533
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.08539	0	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.08710	0	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.08884	0	0	0	0	0	0	0	0	0
Total =		0							3,345			$476,574				0					$259,830	$216,744
											NPV =	$211,054									$158,705	52,349

Total NPV = $52,349
Benefit/Cost Ratio = 1.33

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0
2013	0	0	23,801	23,801	110,282	110,282	(86,481)
2014	0	0	24,753	24,753	10,682	10,682	14,071
2015	0	0	25,743	25,743	10,682	10,682	15,061
2016	0	0	26,771	26,771	10,682	10,682	16,089
2017	0	0	27,844	27,844	10,682	10,682	17,162
2018	0	0	28,957	28,957	10,682	10,682	18,275
2019	0	0	30,116	30,116	10,682	10,682	19,434
2020	0	0	31,320	31,320	10,682	10,682	20,638
2021	0	0	32,574	32,574	10,682	10,682	21,892
2022	0	0	33,876	33,876	10,682	10,682	23,194
2023	0	0	35,230	35,230	10,682	10,682	24,548
2024	0	0	36,639	36,639	10,682	10,682	25,957
2025	0	0	38,106	38,106	10,682	10,682	27,424
2026	0	0	39,629	39,629	10,682	10,682	28,947
2027	0	0	41,215	41,215	10,682	10,682	30,533
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$476,574		$259,830	$216,744
			NPV =	$211,054		$158,705	52,349

Total NPV =	$52,349
Benefit/Cost Ratio =	1.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits					Costs			
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Annual Benefits Less Costs (I)
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0	0	0
2013	0	0	23,801	7,984	31,785	110,282	(10,000)	100,282	(68,497)
2014	0	0	24,753	8,553	33,306	10,682	(10,000)	682	32,624
2015	0	0	25,743	9,162	34,905	10,682	(10,000)	682	34,223
2016	0	0	26,771	9,814	36,585	10,682	(10,000)	682	35,903
2017	0	0	27,844	10,513	38,357	10,682	(10,000)	682	37,675
2018	0	0	28,957	11,261	40,218	10,682	(10,000)	682	39,536
2019	0	0	30,116	12,063	42,179	10,682	(10,000)	682	41,497
2020	0	0	31,320	12,922	44,242	10,682	(10,000)	682	43,560
2021	0	0	32,574	13,843	46,417	10,682	(10,000)	682	45,735
2022	0	0	33,876	14,828	48,704	10,682	(7,000)	3,682	45,022
2023	0	0	35,230	15,883	51,113	10,682	(10,000)	682	50,431
2024	0	0	36,639	17,014	53,653	10,682	(10,000)	682	52,971
2025	0	0	38,106	18,226	56,332	10,682	(10,000)	682	55,650
2026	0	0	39,629	19,523	59,152	10,682	(10,000)	682	58,470
2027	0	0	41,215	20,913	62,128	10,682	(10,000)	682	61,446
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$679,076			$112,830	$566,246
				NPV =	$457,628			$100,716	356,912

Total NPV =	$356,912
Benefit/Cost Ratio =	4.54

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Residential AC Cycling**
Program Years: **2011 - 2013**

	Benefits													Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$0	$0.08665	$0.08266	0	0	0	$0	0	0	$0.000	$0.000	$0	$0	$0	$0	$0	$0	$0
2012	0	0.09092	0.08674	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2013	10,000	0.09541	0.09102	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2014	10,000	0.10011	0.09551	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2015	10,000	0.10505	0.10022	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2016	10,000	0.11023	0.10516	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2017	10,000	0.11566	0.11034	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2018	10,000	0.12137	0.11578	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2019	10,000	0.12735	0.12149	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2020	10,000	0.13363	0.12748	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2021	10,000	0.14022	0.13377	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2022	10,000	0.14714	0.14037	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2023	10,000	0.15439	0.14729	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2024	10,000	0.16200	0.15455	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2025	10,000	0.16999	0.16217	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2026	10,000	0.17838	0.17017	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2027	10,000	0.18717	0.17856	0	0	0	0	200	0	0.000	0.000	0	0	10,000	0	0	0	10,000
2028	0	0.19640	0.18736	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2029	0	0.20609	0.19660	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
2030	0	0.21625	0.20630	0	0	0	0	0	0	0.000	0.000	0	0	0	0	0	0	0
Total =				0	0			3,000	0					$150,000			$0	$150,000
													NPV =	$65,033			$0	65,033

Total NPV = $65,033
Benefit/Cost Ratio = #DIV/0!

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Residential AC Cycling**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	0	0	0	0	0	0	0
2013	0	23,801	23,801	110,282	(10,000)	100,282	(76,481)
2014	0	24,753	24,753	10,682	(10,000)	682	24,071
2015	0	25,743	25,743	10,682	(10,000)	682	25,061
2016	0	26,771	26,771	10,682	(10,000)	682	26,089
2017	0	27,844	27,844	10,682	(10,000)	682	27,162
2018	0	28,957	28,957	10,682	(10,000)	682	28,275
2019	0	30,116	30,116	10,682	(10,000)	682	29,434
2020	0	31,320	31,320	10,682	(10,000)	682	30,638
2021	0	32,574	32,574	10,682	(10,000)	682	31,892
2022	0	33,876	33,876	10,682	(7,000)	3,682	30,194
2023	0	35,230	35,230	10,682	(10,000)	682	34,548
2024	0	36,639	36,639	10,682	(10,000)	682	35,957
2025	0	38,106	38,106	10,682	(10,000)	682	37,424
2026	0	39,629	39,629	10,682	(10,000)	682	38,947
2027	0	41,215	41,215	10,682	(10,000)	682	40,533
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$476,574			$112,830	$363,744
		NPV =	$211,054			$88,834	122,220

Total NPV =	$122,220
Benefit/Cost Ratio =	2.38

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical Lighting**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$256	$537	$1,010
Incentive Costs =	5,920	8,880	14,800
Total Utility Project Costs =	$6,176	$9,417	$15,810
14) Direct Participant Costs ($/Part.) =	$5,000	$5,000	$5,000
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	18	18	18
16) Avg Summer kW/part. Saved =	5.200	5.200	5.200
16a) Avg Winter kW/part Saved =	5.200	5.200	5.200
17) Avg. Summer kWh/Part. Saved =	6,167	6,167	6,167
17a) Avg. Winter kWh/Part. Saved =	12,333	12,333	12,333
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	3	5
20) Incentive/Participant =	$2,960	$2,960	$2,960
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	12,334	18,501	30,835
Annual Winter Kwh Saved	24,666	36,999	61,665
23) Annual Summer KW Saved	10	16	26
Annual Winter KW Saved	10	16	26

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$126,196	2.84
Utility Cost Test	$166,918	6.98
Societal Test	$386,939	8.88
Participant Test	$129,391	3.82
Total Resource Cost Test	$148,765	4.23

Table 1
Ratepayer Impact Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	39,766	$0.02860	$1,137	$0.00000	$0	12	12	24	$98.68	$2,368	$3,505	$0.03807	12,334	24,666	37,000	$854	$256	$5,920	$7,030	($3,525)
2	2012	99,414	0.02988	2,970	0.00000	0	29	29	58	102.62	5,952	8,922	0.03883	30,835	61,665	92,500	2,177	537	8,880	11,594	(2,672)
3	2013	198,829	0.03195	6,353	0.00000	0	58	58	116	106.73	12,381	18,734	0.03960	61,670	123,330	185,000	4,440	1,010	14,800	20,250	(1,516)
4	2014	198,829	0.03348	6,657	0.00000	0	58	58	116	111.00	12,876	19,533	0.04040	61,670	123,330	185,000	4,530	0	0	4,530	15,003
5	2015	198,829	0.03688	7,333	0.00000	0	58	58	116	115.44	13,391	20,724	0.04120	61,670	123,330	185,000	4,620	0	0	4,620	16,104
6	2016	198,829	0.03720	7,396	0.00000	0	58	58	116	120.05	13,926	21,322	0.04203	61,670	123,330	185,000	4,713	0	0	4,713	16,609
7	2017	198,829	0.03911	7,776	0.00000	0	58	58	116	124.86	14,484	22,260	0.04287	61,670	123,330	185,000	4,807	0	0	4,807	17,453
8	2018	198,829	0.04251	8,452	0.00000	0	58	58	116	129.85	15,063	23,515	0.04373	61,670	123,330	185,000	4,904	0	0	4,904	18,611
9	2019	198,829	0.04456	8,860	0.00000	0	58	58	116	135.05	15,666	24,526	0.04460	61,670	123,330	185,000	5,001	0	0	5,001	19,525
10	2020	198,829	0.04769	9,482	0.00000	0	58	58	116	140.45	16,292	25,774	0.04549	61,670	123,330	185,000	5,101	0	0	5,101	20,673
11	2021	198,829	0.04800	9,544	0.00000	0	58	58	116	146.07	16,944	26,488	0.04640	61,670	123,330	185,000	5,203	0	0	5,203	21,285
12	2022	198,829	0.04834	9,611	0.00000	0	58	58	116	151.91	17,622	27,233	0.04733	61,670	123,330	185,000	5,307	0	0	5,307	21,926
13	2023	198,829	0.04871	9,685	0.00000	0	58	58	116	157.98	18,326	28,011	0.04828	61,670	123,330	185,000	5,414	0	0	5,414	22,597
14	2024	198,829	0.04911	9,764	0.00000	0	58	58	116	164.30	19,059	28,823	0.04924	61,670	123,330	185,000	5,521	0	0	5,521	23,302
15	2025	198,829	0.04954	9,850	0.00000	0	58	58	116	170.88	19,822	29,672	0.05023	61,670	123,330	185,000	5,632	0	0	5,632	24,040
16	2026	198,829	0.05000	9,941	0.00000	0	58	58	116	177.71	20,614	30,555	0.05123	61,670	123,330	185,000	5,745	0	0	5,745	24,810
17	2027	198,829	0.05050	10,041	0.00000	0	58	58	116	184.82	21,439	31,480	0.05226	61,670	123,330	185,000	5,860	0	0	5,860	25,620
18	2028	198,829	0.05103	10,146	0.00000	0	58	58	116	192.21	22,296	32,442	0.05330	61,670	123,330	185,000	5,977	0	0	5,977	26,465
19	2029	159,063	0.05160	8,208	0.00000	0	46	46	92	199.90	18,391	26,599	0.05437	49,336	98,664	148,000	4,877	0	0	4,877	21,722
20	2030	99,414	0.05220	5,189	0.00000	0	29	29	58	207.90	12,058	17,247	0.05546	30,835	61,665	92,500	3,109	0	0	3,109	14,138
Total =		3,578,921							2,088			$467,365				3,330,000				$125,195	$342,170
											NPV =	$194,845								$68,649	126,196

Total NPV = $126,196
Benefit/Cost Ratio = 2.84

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$1,137	$0	$2,368	$3,505	$6,176	$6,176	($2,671)
2012	2,970	0	5,952	8,922	9,417	9,417	(495)
2013	6,353	0	12,381	18,734	15,810	15,810	2,924
2014	6,657	0	12,876	19,533	0	0	19,533
2015	7,333	0	13,391	20,724	0	0	20,724
2016	7,396	0	13,926	21,322	0	0	21,322
2017	7,776	0	14,484	22,260	0	0	22,260
2018	8,452	0	15,063	23,515	0	0	23,515
2019	8,860	0	15,666	24,526	0	0	24,526
2020	9,482	0	16,292	25,774	0	0	25,774
2021	9,544	0	16,944	26,488	0	0	26,488
2022	9,611	0	17,622	27,233	0	0	27,233
2023	9,685	0	18,326	28,011	0	0	28,011
2024	9,764	0	19,059	28,823	0	0	28,823
2025	9,850	0	19,822	29,672	0	0	29,672
2026	9,941	0	20,614	30,555	0	0	30,555
2027	10,041	0	21,439	31,480	0	0	31,480
2028	10,146	0	22,296	32,442	0	0	32,442
2029	8,208	0	18,391	26,599	0	0	26,599
2030	5,189	0	12,058	17,247	0	0	17,247
Total =				$467,365		$31,403	$435,962
			NPV =	$194,845		$27,927	166,918

Total NPV =	$166,918
Benefit/Cost Ratio =	6.98

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$1,137	$0	$2,368	$1,108	$4,613	$6,176	$4,080	$10,256	($5,643)
2012	2,970	0	5,952	2,906	11,828	9,417	6,120	15,537	(3,709)
2013	6,353	0	12,381	6,285	25,019	15,810	10,200	26,010	(991)
2014	6,657	0	12,876	6,749	26,282	0	0	0	26,282
2015	7,333	0	13,391	7,376	28,100	0	0	0	28,100
2016	7,396	0	13,926	7,816	29,138	0	0	0	29,138
2017	7,776	0	14,484	8,405	30,665	0	0	0	30,665
2018	8,452	0	15,063	9,145	32,660	0	0	0	32,660
2019	8,860	0	15,666	9,824	34,350	0	0	0	34,350
2020	9,482	0	16,292	10,634	36,408	0	0	0	36,408
2021	9,544	0	16,944	11,256	37,744	0	0	0	37,744
2022	9,611	0	17,622	11,920	39,153	0	0	0	39,153
2023	9,685	0	18,326	12,628	40,639	0	0	0	40,639
2024	9,764	0	19,059	13,384	42,207	0	0	0	42,207
2025	9,850	0	19,822	14,192	43,864	0	0	0	43,864
2026	9,941	0	20,614	15,053	45,608	0	0	0	45,608
2027	10,041	0	21,439	15,974	47,454	0	0	0	47,454
2028	10,146	0	22,296	16,956	49,398	0	0	0	49,398
2029	8,208	0	18,391	14,319	40,918	0	0	0	40,918
2030	5,189	0	12,058	9,563	26,810	0	0	0	26,810
Total =					$672,858			$51,803	$621,055
				NPV =	$436,037			$49,098	386,939

Total NPV = $386,939
Benefit/Cost Ratio = 8.88

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical Lighting**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$5,920	$0.06057	$0.06043	12,334	24,666	37,000	$2,238	10	10	$20.400	$40.800	$612	$0	$8,770	$10,211	$0	$10,211	($1,441)
2012	8,880	0.06355	0.06341	30,835	61,665	92,500	5,870	26	26	20.808	41.616	1,623	0	16,373	15,640	0	15,640	733
2013	14,800	0.06669	0.06654	61,670	123,330	185,000	12,319	52	52	21.224	42.448	3,311	0	30,430	26,616	0	26,616	3,814
2014	0	0.06997	0.06982	61,670	123,330	185,000	12,926	52	52	21.649	43.297	3,377	0	16,303	0	0	0	16,303
2015	0	0.07343	0.07326	61,670	123,330	185,000	13,564	52	52	22.082	44.163	3,445	0	17,009	0	0	0	17,009
2016	0	0.07705	0.07687	61,670	123,330	185,000	14,232	52	52	22.523	45.046	3,514	0	17,746	0	0	0	17,746
2017	0	0.08084	0.08066	61,670	123,330	185,000	14,933	52	52	22.974	45.947	3,584	0	18,517	0	0	0	18,517
2018	0	0.08483	0.08464	61,670	123,330	185,000	15,670	52	52	23.433	46.866	3,656	0	19,326	0	0	0	19,326
2019	0	0.08901	0.08881	61,670	123,330	185,000	16,442	52	52	23.902	47.804	3,729	0	20,171	0	0	0	20,171
2020	0	0.09340	0.09319	61,670	123,330	185,000	17,253	52	52	24.380	48.760	3,803	0	21,056	0	0	0	21,056
2021	0	0.09801	0.09779	61,670	123,330	185,000	18,105	52	52	24.867	49.735	3,879	0	21,984	0	0	0	21,984
2022	0	0.10284	0.10261	61,670	123,330	185,000	18,997	52	52	25.365	50.730	3,957	0	22,954	0	0	0	22,954
2023	0	0.10791	0.10767	61,670	123,330	185,000	19,934	52	52	25.872	51.744	4,036	0	23,970	0	0	0	23,970
2024	0	0.11323	0.11298	61,670	123,330	185,000	20,917	52	52	26.390	52.779	4,117	0	25,034	0	0	0	25,034
2025	0	0.11882	0.11855	61,670	123,330	185,000	21,948	52	52	26.917	53.835	4,199	0	26,147	0	0	0	26,147
2026	0	0.12468	0.12440	61,670	123,330	185,000	23,031	52	52	27.456	54.911	4,283	0	27,314	0	0	0	27,314
2027	0	0.13083	0.13053	61,670	123,330	185,000	24,167	52	52	28.005	56.010	4,369	0	28,536	0	0	0	28,536
2028	0	0.13728	0.13697	61,670	123,330	185,000	25,359	52	52	28.565	57.130	4,456	0	29,815	0	0	0	29,815
2029	0	0.14405	0.14372	49,336	98,664	148,000	21,287	42	42	29.136	58.272	3,671	0	24,958	0	0	0	24,958
2030	0	0.15115	0.15081	30,835	61,665	92,500	13,960	26	26	29.719	59.438	2,318	0	16,278	0	0	0	16,278
Total =				1,110,060	2,219,940			936	936					$432,691			$52,467	$380,224
													NPV =	$175,326			$45,934	129,391

Total NPV =	$129,391
Benefit/Cost Ratio =	3.82

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical Lighting**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$1,137	$2,368	$3,505	$6,176	$4,080	$10,256	($6,751)
2012	2,970	5,952	8,922	9,417	6,120	15,537	(6,615)
2013	6,353	12,381	18,734	15,810	10,200	26,010	(7,276)
2014	6,657	12,876	19,533	0	0	0	19,533
2015	7,333	13,391	20,724	0	0	0	20,724
2016	7,396	13,926	21,322	0	0	0	21,322
2017	7,776	14,484	22,260	0	0	0	22,260
2018	8,452	15,063	23,515	0	0	0	23,515
2019	8,860	15,666	24,526	0	0	0	24,526
2020	9,482	16,292	25,774	0	0	0	25,774
2021	9,544	16,944	26,488	0	0	0	26,488
2022	9,611	17,622	27,233	0	0	0	27,233
2023	9,685	18,326	28,011	0	0	0	28,011
2024	9,764	19,059	28,823	0	0	0	28,823
2025	9,850	19,822	29,672	0	0	0	29,672
2026	9,941	20,614	30,555	0	0	0	30,555
2027	10,041	21,439	31,480	0	0	0	31,480
2028	10,146	22,296	32,442	0	0	0	32,442
2029	8,208	18,391	26,599	0	0	0	26,599
2030	5,189	12,058	17,247	0	0	0	17,247
		Total =	$467,365			$51,803	$415,562
		NPV =	$194,845			$46,080	148,765

Total NPV =	$148,765
Benefit/Cost Ratio =	4.23

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$16	$45	$77
Incentive Costs =	375	750	1,125
Total Utility Project Costs =	$391	$795	$1,202
14) Direct Participant Costs ($/Part.) =	$1,400	$1,400	$1,400
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	0.465	0.465	0.465
16a) Avg Winter kW/part Saved =	0.465	0.465	0.465
17) Avg. Summer kWh/Part. Saved =	1,630	1,630	1,630
17a) Avg. Winter kWh/Part. Saved =	3,262	3,262	3,262
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	2	3
20) Incentive/Participant =	$375	$375	$375
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	1,630	3,260	4,890
Annual Winter Kwh Saved	3,262	6,524	9,786
23) Annual Summer KW Saved	0	1	1
Annual Winter KW Saved	0	1	1

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$9,057	2.04
Utility Cost Test	$15,619	8.38
Societal Test	$31,993	4.96
Participant Test	$15,567	3.02
Total Resource Cost Test	$10,164	2.34

Table 1
Ratepayer Impact Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	5,258	$0.02860	$150	$0.00000	$0	1	1	2	$98.68	$197	$347	$0.03807	1,630	3,262	4,892	$113	$16	$375	$504	($157)
2	2012	15,774	0.02988	471	0.00000	0	2	2	4	102.62	410	881	0.03883	4,890	9,786	14,676	345	45	750	1,140	(259)
3	2013	31,546	0.03195	1,008	0.00000	0	3	3	6	106.73	640	1,648	0.03960	9,780	19,572	29,352	705	77	1,125	1,907	(259)
4	2014	31,546	0.03348	1,056	0.00000	0	3	3	6	111.00	666	1,722	0.04040	9,780	19,572	29,352	719	0	0	719	1,003
5	2015	31,546	0.03688	1,163	0.00000	0	3	3	6	115.44	693	1,856	0.04120	9,780	19,572	29,352	733	0	0	733	1,123
6	2016	31,546	0.03720	1,174	0.00000	0	3	3	6	120.05	720	1,894	0.04203	9,780	19,572	29,352	748	0	0	748	1,146
7	2017	31,546	0.03911	1,234	0.00000	0	3	3	6	124.86	749	1,983	0.04287	9,780	19,572	29,352	763	0	0	763	1,220
8	2018	31,546	0.04251	1,341	0.00000	0	3	3	6	129.85	779	2,120	0.04373	9,780	19,572	29,352	778	0	0	778	1,342
9	2019	31,546	0.04456	1,406	0.00000	0	3	3	6	135.05	810	2,216	0.04460	9,780	19,572	29,352	793	0	0	793	1,423
10	2020	31,546	0.04769	1,504	0.00000	0	3	3	6	140.45	843	2,347	0.04549	9,780	19,572	29,352	809	0	0	809	1,538
11	2021	31,546	0.04800	1,514	0.00000	0	3	3	6	146.07	876	2,390	0.04640	9,780	19,572	29,352	826	0	0	826	1,564
12	2022	31,546	0.04834	1,525	0.00000	0	3	3	6	151.91	911	2,436	0.04733	9,780	19,572	29,352	842	0	0	842	1,594
13	2023	31,546	0.04871	1,537	0.00000	0	3	3	6	157.98	948	2,485	0.04828	9,780	19,572	29,352	859	0	0	859	1,626
14	2024	31,546	0.04911	1,549	0.00000	0	3	3	6	164.30	986	2,535	0.04924	9,780	19,572	29,352	876	0	0	876	1,659
15	2025	31,546	0.04954	1,563	0.00000	0	3	3	6	170.88	1,025	2,588	0.05023	9,780	19,572	29,352	894	0	0	894	1,694
16	2026	31,546	0.05000	1,577	0.00000	0	3	3	6	177.71	1,066	2,643	0.05123	9,780	19,572	29,352	911	0	0	911	1,732
17	2027	31,546	0.05050	1,593	0.00000	0	3	3	6	184.82	1,109	2,702	0.05226	9,780	19,572	29,352	930	0	0	930	1,772
18	2028	31,546	0.05103	1,610	0.00000	0	3	3	6	192.21	1,153	2,763	0.05330	9,780	19,572	29,352	948	0	0	948	1,815
19	2029	31,546	0.05160	1,628	0.00000	0	3	3	6	199.90	1,199	2,827	0.05437	9,780	19,572	29,352	967	0	0	967	1,860
20	2030	31,546	0.05220	1,647	0.00000	0	3	3	6	207.90	1,247	2,894	0.05546	9,780	19,572	29,352	987	0	0	987	1,907
Total =		588,860							114			$43,277				547,904				$17,934	$25,343
											NPV =	$17,736								$8,679	9,057

Total NPV = $9,057
Benefit/Cost Ratio = 2.04

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$150	$0	$197	$347	$391	$391	($44)
2012	471	0	410	881	795	795	86
2013	1,008	0	640	1,648	1,202	1,202	446
2014	1,056	0	666	1,722	0	0	1,722
2015	1,163	0	693	1,856	0	0	1,856
2016	1,174	0	720	1,894	0	0	1,894
2017	1,234	0	749	1,983	0	0	1,983
2018	1,341	0	779	2,120	0	0	2,120
2019	1,406	0	810	2,216	0	0	2,216
2020	1,504	0	843	2,347	0	0	2,347
2021	1,514	0	876	2,390	0	0	2,390
2022	1,525	0	911	2,436	0	0	2,436
2023	1,537	0	948	2,485	0	0	2,485
2024	1,549	0	986	2,535	0	0	2,535
2025	1,563	0	1,025	2,588	0	0	2,588
2026	1,577	0	1,066	2,643	0	0	2,643
2027	1,593	0	1,109	2,702	0	0	2,702
2028	1,610	0	1,153	2,763	0	0	2,763
2029	1,628	0	1,199	2,827	0	0	2,827
2030	1,647	0	1,247	2,894	0	0	2,894
Total =				$43,277		$2,388	$40,889
			NPV =	$17,736		$2,117	15,619

Total NPV =	$15,619
Benefit/Cost Ratio =	8.38

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits					Costs			
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Annual Benefits Less Costs (I)
2011	$150	$0	$197	$110	$457	$391	$1,025	$1,416	($959)
2012	471	0	410	287	1,168	795	2,050	2,845	(1,677)
2013	1,008	0	640	553	2,201	1,202	3,075	4,277	(2,076)
2014	1,056	0	666	595	2,317	0	0	0	2,317
2015	1,163	0	693	661	2,517	0	0	0	2,517
2016	1,174	0	720	694	2,588	0	0	0	2,588
2017	1,234	0	749	749	2,732	0	0	0	2,732
2018	1,341	0	779	824	2,944	0	0	0	2,944
2019	1,406	0	810	888	3,104	0	0	0	3,104
2020	1,504	0	843	968	3,315	0	0	0	3,315
2021	1,514	0	876	1,016	3,406	0	0	0	3,406
2022	1,525	0	911	1,066	3,502	0	0	0	3,502
2023	1,537	0	948	1,120	3,605	0	0	0	3,605
2024	1,549	0	986	1,177	3,712	0	0	0	3,712
2025	1,563	0	1,025	1,238	3,826	0	0	0	3,826
2026	1,577	0	1,066	1,302	3,945	0	0	0	3,945
2027	1,593	0	1,109	1,371	4,073	0	0	0	4,073
2028	1,610	0	1,153	1,444	4,207	0	0	0	4,207
2029	1,628	0	1,199	1,522	4,349	0	0	0	4,349
2030	1,647	0	1,247	1,605	4,499	0	0	0	4,499
Total =					$62,467			$8,538	$53,929
				NPV =	$40,074			$8,081	31,993

Total NPV = $31,993
Benefit/Cost Ratio = 4.96

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Motors - Replacement**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$375	$0.06057	$0.06043	1,630	3,262	4,892	$296	0	0	$20.400	$40.800	$0	$0	$671	$1,430	$0	$1,430	($759)
2012	750	0.06355	0.06341	4,890	9,786	14,676	931	1	1	20.808	41.616	62	0	1,743	2,919	0	2,919	(1,176)
2013	1,125	0.06669	0.06654	9,780	19,572	29,352	1,955	3	3	21.224	42.448	191	0	3,271	4,472	0	4,472	(1,201)
2014	0	0.06997	0.06982	9,780	19,572	29,352	2,051	3	3	21.649	43.297	195	0	2,246	0	0	0	2,246
2015	0	0.07343	0.07326	9,780	19,572	29,352	2,152	3	3	22.082	44.163	199	0	2,351	0	0	0	2,351
2016	0	0.07705	0.07687	9,780	19,572	29,352	2,258	3	3	22.523	45.046	203	0	2,461	0	0	0	2,461
2017	0	0.08084	0.08066	9,780	19,572	29,352	2,369	3	3	22.974	45.947	207	0	2,576	0	0	0	2,576
2018	0	0.08483	0.08464	9,780	19,572	29,352	2,486	3	3	23.433	46.866	211	0	2,697	0	0	0	2,697
2019	0	0.08901	0.08881	9,780	19,572	29,352	2,609	3	3	23.902	47.804	215	0	2,824	0	0	0	2,824
2020	0	0.09340	0.09319	9,780	19,572	29,352	2,737	3	3	24.380	48.760	219	0	2,956	0	0	0	2,956
2021	0	0.09801	0.09779	9,780	19,572	29,352	2,872	3	3	24.867	49.735	224	0	3,096	0	0	0	3,096
2022	0	0.10284	0.10261	9,780	19,572	29,352	3,014	3	3	25.365	50.730	228	0	3,242	0	0	0	3,242
2023	0	0.10791	0.10767	9,780	19,572	29,352	3,163	3	3	25.872	51.744	233	0	3,396	0	0	0	3,396
2024	0	0.11323	0.11298	9,780	19,572	29,352	3,319	3	3	26.390	52.779	238	0	3,557	0	0	0	3,557
2025	0	0.11882	0.11855	9,780	19,572	29,352	3,482	3	3	26.917	53.835	242	0	3,724	0	0	0	3,724
2026	0	0.12468	0.12440	9,780	19,572	29,352	3,654	3	3	27.456	54.911	247	0	3,901	0	0	0	3,901
2027	0	0.13083	0.13053	9,780	19,572	29,352	3,834	3	3	28.005	56.010	252	0	4,086	0	0	0	4,086
2028	0	0.13728	0.13697	9,780	19,572	29,352	4,023	3	3	28.565	57.130	257	0	4,280	0	0	0	4,280
2029	0	0.14405	0.14372	9,780	19,572	29,352	4,222	3	3	29.136	58.272	262	0	4,484	0	0	0	4,484
2030	0	0.15115	0.15081	9,780	19,572	29,352	4,430	14	3	29.719	59.438	594	0	5,024	0	0	0	5,024
Total =				182,560	365,344			66	55					$62,586			$8,821	$53,765
													NPV =	$23,261			$7,695	15,567

Total NPV =	$15,567
Benefit/Cost Ratio =	3.02

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Motors - Replacement**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$150	$197	$347	$391	$1,025	$1,416	($1,069)
2012	471	410	881	795	2,050	2,845	(1,964)
2013	1,008	640	1,648	1,202	3,075	4,277	(2,629)
2014	1,056	666	1,722	0	0	0	1,722
2015	1,163	693	1,856	0	0	0	1,856
2016	1,174	720	1,894	0	0	0	1,894
2017	1,234	749	1,983	0	0	0	1,983
2018	1,341	779	2,120	0	0	0	2,120
2019	1,406	810	2,216	0	0	0	2,216
2020	1,504	843	2,347	0	0	0	2,347
2021	1,514	876	2,390	0	0	0	2,390
2022	1,525	911	2,436	0	0	0	2,436
2023	1,537	948	2,485	0	0	0	2,485
2024	1,549	986	2,535	0	0	0	2,535
2025	1,563	1,025	2,588	0	0	0	2,588
2026	1,577	1,066	2,643	0	0	0	2,643
2027	1,593	1,109	2,702	0	0	0	2,702
2028	1,610	1,153	2,763	0	0	0	2,763
2029	1,628	1,199	2,827	0	0	0	2,827
2030	1,647	1,247	2,894	0	0	0	2,894
		Total =	$43,277			$8,538	$34,739
		NPV =	$17,736			$7,571	10,164

Total NPV =	$10,164
Benefit/Cost Ratio =	2.34

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$4	$12	$20
Incentive Costs =	100	200	300
Total Utility Project Costs =	$104	$212	$320
14) Direct Participant Costs ($/Part.) =	$201	$201	$201
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	0.113	0.113	0.113
16a) Avg Winter kW/part Saved =	0.113	0.113	0.113
17) Avg. Summer kWh/Part. Saved =	401	401	401
17a) Avg. Winter kWh/Part. Saved =	801	801	801
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	2	3
20) Incentive/Participant =	$100	$100	$100
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	401	802	1,203
Annual Winter Kwh Saved	801	1,602	2,403
23) Annual Summer KW Saved	0	0	0
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$2,600	2.19
Utility Cost Test	$4,213	8.47
Societal Test	$9,792	9.33
Participant Test	$4,769	5.32
Total Resource Cost Test	$3,676	4.34

Table 1
Ratepayer Impact Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	1,292	$0.02860	$37	$0.00000	$0	0	0	0	$98.68	$0	$37	$0.03807	401	801	1,202	$28	$4	$100	$132	($95)
2	2012	3,876	0.02988	116	0.00000	0	0	0	0	102.62	0	116	0.03883	1,203	2,403	3,606	85	12	200	297	(181)
3	2013	7,751	0.03195	248	0.00000	0	1	1	2	106.73	213	461	0.03960	2,406	4,806	7,212	173	20	300	493	(32)
4	2014	7,751	0.03348	260	0.00000	0	1	1	2	111.00	222	482	0.04040	2,406	4,806	7,212	177	0	0	177	305
5	2015	7,751	0.03688	286	0.00000	0	1	1	2	115.44	231	517	0.04120	2,406	4,806	7,212	180	0	0	180	337
6	2016	7,751	0.03720	288	0.00000	0	1	1	2	120.05	240	528	0.04203	2,406	4,806	7,212	184	0	0	184	344
7	2017	7,751	0.03911	303	0.00000	0	1	1	2	124.86	250	553	0.04287	2,406	4,806	7,212	187	0	0	187	366
8	2018	7,751	0.04251	329	0.00000	0	1	1	2	129.85	260	589	0.04373	2,406	4,806	7,212	191	0	0	191	398
9	2019	7,751	0.04456	345	0.00000	0	1	1	2	135.05	270	615	0.04460	2,406	4,806	7,212	195	0	0	195	420
10	2020	7,751	0.04769	370	0.00000	0	1	1	2	140.45	281	651	0.04549	2,406	4,806	7,212	199	0	0	199	452
11	2021	7,751	0.04800	372	0.00000	0	1	1	2	146.07	292	664	0.04640	2,406	4,806	7,212	203	0	0	203	461
12	2022	7,751	0.04834	375	0.00000	0	1	1	2	151.91	304	679	0.04733	2,406	4,806	7,212	207	0	0	207	472
13	2023	7,751	0.04871	378	0.00000	0	1	1	2	157.98	316	694	0.04828	2,406	4,806	7,212	211	0	0	211	483
14	2024	7,751	0.04911	381	0.00000	0	1	1	2	164.30	329	710	0.04924	2,406	4,806	7,212	215	0	0	215	495
15	2025	7,751	0.04954	384	0.00000	0	1	1	2	170.88	342	726	0.05023	2,406	4,806	7,212	220	0	0	220	506
16	2026	7,751	0.05000	388	0.00000	0	1	1	2	177.71	355	743	0.05123	2,406	4,806	7,212	224	0	0	224	519
17	2027	7,751	0.05050	391	0.00000	0	1	1	2	184.82	370	761	0.05226	2,406	4,806	7,212	228	0	0	228	533
18	2028	7,751	0.05103	396	0.00000	0	1	1	2	192.21	384	780	0.05330	2,406	4,806	7,212	233	0	0	233	547
19	2029	7,751	0.05160	400	0.00000	0	1	1	2	199.90	400	800	0.05437	2,406	4,806	7,212	238	0	0	238	562
20	2030	7,751	0.05220	405	0.00000	0	1	1	2	207.90	416	821	0.05546	2,406	4,806	7,212	242	0	0	242	579
Total =		144,686							36			$11,927				134,624				$4,456	$7,471
											NPV =	$4,777								$2,177	2,600

Total NPV = $2,600
Benefit/Cost Ratio = 2.19

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits				Costs		
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Annual Benefits Less Costs (G)
2011	$37	$0	$0	$37	$104	$104	($67)
2012	116	0	0	116	212	212	(96)
2013	248	0	213	461	320	320	141
2014	260	0	222	482	0	0	482
2015	286	0	231	517	0	0	517
2016	288	0	240	528	0	0	528
2017	303	0	250	553	0	0	553
2018	329	0	260	589	0	0	589
2019	345	0	270	615	0	0	615
2020	370	0	281	651	0	0	651
2021	372	0	292	664	0	0	664
2022	375	0	304	679	0	0	679
2023	378	0	316	694	0	0	694
2024	381	0	329	710	0	0	710
2025	384	0	342	726	0	0	726
2026	388	0	355	743	0	0	743
2027	391	0	370	761	0	0	761
2028	396	0	384	780	0	0	780
2029	400	0	400	800	0	0	800
2030	405	0	416	821	0	0	821
Total =				$11,927		$636	$11,291
			NPV =	$4,777		$564	4,213

Total NPV =	$4,213
Benefit/Cost Ratio =	8.47

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$37	$0	$0	$12	$49	$104	$101	$205	($156)
2012	116	0	0	38	154	212	202	414	(260)
2013	248	0	213	155	616	320	303	623	(7)
2014	260	0	222	167	649	0	0	0	649
2015	286	0	231	184	701	0	0	0	701
2016	288	0	240	194	722	0	0	0	722
2017	303	0	250	209	762	0	0	0	762
2018	329	0	260	229	818	0	0	0	818
2019	345	0	270	246	861	0	0	0	861
2020	370	0	281	269	920	0	0	0	920
2021	372	0	292	282	946	0	0	0	946
2022	375	0	304	297	976	0	0	0	976
2023	378	0	316	313	1,007	0	0	0	1,007
2024	381	0	329	330	1,040	0	0	0	1,040
2025	384	0	342	347	1,073	0	0	0	1,073
2026	388	0	355	366	1,109	0	0	0	1,109
2027	391	0	370	386	1,147	0	0	0	1,147
2028	396	0	384	408	1,188	0	0	0	1,188
2029	400	0	400	431	1,231	0	0	0	1,231
2030	405	0	416	455	1,276	0	0	0	1,276
Total =					$17,245			$1,242	$16,003
				NPV =	$10,968			$1,176	9,792

Total NPV = $9,792
Benefit/Cost Ratio = 9.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical Motors - New / on Failure**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$100	$0.06057	$0.06043	401	801	1,202	$73	0	0	$20.400	$40.800	$0	$0	$173	$205	$0	$205	($32)
2012	200	0.06355	0.06341	1,203	2,403	3,606	229	0	0	20.808	41.616	0	0	429	419	0	419	10
2013	300	0.06669	0.06654	2,406	4,806	7,212	480	1	1	21.224	42.448	64	0	844	642	0	642	202
2014	0	0.06997	0.06982	2,406	4,806	7,212	504	1	1	21.649	43.297	65	0	569	0	0	0	569
2015	0	0.07343	0.07326	2,406	4,806	7,212	529	1	1	22.082	44.163	66	0	595	0	0	0	595
2016	0	0.07705	0.07687	2,406	4,806	7,212	555	1	1	22.523	45.046	68	0	623	0	0	0	623
2017	0	0.08084	0.08066	2,406	4,806	7,212	582	1	1	22.974	45.947	69	0	651	0	0	0	651
2018	0	0.08483	0.08464	2,406	4,806	7,212	611	1	1	23.433	46.866	70	0	681	0	0	0	681
2019	0	0.08901	0.08881	2,406	4,806	7,212	641	1	1	23.902	47.804	72	0	713	0	0	0	713
2020	0	0.09340	0.09319	2,406	4,806	7,212	673	1	1	24.380	48.760	73	0	746	0	0	0	746
2021	0	0.09801	0.09779	2,406	4,806	7,212	706	1	1	24.867	49.735	75	0	781	0	0	0	781
2022	0	0.10284	0.10261	2,406	4,806	7,212	741	1	1	25.365	50.730	76	0	817	0	0	0	817
2023	0	0.10791	0.10767	2,406	4,806	7,212	777	1	1	25.872	51.744	78	0	855	0	0	0	855
2024	0	0.11323	0.11298	2,406	4,806	7,212	815	1	1	26.390	52.779	79	0	894	0	0	0	894
2025	0	0.11882	0.11855	2,406	4,806	7,212	856	1	1	26.917	53.835	81	0	937	0	0	0	937
2026	0	0.12468	0.12440	2,406	4,806	7,212	898	1	1	27.456	54.911	82	0	980	0	0	0	980
2027	0	0.13083	0.13053	2,406	4,806	7,212	942	1	1	28.005	56.010	84	0	1,026	0	0	0	1,026
2028	0	0.13728	0.13697	2,406	4,806	7,212	989	1	1	28.565	57.130	86	0	1,075	0	0	0	1,075
2029	0	0.14405	0.14372	2,406	4,806	7,212	1,037	1	1	29.136	58.272	87	0	1,124	0	0	0	1,124
2030	0	0.15115	0.15081	2,406	4,806	7,212	1,088	3	1	29.719	59.438	149	0	1,237	0	0	0	1,237
Total =				44,912	89,712			20	18					$15,750			$1,266	$14,484
													NPV =	$5,873			$1,104	4,769

Total NPV = $4,769
Benefit/Cost Ratio = 5.32

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical Motors - New / on Failure**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$37	$0	$37	$104	$101	$205	($168)
2012	116	0	116	212	202	414	(298)
2013	248	213	461	320	303	623	(162)
2014	260	222	482	0	0	0	482
2015	286	231	517	0	0	0	517
2016	288	240	528	0	0	0	528
2017	303	250	553	0	0	0	553
2018	329	260	589	0	0	0	589
2019	345	270	615	0	0	0	615
2020	370	281	651	0	0	0	651
2021	372	292	664	0	0	0	664
2022	375	304	679	0	0	0	679
2023	378	316	694	0	0	0	694
2024	381	329	710	0	0	0	710
2025	384	342	726	0	0	0	726
2026	388	355	743	0	0	0	743
2027	391	370	761	0	0	0	761
2028	396	384	780	0	0	0	780
2029	400	400	800	0	0	0	800
2030	405	416	821	0	0	0	821
		Total =	$11,927			$1,242	$10,685
		NPV =	$4,777			$1,101	3,676

Total NPV =	$3,676
Benefit/Cost Ratio =	4.34

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$32	$91	$102
Incentive Costs =	750	1,500	1,500
Total Utility Project Costs =	$782	$1,591	$1,602
14) Direct Participant Costs ($/Part.) =	$2,500	$2,500	$2,500
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	4.400	4.400	4.400
16a) Avg Winter kW/part Saved =	4.400	4.400	4.400
17) Avg. Summer kWh/Part. Saved =	7,074	7,074	7,074
17a) Avg. Winter kWh/Part. Saved =	14,148	14,148	14,148
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	2	2
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	7,074	14,148	14,148
Annual Winter Kwh Saved	14,148	28,296	28,296
23) Annual Summer KW Saved	4	9	9
Annual Winter KW Saved	4	9	9

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$59,417	3.38
Utility Cost Test	$80,802	23.65
Societal Test	$162,177	14.39
Participant Test	$65,367	6.65
Total Resource Cost Test	$72,946	7.39

Table 1
Ratepayer Impact Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	22,809	$0.02860	$652	$0.00000	$0	5	5	10	$98.68	$987	$1,639	$0.03807	7,074	14,148	21,222	$490	$32	$750	$1,272	$367
2	2012	68,425	0.02988	2,045	0.00000	0	15	15	30	102.62	3,079	5,124	0.03883	21,222	42,444	63,666	1,498	91	1,500	3,089	2,035
3	2013	114,042	0.03195	3,644	0.00000	0	25	25	50	106.73	5,337	8,981	0.03960	35,370	70,740	106,110	2,547	102	1,500	4,149	4,832
4	2014	114,042	0.03348	3,818	0.00000	0	25	25	50	111.00	5,550	9,368	0.04040	35,370	70,740	106,110	2,598	0	0	2,598	6,770
5	2015	114,042	0.03688	4,206	0.00000	0	25	25	50	115.44	5,772	9,978	0.04120	35,370	70,740	106,110	2,650	0	0	2,650	7,328
6	2016	114,042	0.03720	4,242	0.00000	0	25	25	50	120.05	6,003	10,245	0.04203	35,370	70,740	106,110	2,703	0	0	2,703	7,542
7	2017	114,042	0.03911	4,460	0.00000	0	25	25	50	124.86	6,243	10,703	0.04287	35,370	70,740	106,110	2,757	0	0	2,757	7,946
8	2018	114,042	0.04251	4,848	0.00000	0	25	25	50	129.85	6,493	11,341	0.04373	35,370	70,740	106,110	2,813	0	0	2,813	8,528
9	2019	114,042	0.04456	5,082	0.00000	0	25	25	50	135.05	6,753	11,835	0.04460	35,370	70,740	106,110	2,868	0	0	2,868	8,967
10	2020	114,042	0.04769	5,439	0.00000	0	25	25	50	140.45	7,023	12,462	0.04549	35,370	70,740	106,110	2,926	0	0	2,926	9,536
11	2021	114,042	0.04800	5,474	0.00000	0	25	25	50	146.07	7,304	12,778	0.04640	35,370	70,740	106,110	2,984	0	0	2,984	9,794
12	2022	114,042	0.04834	5,513	0.00000	0	25	25	50	151.91	7,596	13,109	0.04733	35,370	70,740	106,110	3,044	0	0	3,044	10,065
13	2023	114,042	0.04871	5,555	0.00000	0	25	25	50	157.98	7,899	13,454	0.04828	35,370	70,740	106,110	3,105	0	0	3,105	10,349
14	2024	114,042	0.04911	5,601	0.00000	0	25	25	50	164.30	8,215	13,816	0.04924	35,370	70,740	106,110	3,167	0	0	3,167	10,649
15	2025	114,042	0.04954	5,650	0.00000	0	25	25	50	170.88	8,544	14,194	0.05023	35,370	70,740	106,110	3,231	0	0	3,231	10,963
16	2026	91,233	0.05000	4,562	0.00000	0	20	20	40	177.71	7,108	11,670	0.05123	28,296	56,592	84,888	2,636	0	0	2,636	9,034
17	2027	45,617	0.05050	2,304	0.00000	0	10	10	20	184.82	3,696	6,000	0.05226	14,148	28,296	42,444	1,344	0	0	1,344	4,656
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05330	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.05437	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.05546	0	0	0	0	0	0	0	0
Total =		1,710,630							750			$176,697				1,591,650				$47,336	$129,361
											NPV =	$84,369								$24,952	59,417

Total NPV = $59,417
Benefit/Cost Ratio = 3.38

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$652	$0	$987	$1,639	$782	$782	$857
2012	2,045	0	3,079	5,124	1,591	1,591	3,533
2013	3,644	0	5,337	8,981	1,602	1,602	7,379
2014	3,818	0	5,550	9,368	0	0	9,368
2015	4,206	0	5,772	9,978	0	0	9,978
2016	4,242	0	6,003	10,245	0	0	10,245
2017	4,460	0	6,243	10,703	0	0	10,703
2018	4,848	0	6,493	11,341	0	0	11,341
2019	5,082	0	6,753	11,835	0	0	11,835
2020	5,439	0	7,023	12,462	0	0	12,462
2021	5,474	0	7,304	12,778	0	0	12,778
2022	5,513	0	7,596	13,109	0	0	13,109
2023	5,555	0	7,899	13,454	0	0	13,454
2024	5,601	0	8,215	13,816	0	0	13,816
2025	5,650	0	8,544	14,194	0	0	14,194
2026	4,562	0	7,108	11,670	0	0	11,670
2027	2,304	0	3,696	6,000	0	0	6,000
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$176,697		$3,975	$172,722
			NPV =	$84,369		$3,567	80,802

Total NPV =	$80,802
Benefit/Cost Ratio =	23.65

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$652	$0	$987	$518	$2,157	$782	$1,750	$2,532	($375)
2012	2,045	0	3,079	1,669	6,793	1,591	3,500	5,091	1,702
2013	3,644	0	5,337	3,013	11,994	1,602	3,500	5,102	6,892
2014	3,818	0	5,550	3,237	12,605	0	0	0	12,605
2015	4,206	0	5,772	3,551	13,529	0	0	0	13,529
2016	4,242	0	6,003	3,756	14,001	0	0	0	14,001
2017	4,460	0	6,243	4,041	14,744	0	0	0	14,744
2018	4,848	0	6,493	4,410	15,751	0	0	0	15,751
2019	5,082	0	6,753	4,741	16,576	0	0	0	16,576
2020	5,439	0	7,023	5,142	17,604	0	0	0	17,604
2021	5,474	0	7,304	5,430	18,208	0	0	0	18,208
2022	5,513	0	7,596	5,738	18,847	0	0	0	18,847
2023	5,555	0	7,899	6,066	19,520	0	0	0	19,520
2024	5,601	0	8,215	6,416	20,232	0	0	0	20,232
2025	5,650	0	8,544	6,789	20,983	0	0	0	20,983
2026	4,562	0	7,108	5,749	17,419	0	0	0	17,419
2027	2,304	0	3,696	3,045	9,045	0	0	0	9,045
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$250,008			$12,725	$237,283
				NPV =	$174,288			$12,111	162,177

Total NPV =	$162,177
Benefit/Cost Ratio =	14.39

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Variable Speed Drives - VFD'S**
Program Years: **2011 - 2013**

	Benefits														Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$750	$0.06057	$0.06043	7,074	14,148	21,222	$1,283	4	4	$20.400	$40.800	$245	$0	$2,278	$2,553	$0	$2,553	($275)
2012	1,500	0.06355	0.06341	21,222	42,444	63,666	4,040	13	13	20.808	41.616	812	0	6,352	5,213	0	5,213	1,139
2013	1,500	0.06669	0.06654	35,370	70,740	106,110	7,066	22	22	21.224	42.448	1,401	0	9,967	5,323	0	5,323	4,644
2014	0	0.06997	0.06982	35,370	70,740	106,110	7,414	22	22	21.649	43.297	1,429	0	8,843	0	0	0	8,843
2015	0	0.07343	0.07326	35,370	70,740	106,110	7,780	22	22	22.082	44.163	1,457	0	9,237	0	0	0	9,237
2016	0	0.07705	0.07687	35,370	70,740	106,110	8,163	22	22	22.523	45.046	1,487	0	9,650	0	0	0	9,650
2017	0	0.08084	0.08066	35,370	70,740	106,110	8,565	22	22	22.974	45.947	1,516	0	10,081	0	0	0	10,081
2018	0	0.08483	0.08464	35,370	70,740	106,110	8,988	22	22	23.433	46.866	1,547	0	10,535	0	0	0	10,535
2019	0	0.08901	0.08881	35,370	70,740	106,110	9,431	22	22	23.902	47.804	1,578	0	11,009	0	0	0	11,009
2020	0	0.09340	0.09319	35,370	70,740	106,110	9,896	22	22	24.380	48.760	1,609	0	11,505	0	0	0	11,505
2021	0	0.09801	0.09779	35,370	70,740	106,110	10,384	22	22	24.867	49.735	1,641	0	12,025	0	0	0	12,025
2022	0	0.10284	0.10261	35,370	70,740	106,110	10,896	22	22	25.365	50.730	1,674	0	12,570	0	0	0	12,570
2023	0	0.10791	0.10767	35,370	70,740	106,110	11,433	22	22	25.872	51.744	1,708	0	13,141	0	0	0	13,141
2024	0	0.11323	0.11298	35,370	70,740	106,110	11,997	22	22	26.390	52.779	1,742	0	13,739	0	0	0	13,739
2025	0	0.11882	0.11855	35,370	70,740	106,110	12,589	22	22	26.917	53.835	1,777	0	14,366	0	0	0	14,366
2026	0	0.12468	0.12440	28,296	56,592	84,888	10,568	18	18	27.456	54.911	1,483	0	12,051	0	0	0	12,051
2027	0	0.13083	0.13053	14,148	28,296	42,444	5,544	9	9	28.005	56.010	756	0	6,300	0	0	0	6,300
2028	0	0.13728	0.13697	0	0	0	0	0	0	28.565	57.130	0	0	0	0	0	0	0
2029	0	0.14405	0.14372	0	0	0	0	0	0	29.136	58.272	0	0	0	0	0	0	0
2030	0	0.15115	0.15081	0	0	0	0	0	0	29.719	59.438	0	0	0	0	0	0	0
Total =				530,550	1,061,100			330	330					$173,649			$13,089	$160,560
													NPV =	$76,944			$11,577	65,367

Total NPV = $65,367
Benefit/Cost Ratio = 6.65

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Variable Speed Drives - VFD'S**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$652	$987	$1,639	$782	$1,750	$2,532	($893)
2012	2,045	3,079	5,124	1,591	3,500	5,091	33
2013	3,644	5,337	8,981	1,602	3,500	5,102	3,879
2014	3,818	5,550	9,368	0	0	0	9,368
2015	4,206	5,772	9,978	0	0	0	9,978
2016	4,242	6,003	10,245	0	0	0	10,245
2017	4,460	6,243	10,703	0	0	0	10,703
2018	4,848	6,493	11,341	0	0	0	11,341
2019	5,082	6,753	11,835	0	0	0	11,835
2020	5,439	7,023	12,462	0	0	0	12,462
2021	5,474	7,304	12,778	0	0	0	12,778
2022	5,513	7,596	13,109	0	0	0	13,109
2023	5,555	7,899	13,454	0	0	0	13,454
2024	5,601	8,215	13,816	0	0	0	13,816
2025	5,650	8,544	14,194	0	0	0	14,194
2026	4,562	7,108	11,670	0	0	0	11,670
2027	2,304	3,696	6,000	0	0	0	6,000
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$176,697			$12,725	$163,972
		NPV =	$84,369			$11,423	72,946

Total NPV =	$72,946
Benefit/Cost Ratio =	7.39

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$65	$136	$256
Incentive Costs =	1,500	2,250	3,750
Total Utility Project Costs =	$1,565	$2,386	$4,006
14) Direct Participant Costs ($/Part.) =	$1,035	$1,035	$1,035
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	2.430	2.430	2.430
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,593	1,593	1,593
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	3	5
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	3,186	4,779	7,965
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	5	7	12
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$21,540	3.10
Utility Cost Test	$24,728	4.49
Societal Test	$55,908	6.46
Participant Test	$10,371	2.09
Total Resource Cost Test	$22,192	3.31

Table 1
Ratepayer Impact Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	3,424	$0.02860	$98	$0.00000	$0	5	0	5	$98.68	$493	$591	$0.03807	3,186	0	3,186	$74	$65	$1,500	$1,639	($1,048)
2	2012	8,560	0.02988	256	0.00000	0	14	0	14	102.62	1,437	1,693	0.03883	7,965	0	7,965	187	136	2,250	2,573	(880)
3	2013	17,121	0.03195	547	0.00000	0	27	0	27	106.73	2,882	3,429	0.03960	15,930	0	15,930	382	256	3,750	4,388	(959)
4	2014	17,121	0.03348	573	0.00000	0	27	0	27	111.00	2,997	3,570	0.04040	15,930	0	15,930	390	0	0	390	3,180
5	2015	17,121	0.03688	631	0.00000	0	27	0	27	115.44	3,117	3,748	0.04120	15,930	0	15,930	398	0	0	398	3,350
6	2016	17,121	0.03720	637	0.00000	0	27	0	27	120.05	3,241	3,878	0.04203	15,930	0	15,930	406	0	0	406	3,472
7	2017	17,121	0.03911	670	0.00000	0	27	0	27	124.86	3,371	4,041	0.04287	15,930	0	15,930	414	0	0	414	3,627
8	2018	17,121	0.04251	728	0.00000	0	27	0	27	129.85	3,506	4,234	0.04373	15,930	0	15,930	422	0	0	422	3,812
9	2019	17,121	0.04456	763	0.00000	0	27	0	27	135.05	3,646	4,409	0.04460	15,930	0	15,930	431	0	0	431	3,978
10	2020	17,121	0.04769	817	0.00000	0	27	0	27	140.45	3,792	4,609	0.04549	15,930	0	15,930	439	0	0	439	4,170
11	2021	17,121	0.04800	822	0.00000	0	27	0	27	146.07	3,944	4,766	0.04640	15,930	0	15,930	448	0	0	448	4,318
12	2022	17,121	0.04834	828	0.00000	0	27	0	27	151.91	4,102	4,930	0.04733	15,930	0	15,930	457	0	0	457	4,473
13	2023	17,121	0.04871	834	0.00000	0	27	0	27	157.98	4,265	5,099	0.04828	15,930	0	15,930	466	0	0	466	4,633
14	2024	17,121	0.04911	841	0.00000	0	27	0	27	164.30	4,436	5,277	0.04924	15,930	0	15,930	475	0	0	475	4,802
15	2025	17,121	0.04954	848	0.00000	0	27	0	27	170.88	4,614	5,462	0.05023	15,930	0	15,930	485	0	0	485	4,977
16	2026	13,697	0.05000	685	0.00000	0	22	0	22	177.71	3,910	4,595	0.05123	12,744	0	12,744	396	0	0	396	4,199
17	2027	8,560	0.05050	432	0.00000	0	14	0	14	184.82	2,587	3,019	0.05226	7,965	0	7,965	252	0	0	252	2,767
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05330	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.05437	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.05546	0	0	0	0	0	0	0	0
Total =		256,814							406			$67,350				238,950				$14,479	$52,871
											NPV =	$31,804								$10,264	21,540

Total NPV = $21,540
Benefit/Cost Ratio = 3.10

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$98	$0	$493	$591	$1,565	$1,565	($974)
2012	256	0	1,437	1,693	2,386	2,386	(693)
2013	547	0	2,882	3,429	4,006	4,006	(577)
2014	573	0	2,997	3,570	0	0	3,570
2015	631	0	3,117	3,748	0	0	3,748
2016	637	0	3,241	3,878	0	0	3,878
2017	670	0	3,371	4,041	0	0	4,041
2018	728	0	3,506	4,234	0	0	4,234
2019	763	0	3,646	4,409	0	0	4,409
2020	817	0	3,792	4,609	0	0	4,609
2021	822	0	3,944	4,766	0	0	4,766
2022	828	0	4,102	4,930	0	0	4,930
2023	834	0	4,265	5,099	0	0	5,099
2024	841	0	4,436	5,277	0	0	5,277
2025	848	0	4,614	5,462	0	0	5,462
2026	685	0	3,910	4,595	0	0	4,595
2027	432	0	2,587	3,019	0	0	3,019
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$67,350		$7,957	$59,393
			NPV =	$31,804		$7,076	24,728

Total NPV =	$24,728
Benefit/Cost Ratio =	4.49

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits					Costs			
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Annual Benefits Less Costs (I)
2011	$98	$0	$493	$187	$778	$1,565	$570	$2,135	($1,357)
2012	256	0	1,437	551	2,244	2,386	855	3,241	(997)
2013	547	0	2,882	1,150	4,579	4,006	1,425	5,431	(852)
2014	573	0	2,997	1,234	4,804	0	0	0	4,804
2015	631	0	3,117	1,334	5,082	0	0	0	5,082
2016	637	0	3,241	1,422	5,300	0	0	0	5,300
2017	670	0	3,371	1,526	5,567	0	0	0	5,567
2018	728	0	3,506	1,647	5,881	0	0	0	5,881
2019	763	0	3,646	1,766	6,175	0	0	0	6,175
2020	817	0	3,792	1,902	6,511	0	0	0	6,511
2021	822	0	3,944	2,025	6,791	0	0	0	6,791
2022	828	0	4,102	2,158	7,088	0	0	0	7,088
2023	834	0	4,265	2,299	7,398	0	0	0	7,398
2024	841	0	4,436	2,450	7,727	0	0	0	7,727
2025	848	0	4,614	2,612	8,074	0	0	0	8,074
2026	685	0	3,910	2,264	6,859	0	0	0	6,859
2027	432	0	2,587	1,532	4,551	0	0	0	4,551
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$95,409			$10,807	$84,602
				NPV =	$66,150			$10,242	55,908

Total NPV = $55,908
Benefit/Cost Ratio = 6.46

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial AC - Split Systems**
Program Years: **2011 - 2013**

	Benefits														Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$1,500	$0.06057	$0.06043	3,186	0	3,186	$193	5	0	$20.400	$40.800	$102	$0	$1,795	$2,114	$0	$2,114	($319)
2012	2,250	0.06355	0.06341	7,965	0	7,965	506	12	0	20.808	41.616	250	0	3,006	3,237	0	3,237	(231)
2013	3,750	0.06669	0.06654	15,930	0	15,930	1,062	24	0	21.224	42.448	509	0	5,321	5,510	0	5,510	(189)
2014	0	0.06997	0.06982	15,930	0	15,930	1,115	24	0	21.649	43.297	520	0	1,635	0	0	0	1,635
2015	0	0.07343	0.07326	15,930	0	15,930	1,170	24	0	22.082	44.163	530	0	1,700	0	0	0	1,700
2016	0	0.07705	0.07687	15,930	0	15,930	1,227	24	0	22.523	45.046	541	0	1,768	0	0	0	1,768
2017	0	0.08084	0.08066	15,930	0	15,930	1,288	24	0	22.974	45.947	551	0	1,839	0	0	0	1,839
2018	0	0.08483	0.08464	15,930	0	15,930	1,351	24	0	23.433	46.866	562	0	1,913	0	0	0	1,913
2019	0	0.08901	0.08881	15,930	0	15,930	1,418	24	0	23.902	47.804	574	0	1,992	0	0	0	1,992
2020	0	0.09340	0.09319	15,930	0	15,930	1,488	24	0	24.380	48.760	585	0	2,073	0	0	0	2,073
2021	0	0.09801	0.09779	15,930	0	15,930	1,561	24	0	24.867	49.735	597	0	2,158	0	0	0	2,158
2022	0	0.10284	0.10261	15,930	0	15,930	1,638	24	0	25.365	50.730	609	0	2,247	0	0	0	2,247
2023	0	0.10791	0.10767	15,930	0	15,930	1,719	24	0	25.872	51.744	621	0	2,340	0	0	0	2,340
2024	0	0.11323	0.11298	15,930	0	15,930	1,804	24	0	26.390	52.779	633	0	2,437	0	0	0	2,437
2025	0	0.11882	0.11855	15,930	0	15,930	1,893	24	0	26.917	53.835	646	0	2,539	0	0	0	2,539
2026	0	0.12468	0.12440	12,744	0	12,744	1,589	19	0	27.456	54.911	522	0	2,111	0	0	0	2,111
2027	0	0.13083	0.13053	7,965	0	7,965	1,042	12	0	28.005	56.010	336	0	1,378	0	0	0	1,378
2028	0	0.13728	0.13697	0	0	0	0	0	0	28.565	57.130	0	0	0	0	0	0	0
2029	0	0.14405	0.14372	0	0	0	0	0	0	29.136	58.272	0	0	0	0	0	0	0
2030	0	0.15115	0.15081	0	0	0	0	0	0	29.719	59.438	0	0	0	0	0	0	0
Total =				238,950	0			360	0					$38,252			$10,861	$27,391
													NPV =	$19,880			$9,509	10,371

Total NPV = $10,371
Benefit/Cost Ratio = 2.09

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial AC - Split Systems**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$98	$493	$591	$1,565	$570	$2,135	($1,544)
2012	256	1,437	1,693	2,386	855	3,241	(1,548)
2013	547	2,882	3,429	4,006	1,425	5,431	(2,002)
2014	573	2,997	3,570	0	0	0	3,570
2015	631	3,117	3,748	0	0	0	3,748
2016	637	3,241	3,878	0	0	0	3,878
2017	670	3,371	4,041	0	0	0	4,041
2018	728	3,506	4,234	0	0	0	4,234
2019	763	3,646	4,409	0	0	0	4,409
2020	817	3,792	4,609	0	0	0	4,609
2021	822	3,944	4,766	0	0	0	4,766
2022	828	4,102	4,930	0	0	0	4,930
2023	834	4,265	5,099	0	0	0	5,099
2024	841	4,436	5,277	0	0	0	5,277
2025	848	4,614	5,462	0	0	0	5,462
2026	685	3,910	4,595	0	0	0	4,595
2027	432	2,587	3,019	0	0	0	3,019
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$67,350			$10,807	$56,543
		NPV =	$31,804			$9,612	22,192

Total NPV =	$22,192
Benefit/Cost Ratio =	3.31

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$65	$91	$102
Incentive Costs =	1,500	1,500	1,500
Total Utility Project Costs =	$1,565	$1,591	$1,602
14) Direct Participant Costs ($/Part.) =	$1,246	$1,246	$1,246
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	15	15	15
16) Avg Summer kW/part. Saved =	2.790	2.790	2.790
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	1,806	1,806	1,806
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	2	2	2
20) Incentive/Participant =	$750	$750	$750
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	3,612	3,612	3,612
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	6	6	6
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$15,872	3.42
Utility Cost Test	$18,088	5.16
Societal Test	$38,419	6.18
Participant Test	$6,367	1.90
Total Resource Cost Test	$15,365	3.17

Table 1
Ratepayer Impact Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	3,882	$0.02860	$111	$0.00000	$0	6	0	6	$98.68	$592	$703	$0.03807	3,612	0	3,612	$83	$65	$1,500	$1,648	($945)
2	2012	7,764	0.02988	232	0.00000	0	12	0	12	102.62	1,231	1,463	0.03883	7,224	0	7,224	170	91	1,500	1,761	(298)
3	2013	11,646	0.03195	372	0.00000	0	19	0	19	106.73	2,028	2,400	0.03960	10,836	0	10,836	260	102	1,500	1,862	538
4	2014	11,646	0.03348	390	0.00000	0	19	0	19	111.00	2,109	2,499	0.04040	10,836	0	10,836	265	0	0	265	2,234
5	2015	11,646	0.03688	430	0.00000	0	19	0	19	115.44	2,193	2,623	0.04120	10,836	0	10,836	271	0	0	271	2,352
6	2016	11,646	0.03720	433	0.00000	0	19	0	19	120.05	2,281	2,714	0.04203	10,836	0	10,836	276	0	0	276	2,438
7	2017	11,646	0.03911	455	0.00000	0	19	0	19	124.86	2,372	2,827	0.04287	10,836	0	10,836	282	0	0	282	2,545
8	2018	11,646	0.04251	495	0.00000	0	19	0	19	129.85	2,467	2,962	0.04373	10,836	0	10,836	287	0	0	287	2,675
9	2019	11,646	0.04456	519	0.00000	0	19	0	19	135.05	2,566	3,085	0.04460	10,836	0	10,836	293	0	0	293	2,792
10	2020	11,646	0.04769	555	0.00000	0	19	0	19	140.45	2,669	3,224	0.04549	10,836	0	10,836	299	0	0	299	2,925
11	2021	11,646	0.04800	559	0.00000	0	19	0	19	146.07	2,775	3,334	0.04640	10,836	0	10,836	305	0	0	305	3,029
12	2022	11,646	0.04834	563	0.00000	0	19	0	19	151.91	2,886	3,449	0.04733	10,836	0	10,836	311	0	0	311	3,138
13	2023	11,646	0.04871	567	0.00000	0	19	0	19	157.98	3,002	3,569	0.04828	10,836	0	10,836	317	0	0	317	3,252
14	2024	11,646	0.04911	572	0.00000	0	19	0	19	164.30	3,122	3,694	0.04924	10,836	0	10,836	323	0	0	323	3,371
15	2025	11,646	0.04954	577	0.00000	0	19	0	19	170.88	3,247	3,824	0.05023	10,836	0	10,836	330	0	0	330	3,494
16	2026	7,764	0.05000	388	0.00000	0	12	0	12	177.71	2,133	2,521	0.05123	7,224	0	7,224	224	0	0	224	2,297
17	2027	3,882	0.05050	196	0.00000	0	6	0	6	184.82	1,109	1,305	0.05226	3,612	0	3,612	114	0	0	114	1,191
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05330	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.05437	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.05546	0	0	0	0	0	0	0	0
Total =		174,690							283			$46,196				162,540				$9,168	$37,028
											NPV =	$22,438								$6,566	15,872

Total NPV = $15,872
Benefit/Cost Ratio = 3.42

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$111	$0	$592	$703	$1,565	$1,565	($862)
2012	232	0	1,231	1,463	1,591	1,591	(128)
2013	372	0	2,028	2,400	1,602	1,602	798
2014	390	0	2,109	2,499	0	0	2,499
2015	430	0	2,193	2,623	0	0	2,623
2016	433	0	2,281	2,714	0	0	2,714
2017	455	0	2,372	2,827	0	0	2,827
2018	495	0	2,467	2,962	0	0	2,962
2019	519	0	2,566	3,085	0	0	3,085
2020	555	0	2,669	3,224	0	0	3,224
2021	559	0	2,775	3,334	0	0	3,334
2022	563	0	2,886	3,449	0	0	3,449
2023	567	0	3,002	3,569	0	0	3,569
2024	572	0	3,122	3,694	0	0	3,694
2025	577	0	3,247	3,824	0	0	3,824
2026	388	0	2,133	2,521	0	0	2,521
2027	196	0	1,109	1,305	0	0	1,305
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$46,196		$4,758	$41,438
			NPV =	$22,438		$4,350	18,088

Total NPV =	$18,088
Benefit/Cost Ratio =	5.16

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$111	$0	$592	$222	$925	$1,565	$992	$2,557	($1,632)
2012	232	0	1,231	476	1,939	1,591	992	2,583	(644)
2013	372	0	2,028	805	3,205	1,602	992	2,594	611
2014	390	0	2,109	863	3,362	0	0	0	3,362
2015	430	0	2,193	934	3,557	0	0	0	3,557
2016	433	0	2,281	995	3,709	0	0	0	3,709
2017	455	0	2,372	1,067	3,894	0	0	0	3,894
2018	495	0	2,467	1,152	4,114	0	0	0	4,114
2019	519	0	2,566	1,236	4,321	0	0	0	4,321
2020	555	0	2,669	1,330	4,554	0	0	0	4,554
2021	559	0	2,775	1,417	4,751	0	0	0	4,751
2022	563	0	2,886	1,510	4,959	0	0	0	4,959
2023	567	0	3,002	1,609	5,178	0	0	0	5,178
2024	572	0	3,122	1,715	5,409	0	0	0	5,409
2025	577	0	3,247	1,829	5,653	0	0	0	5,653
2026	388	0	2,133	1,242	3,763	0	0	0	3,763
2027	196	0	1,109	662	1,967	0	0	0	1,967
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$65,260			$7,734	$57,526
				NPV =	$45,841			$7,422	38,419

Total NPV = $38,419
Benefit/Cost Ratio = 6.18

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical AC - Packaged Systems**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$1,500	$0.06057	$0.06043	3,612	0	3,612	$219	6	0	$20.400	$40.800	$122	$0	$1,841	$2,545	$0	$2,545	($704)
2012	1,500	0.06355	0.06341	7,224	0	7,224	459	11	0	20.808	41.616	229	0	2,188	2,598	0	2,598	(410)
2013	1,500	0.06669	0.06654	10,836	0	10,836	723	17	0	21.224	42.448	361	0	2,584	2,653	0	2,653	(69)
2014	0	0.06997	0.06982	10,836	0	10,836	758	17	0	21.649	43.297	368	0	1,126	0	0	0	1,126
2015	0	0.07343	0.07326	10,836	0	10,836	796	17	0	22.082	44.163	375	0	1,171	0	0	0	1,171
2016	0	0.07705	0.07687	10,836	0	10,836	835	17	0	22.523	45.046	383	0	1,218	0	0	0	1,218
2017	0	0.08084	0.08066	10,836	0	10,836	876	17	0	22.974	45.947	391	0	1,267	0	0	0	1,267
2018	0	0.08483	0.08464	10,836	0	10,836	919	17	0	23.433	46.866	398	0	1,317	0	0	0	1,317
2019	0	0.08901	0.08881	10,836	0	10,836	965	17	0	23.902	47.804	406	0	1,371	0	0	0	1,371
2020	0	0.09340	0.09319	10,836	0	10,836	1,012	17	0	24.380	48.760	414	0	1,426	0	0	0	1,426
2021	0	0.09801	0.09779	10,836	0	10,836	1,062	17	0	24.867	49.735	423	0	1,485	0	0	0	1,485
2022	0	0.10284	0.10261	10,836	0	10,836	1,114	17	0	25.365	50.730	431	0	1,545	0	0	0	1,545
2023	0	0.10791	0.10767	10,836	0	10,836	1,169	17	0	25.872	51.744	440	0	1,609	0	0	0	1,609
2024	0	0.11323	0.11298	10,836	0	10,836	1,227	17	0	26.390	52.779	449	0	1,676	0	0	0	1,676
2025	0	0.11882	0.11855	10,836	0	10,836	1,288	17	0	26.917	53.835	458	0	1,746	0	0	0	1,746
2026	0	0.12468	0.12440	7,224	0	7,224	901	11	0	27.456	54.911	302	0	1,203	0	0	0	1,203
2027	0	0.13083	0.13053	3,612	0	3,612	473	6	0	28.005	56.010	168	0	641	0	0	0	641
2028	0	0.13728	0.13697	0	0	0	0	0	0	28.565	57.130	0	0	0	0	0	0	0
2029	0	0.14405	0.14372	0	0	0	0	0	0	29.136	58.272	0	0	0	0	0	0	0
2030	0	0.15115	0.15081	0	0	0	0	0	0	29.719	59.438	0	0	0	0	0	0	0
Total =				162,540	0			255	0					$25,414			$7,796	$17,618
													NPV =	$13,409			$7,042	6,367

Total NPV = $6,367
Benefit/Cost Ratio = 1.90

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical AC - Packaged Systems**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$111	$592	$703	$1,565	$992	$2,557	($1,854)
2012	232	1,231	1,463	1,591	992	2,583	(1,120)
2013	372	2,028	2,400	1,602	992	2,594	(194)
2014	390	2,109	2,499	0	0	0	2,499
2015	430	2,193	2,623	0	0	0	2,623
2016	433	2,281	2,714	0	0	0	2,714
2017	455	2,372	2,827	0	0	0	2,827
2018	495	2,467	2,962	0	0	0	2,962
2019	519	2,566	3,085	0	0	0	3,085
2020	555	2,669	3,224	0	0	0	3,224
2021	559	2,775	3,334	0	0	0	3,334
2022	563	2,886	3,449	0	0	0	3,449
2023	567	3,002	3,569	0	0	0	3,569
2024	572	3,122	3,694	0	0	0	3,694
2025	577	3,247	3,824	0	0	0	3,824
2026	388	2,133	2,521	0	0	0	2,521
2027	196	1,109	1,305	0	0	0	1,305
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$46,196			$7,734	$38,462
		NPV =	$22,438			$7,073	15,365

Total NPV =	$15,365
Benefit/Cost Ratio =	3.17

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$108	$151	$171
Incentive Costs =	2,500	2,500	2,500
Total Utility Project Costs =	$2,608	$2,651	$2,671
14) Direct Participant Costs ($/Part.) =	$1,997	$1,997	$1,997
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	4.950	4.950	4.950
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	4,315	4,315	4,315
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	1	1
20) Incentive/Participant =	$2,500	$2,500	$2,500
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	4,315	4,315	4,315
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	5	5	5
Annual Winter KW Saved	0	0	0

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$14,320	2.40
Utility Cost Test	$17,310	3.39
Societal Test	$49,289	9.00
Participant Test	$12,885	3.28
Total Resource Cost Test	$18,691	4.18

Table 1
Ratepayer Impact Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	4,638	$0.02860	$133	$0.00000	$0	6	0	6	$98.68	$592	$725	$0.03807	4,315	0	4,315	$100	$108	$2,500	$2,708	($1,983)
2	2012	9,275	0.02988	277	0.00000	0	11	0	11	102.62	1,129	1,406	0.03883	8,630	0	8,630	203	151	2,500	2,854	(1,448)
3	2013	13,913	0.03195	445	0.00000	0	17	0	17	106.73	1,814	2,259	0.03960	12,945	0	12,945	311	171	2,500	2,982	(723)
4	2014	13,913	0.03348	466	0.00000	0	17	0	17	111.00	1,887	2,353	0.04040	12,945	0	12,945	317	0	0	317	2,036
5	2015	13,913	0.03688	513	0.00000	0	17	0	17	115.44	1,962	2,475	0.04120	12,945	0	12,945	323	0	0	323	2,152
6	2016	13,913	0.03720	518	0.00000	0	17	0	17	120.05	2,041	2,559	0.04203	12,945	0	12,945	330	0	0	330	2,229
7	2017	13,913	0.03911	544	0.00000	0	17	0	17	124.86	2,123	2,667	0.04287	12,945	0	12,945	336	0	0	336	2,331
8	2018	13,913	0.04251	591	0.00000	0	17	0	17	129.85	2,207	2,798	0.04373	12,945	0	12,945	343	0	0	343	2,455
9	2019	13,913	0.04456	620	0.00000	0	17	0	17	135.05	2,296	2,916	0.04460	12,945	0	12,945	350	0	0	350	2,566
10	2020	13,913	0.04769	664	0.00000	0	17	0	17	140.45	2,388	3,052	0.04549	12,945	0	12,945	357	0	0	357	2,695
11	2021	13,913	0.04800	668	0.00000	0	17	0	17	146.07	2,483	3,151	0.04640	12,945	0	12,945	364	0	0	364	2,787
12	2022	13,913	0.04834	673	0.00000	0	17	0	17	151.91	2,582	3,255	0.04733	12,945	0	12,945	371	0	0	371	2,884
13	2023	13,913	0.04871	678	0.00000	0	17	0	17	157.98	2,686	3,364	0.04828	12,945	0	12,945	379	0	0	379	2,985
14	2024	13,913	0.04911	683	0.00000	0	17	0	17	164.30	2,793	3,476	0.04924	12,945	0	12,945	386	0	0	386	3,090
15	2025	13,913	0.04954	689	0.00000	0	17	0	17	170.88	2,905	3,594	0.05023	12,945	0	12,945	394	0	0	394	3,200
16	2026	13,913	0.05000	696	0.00000	0	17	0	17	177.71	3,021	3,717	0.05123	12,945	0	12,945	402	0	0	402	3,315
17	2027	13,913	0.05050	703	0.00000	0	17	0	17	184.82	3,142	3,845	0.05226	12,945	0	12,945	410	0	0	410	3,435
18	2028	13,913	0.05103	710	0.00000	0	17	0	17	192.21	3,268	3,978	0.05330	12,945	0	12,945	418	0	0	418	3,560
19	2029	13,913	0.05160	718	0.00000	0	17	0	17	199.90	3,398	4,116	0.05437	12,945	0	12,945	427	0	0	427	3,689
20	2030	13,913	0.05220	726	0.00000	0	17	0	17	207.90	3,534	4,260	0.05546	12,945	0	12,945	435	0	0	435	3,825
Total =		264,347							323			$59,966				245,955				$14,886	$45,080
											NPV =	$24,560								$10,240	14,320

Total NPV = $14,320
Benefit/Cost Ratio = 2.40

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$133	$0	$592	$725	$2,608	$2,608	($1,883)
2012	277	0	1,129	1,406	2,651	2,651	(1,245)
2013	445	0	1,814	2,259	2,671	2,671	(412)
2014	466	0	1,887	2,353	0	0	2,353
2015	513	0	1,962	2,475	0	0	2,475
2016	518	0	2,041	2,559	0	0	2,559
2017	544	0	2,123	2,667	0	0	2,667
2018	591	0	2,207	2,798	0	0	2,798
2019	620	0	2,296	2,916	0	0	2,916
2020	664	0	2,388	3,052	0	0	3,052
2021	668	0	2,483	3,151	0	0	3,151
2022	673	0	2,582	3,255	0	0	3,255
2023	678	0	2,686	3,364	0	0	3,364
2024	683	0	2,793	3,476	0	0	3,476
2025	689	0	2,905	3,594	0	0	3,594
2026	696	0	3,021	3,717	0	0	3,717
2027	703	0	3,142	3,845	0	0	3,845
2028	710	0	3,268	3,978	0	0	3,978
2029	718	0	3,398	4,116	0	0	4,116
2030	726	0	3,534	4,260	0	0	4,260
Total =				$59,966		$7,930	$52,036
			NPV =	$24,560		$7,250	17,310

Total NPV =	$17,310
Benefit/Cost Ratio =	3.39

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$133	$0	$592	$229	$954	$2,608	($503)	$2,105	($1,151)
2012	277	0	1,129	458	1,864	2,651	(503)	2,148	(284)
2013	445	0	1,814	758	3,017	2,671	(503)	2,168	849
2014	466	0	1,887	813	3,166	0	0	0	3,166
2015	513	0	1,962	881	3,356	0	0	0	3,356
2016	518	0	2,041	938	3,497	0	0	0	3,497
2017	544	0	2,123	1,007	3,674	0	0	0	3,674
2018	591	0	2,207	1,088	3,886	0	0	0	3,886
2019	620	0	2,296	1,168	4,084	0	0	0	4,084
2020	664	0	2,388	1,259	4,311	0	0	0	4,311
2021	668	0	2,483	1,339	4,490	0	0	0	4,490
2022	673	0	2,582	1,425	4,680	0	0	0	4,680
2023	678	0	2,686	1,517	4,881	0	0	0	4,881
2024	683	0	2,793	1,614	5,090	0	0	0	5,090
2025	689	0	2,905	1,719	5,313	0	0	0	5,313
2026	696	0	3,021	1,831	5,548	0	0	0	5,548
2027	703	0	3,142	1,951	5,796	0	0	0	5,796
2028	710	0	3,268	2,079	6,057	0	0	0	6,057
2029	718	0	3,398	2,216	6,332	0	0	0	6,332
2030	726	0	3,534	2,362	6,622	0	0	0	6,622
Total =					$86,618			$6,421	$80,197
				NPV =	$55,450			$6,161	49,289

Total NPV = $49,289
Benefit/Cost Ratio = 9.00

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commerical AC - Water Cooled Chillers**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$2,500	$0.06057	$0.06043	4,315	0	4,315	$261	5	0	$20.400	$40.800	$102	$0	$2,863	$2,039	$0	$2,039	$824
2012	2,500	0.06355	0.06341	8,630	0	8,630	548	10	0	20.808	41.616	208	0	3,256	2,082	0	2,082	1,174
2013	2,500	0.06669	0.06654	12,945	0	12,945	863	15	0	21.224	42.448	318	0	3,681	2,126	0	2,126	1,555
2014	0	0.06997	0.06982	12,945	0	12,945	906	15	0	21.649	43.297	325	0	1,231	0	0	0	1,231
2015	0	0.07343	0.07326	12,945	0	12,945	951	15	0	22.082	44.163	331	0	1,282	0	0	0	1,282
2016	0	0.07705	0.07687	12,945	0	12,945	997	15	0	22.523	45.046	338	0	1,335	0	0	0	1,335
2017	0	0.08084	0.08066	12,945	0	12,945	1,046	15	0	22.974	45.947	345	0	1,391	0	0	0	1,391
2018	0	0.08483	0.08464	12,945	0	12,945	1,098	15	0	23.433	46.866	351	0	1,449	0	0	0	1,449
2019	0	0.08901	0.08881	12,945	0	12,945	1,152	15	0	23.902	47.804	359	0	1,511	0	0	0	1,511
2020	0	0.09340	0.09319	12,945	0	12,945	1,209	15	0	24.380	48.760	366	0	1,575	0	0	0	1,575
2021	0	0.09801	0.09779	12,945	0	12,945	1,269	15	0	24.867	49.735	373	0	1,642	0	0	0	1,642
2022	0	0.10284	0.10261	12,945	0	12,945	1,331	15	0	25.365	50.730	380	0	1,711	0	0	0	1,711
2023	0	0.10791	0.10767	12,945	0	12,945	1,397	15	0	25.872	51.744	388	0	1,785	0	0	0	1,785
2024	0	0.11323	0.11298	12,945	0	12,945	1,466	15	0	26.390	52.779	396	0	1,862	0	0	0	1,862
2025	0	0.11882	0.11855	12,945	0	12,945	1,538	15	0	26.917	53.835	404	0	1,942	0	0	0	1,942
2026	0	0.12468	0.12440	12,945	0	12,945	1,614	15	0	27.456	54.911	412	0	2,026	0	0	0	2,026
2027	0	0.13083	0.13053	12,945	0	12,945	1,694	15	0	28.005	56.010	420	0	2,114	0	0	0	2,114
2028	0	0.13728	0.13697	12,945	0	12,945	1,777	15	0	28.565	57.130	428	0	2,205	0	0	0	2,205
2029	0	0.14405	0.14372	12,945	0	12,945	1,865	15	0	29.136	58.272	437	0	2,302	0	0	0	2,302
2030	0	0.15115	0.15081	12,945	0	12,945	1,957	15	0	29.719	59.438	446	0	2,403	0	0	0	2,403
Total =				245,955	0			285	0					$39,566			$6,247	$33,319
													NPV =	$18,528			$5,643	12,885

Total NPV =	$12,885
Benefit/Cost Ratio =	3.28

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commerical AC - Water Cooled Chillers**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$133	$592	$725	$2,608	($503)	$2,105	($1,380)
2012	277	1,129	1,406	2,651	(503)	2,148	(742)
2013	445	1,814	2,259	2,671	(503)	2,168	91
2014	466	1,887	2,353	0	0	0	2,353
2015	513	1,962	2,475	0	0	0	2,475
2016	518	2,041	2,559	0	0	0	2,559
2017	544	2,123	2,667	0	0	0	2,667
2018	591	2,207	2,798	0	0	0	2,798
2019	620	2,296	2,916	0	0	0	2,916
2020	664	2,388	3,052	0	0	0	3,052
2021	668	2,483	3,151	0	0	0	3,151
2022	673	2,582	3,255	0	0	0	3,255
2023	678	2,686	3,364	0	0	0	3,364
2024	683	2,793	3,476	0	0	0	3,476
2025	689	2,905	3,594	0	0	0	3,594
2026	696	3,021	3,717	0	0	0	3,717
2027	703	3,142	3,845	0	0	0	3,845
2028	710	3,268	3,978	0	0	0	3,978
2029	718	3,398	4,116	0	0	0	4,116
2030	726	3,534	4,260	0	0	0	4,260
		Total =	$59,966			$6,421	$53,545
		NPV =	$24,560			$5,869	18,691

Total NPV =	$18,691
Benefit/Cost Ratio =	4.18

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$108	$151	$171
Incentive Costs =	2,500	2,500	2,500
Total Utility Project Costs =	$2,608	$2,651	$2,671
14) Direct Participant Costs ($/Part.) =	$7,276	$7,276	$7,276
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	20	20	20
16) Avg Summer kW/part. Saved =	11.250	11.250	11.250
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	2,762	2,762	2,762
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	1	1
20) Incentive/Participant =	$2,500	$2,500	$2,500
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	2,762	2,762	2,762
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	11	11	11
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$37,928	5.14
Utility Cost Test	$39,842	6.50
Societal Test	$85,161	4.99
Participant Test	($1,718)	0.92
Total Resource Cost Test	$26,734	2.31

Table 1
Ratepayer Impact Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	2,968	$0.02860	$85	$0.00000	$0	13	0	13	$98.68	$1,283	$1,368	$0.03807	2,762	0	2,762	$64	$108	$2,500	$2,672	($1,304)
2	2012	5,937	0.02988	177	0.00000	0	25	0	25	102.62	2,566	2,743	0.03883	5,524	0	5,524	130	151	2,500	2,781	(38)
3	2013	8,905	0.03195	285	0.00000	0	38	0	38	106.73	4,056	4,341	0.03960	8,286	0	8,286	199	171	2,500	2,870	1,471
4	2014	8,905	0.03348	298	0.00000	0	38	0	38	111.00	4,218	4,516	0.04040	8,286	0	8,286	203	0	0	203	4,313
5	2015	8,905	0.03688	328	0.00000	0	38	0	38	115.44	4,387	4,715	0.04120	8,286	0	8,286	207	0	0	207	4,508
6	2016	8,905	0.03720	331	0.00000	0	38	0	38	120.05	4,562	4,893	0.04203	8,286	0	8,286	211	0	0	211	4,682
7	2017	8,905	0.03911	348	0.00000	0	38	0	38	124.86	4,745	5,093	0.04287	8,286	0	8,286	215	0	0	215	4,878
8	2018	8,905	0.04251	379	0.00000	0	38	0	38	129.85	4,934	5,313	0.04373	8,286	0	8,286	220	0	0	220	5,093
9	2019	8,905	0.04456	397	0.00000	0	38	0	38	135.05	5,132	5,529	0.04460	8,286	0	8,286	224	0	0	224	5,305
10	2020	8,905	0.04769	425	0.00000	0	38	0	38	140.45	5,337	5,762	0.04549	8,286	0	8,286	228	0	0	228	5,534
11	2021	8,905	0.04800	427	0.00000	0	38	0	38	146.07	5,551	5,978	0.04640	8,286	0	8,286	233	0	0	233	5,745
12	2022	8,905	0.04834	430	0.00000	0	38	0	38	151.91	5,773	6,203	0.04733	8,286	0	8,286	238	0	0	238	5,965
13	2023	8,905	0.04871	434	0.00000	0	38	0	38	157.98	6,003	6,437	0.04828	8,286	0	8,286	242	0	0	242	6,195
14	2024	8,905	0.04911	437	0.00000	0	38	0	38	164.30	6,243	6,680	0.04924	8,286	0	8,286	247	0	0	247	6,433
15	2025	8,905	0.04954	441	0.00000	0	38	0	38	170.88	6,493	6,934	0.05023	8,286	0	8,286	252	0	0	252	6,682
16	2026	8,905	0.05000	445	0.00000	0	38	0	38	177.71	6,753	7,198	0.05123	8,286	0	8,286	257	0	0	257	6,941
17	2027	8,905	0.05050	450	0.00000	0	38	0	38	184.82	7,023	7,473	0.05226	8,286	0	8,286	262	0	0	262	7,211
18	2028	8,905	0.05103	454	0.00000	0	38	0	38	192.21	7,304	7,758	0.05330	8,286	0	8,286	268	0	0	268	7,490
19	2029	8,905	0.05160	459	0.00000	0	38	0	38	199.90	7,596	8,055	0.05437	8,286	0	8,286	273	0	0	273	7,782
20	2030	8,905	0.05220	465	0.00000	0	38	0	38	207.90	7,900	8,365	0.05546	8,286	0	8,286	279	0	0	279	8,086
Total =		169,195							722			$115,354				157,434				$12,382	$102,972
											NPV =	$47,092								$9,164	37,928

Total NPV = $37,928
Benefit/Cost Ratio = 5.14

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$85	$0	$1,283	$1,368	$2,608	$2,608	($1,240)
2012	177	0	2,566	2,743	2,651	2,651	92
2013	285	0	4,056	4,341	2,671	2,671	1,670
2014	298	0	4,218	4,516	0	0	4,516
2015	328	0	4,387	4,715	0	0	4,715
2016	331	0	4,562	4,893	0	0	4,893
2017	348	0	4,745	5,093	0	0	5,093
2018	379	0	4,934	5,313	0	0	5,313
2019	397	0	5,132	5,529	0	0	5,529
2020	425	0	5,337	5,762	0	0	5,762
2021	427	0	5,551	5,978	0	0	5,978
2022	430	0	5,773	6,203	0	0	6,203
2023	434	0	6,003	6,437	0	0	6,437
2024	437	0	6,243	6,680	0	0	6,680
2025	441	0	6,493	6,934	0	0	6,934
2026	445	0	6,753	7,198	0	0	7,198
2027	450	0	7,023	7,473	0	0	7,473
2028	454	0	7,304	7,758	0	0	7,758
2029	459	0	7,596	8,055	0	0	8,055
2030	465	0	7,900	8,365	0	0	8,365
Total =				$115,354		$7,930	$107,424
			NPV =	$47,092		$7,250	39,842

Total NPV =	$39,842
Benefit/Cost Ratio =	6.50

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits					Costs			
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Annual Benefits Less Costs (I)
2011	$85	$0	$1,283	$433	$1,801	$2,608	$4,776	$7,384	($5,583)
2012	177	0	2,566	893	3,636	2,651	4,776	7,427	(3,791)
2013	285	0	4,056	1,456	5,797	2,671	4,776	7,447	(1,650)
2014	298	0	4,218	1,560	6,076	0	0	0	6,076
2015	328	0	4,387	1,678	6,393	0	0	0	6,393
2016	331	0	4,562	1,794	6,687	0	0	0	6,687
2017	348	0	4,745	1,923	7,016	0	0	0	7,016
2018	379	0	4,934	2,066	7,379	0	0	0	7,379
2019	397	0	5,132	2,215	7,744	0	0	0	7,744
2020	425	0	5,337	2,377	8,139	0	0	0	8,139
2021	427	0	5,551	2,540	8,518	0	0	0	8,518
2022	430	0	5,773	2,715	8,918	0	0	0	8,918
2023	434	0	6,003	2,902	9,339	0	0	0	9,339
2024	437	0	6,243	3,102	9,782	0	0	0	9,782
2025	441	0	6,493	3,317	10,251	0	0	0	10,251
2026	445	0	6,753	3,546	10,744	0	0	0	10,744
2027	450	0	7,023	3,792	11,265	0	0	0	11,265
2028	454	0	7,304	4,055	11,813	0	0	0	11,813
2029	459	0	7,596	4,336	12,391	0	0	0	12,391
2030	465	0	7,900	4,638	13,003	0	0	0	13,003
Total =					$166,692			$22,258	$144,434
				NPV =	$106,523			$21,362	85,161

Total NPV =	$85,161
Benefit/Cost Ratio =	4.99

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial AC - Centrifugal Chillers**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$2,500	$0.06057	$0.06043	2,762	0	2,762	$167	11	0	$20.400	$40.800	$224	$0	$2,891	$7,430	$0	$7,430	($4,539)
2012	2,500	0.06355	0.06341	5,524	0	5,524	351	23	0	20.808	41.616	479	0	3,330	7,586	0	7,586	(4,256)
2013	2,500	0.06669	0.06654	8,286	0	8,286	553	34	0	21.224	42.448	722	0	3,775	7,746	0	7,746	(3,971)
2014	0	0.06997	0.06982	8,286	0	8,286	580	34	0	21.649	43.297	736	0	1,316	0	0	0	1,316
2015	0	0.07343	0.07326	8,286	0	8,286	608	34	0	22.082	44.163	751	0	1,359	0	0	0	1,359
2016	0	0.07705	0.07687	8,286	0	8,286	638	34	0	22.523	45.046	766	0	1,404	0	0	0	1,404
2017	0	0.08084	0.08066	8,286	0	8,286	670	34	0	22.974	45.947	781	0	1,451	0	0	0	1,451
2018	0	0.08483	0.08464	8,286	0	8,286	703	34	0	23.433	46.866	797	0	1,500	0	0	0	1,500
2019	0	0.08901	0.08881	8,286	0	8,286	738	34	0	23.902	47.804	813	0	1,551	0	0	0	1,551
2020	0	0.09340	0.09319	8,286	0	8,286	774	34	0	24.380	48.760	829	0	1,603	0	0	0	1,603
2021	0	0.09801	0.09779	8,286	0	8,286	812	34	0	24.867	49.735	845	0	1,657	0	0	0	1,657
2022	0	0.10284	0.10261	8,286	0	8,286	852	34	0	25.365	50.730	862	0	1,714	0	0	0	1,714
2023	0	0.10791	0.10767	8,286	0	8,286	894	34	0	25.872	51.744	880	0	1,774	0	0	0	1,774
2024	0	0.11323	0.11298	8,286	0	8,286	938	34	0	26.390	52.779	897	0	1,835	0	0	0	1,835
2025	0	0.11882	0.11855	8,286	0	8,286	985	34	0	26.917	53.835	915	0	1,900	0	0	0	1,900
2026	0	0.12468	0.12440	8,286	0	8,286	1,033	34	0	27.456	54.911	934	0	1,967	0	0	0	1,967
2027	0	0.13083	0.13053	8,286	0	8,286	1,084	34	0	28.005	56.010	952	0	2,036	0	0	0	2,036
2028	0	0.13728	0.13697	8,286	0	8,286	1,138	34	0	28.565	57.130	971	0	2,109	0	0	0	2,109
2029	0	0.14405	0.14372	8,286	0	8,286	1,194	34	0	29.136	58.272	991	0	2,185	0	0	0	2,185
2030	0	0.15115	0.15081	8,286	0	8,286	1,252	34	0	29.719	59.438	1,010	0	2,262	0	0	0	2,262
Total =				157,434	0			646	0					$39,619			$22,762	$16,857
													NPV =	$18,844			$20,562	(1,718)

Total NPV = ($1,718)
Benefit/Cost Ratio = 0.92

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial AC - Centrifugal Chillers**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$85	$1,283	$1,368	$2,608	$4,776	$7,384	($6,016)
2012	177	2,566	2,743	2,651	4,776	7,427	(4,684)
2013	285	4,056	4,341	2,671	4,776	7,447	(3,106)
2014	298	4,218	4,516	0	0	0	4,516
2015	328	4,387	4,715	0	0	0	4,715
2016	331	4,562	4,893	0	0	0	4,893
2017	348	4,745	5,093	0	0	0	5,093
2018	379	4,934	5,313	0	0	0	5,313
2019	397	5,132	5,529	0	0	0	5,529
2020	425	5,337	5,762	0	0	0	5,762
2021	427	5,551	5,978	0	0	0	5,978
2022	430	5,773	6,203	0	0	0	6,203
2023	434	6,003	6,437	0	0	0	6,437
2024	437	6,243	6,680	0	0	0	6,680
2025	441	6,493	6,934	0	0	0	6,934
2026	445	6,753	7,198	0	0	0	7,198
2027	450	7,023	7,473	0	0	0	7,473
2028	454	7,304	7,758	0	0	0	7,758
2029	459	7,596	8,055	0	0	0	8,055
2030	465	7,900	8,365	0	0	0	8,365
		Total =	$115,354			$22,258	$93,096
		NPV =	$47,092			$20,358	26,734

Total NPV =	$26,734
Benefit/Cost Ratio =	2.31

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

Input Data	
1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$432	$605	$682
Incentive Costs =	10,000	10,000	10,000
Total Utility Project Costs =	$10,432	$10,605	$10,682
14) Direct Participant Costs ($/Part.) =	$20,000	$20,000	$20,000
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	10	10	10
16) Avg Summer kW/part. Saved =	15.000	15.000	15.000
16a) Avg Winter kW/part Saved =	15.000	15.000	15.000
17) Avg. Summer kWh/Part. Saved =	50,000	50,000	50,000
17a) Avg. Winter kWh/Part. Saved =	50,000	50,000	50,000
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	1	1	1
20) Incentive/Participant =	$10,000	$10,000	$10,000
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	50,000	50,000	50,000
Annual Winter Kwh Saved	50,000	50,000	50,000
23) Annual Summer KW Saved	15	15	15
Annual Winter KW Saved	15	15	15

Test Results	**NPV**	**B/C**
Ratepayer Impact Measure Test	$73,799	1.96
Utility Cost Test	$121,480	5.19
Societal Test	$210,838	4.56
Participant Test	$123,990	3.19
Total Resource Cost Test	$94,033	2.67

Table 1
Ratepayer Impact Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Total Project Costs (O)	Annual Benefits Less Costs (P)
1	2011	107,476	$0.02860	$3,074	$0.00000	$0	17	17	34	$98.68	$3,355	$6,429	$0.03807	50,000	50,000	100,000	$2,308	$432	$10,000	$12,740	($6,311)
2	2012	214,950	0.02988	6,423	0.00000	0	33	33	66	102.62	6,773	13,196	0.03883	100,000	100,000	200,000	4,707	605	10,000	15,312	(2,116)
3	2013	322,426	0.03195	10,302	0.00000	0	50	50	100	106.73	10,673	20,975	0.03960	150,000	150,000	300,000	7,201	682	10,000	17,883	3,092
4	2014	322,426	0.03348	10,795	0.00000	0	50	50	100	111.00	11,100	21,895	0.04040	150,000	150,000	300,000	7,346	0	0	7,346	14,549
5	2015	322,426	0.03688	11,891	0.00000	0	50	50	100	115.44	11,544	23,435	0.04120	150,000	150,000	300,000	7,492	0	0	7,492	15,943
6	2016	322,426	0.03720	11,994	0.00000	0	50	50	100	120.05	12,005	23,999	0.04203	150,000	150,000	300,000	7,643	0	0	7,643	16,356
7	2017	322,426	0.03911	12,610	0.00000	0	50	50	100	124.86	12,486	25,096	0.04287	150,000	150,000	300,000	7,795	0	0	7,795	17,301
8	2018	322,426	0.04251	13,706	0.00000	0	50	50	100	129.85	12,985	26,691	0.04373	150,000	150,000	300,000	7,952	0	0	7,952	18,739
9	2019	322,426	0.04456	14,367	0.00000	0	50	50	100	135.05	13,505	27,872	0.04460	150,000	150,000	300,000	8,110	0	0	8,110	19,762
10	2020	322,426	0.04769	15,376	0.00000	0	50	50	100	140.45	14,045	29,421	0.04549	150,000	150,000	300,000	8,272	0	0	8,272	21,149
11	2021	214,950	0.04800	10,318	0.00000	0	33	33	66	146.07	9,641	19,959	0.04640	100,000	100,000	200,000	5,625	0	0	5,625	14,334
12	2022	107,476	0.04834	5,195	0.00000	0	17	17	34	151.91	5,165	10,360	0.04733	50,000	50,000	100,000	2,869	0	0	2,869	7,491
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.04828	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.04924	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.05023	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.05123	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05226	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05330	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.05437	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.05546	0	0	0	0	0	0	0	0
Total =		3,224,260							1,000			$249,328				3,000,000				$109,039	$140,289
											NPV =	$150,478								$76,679	73,799

Total NPV = $73,799
Benefit/Cost Ratio = 1.96

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$3,074	$0	$3,355	$6,429	$10,432	$10,432	($4,003)
2012	6,423	0	6,773	13,196	10,605	10,605	2,591
2013	10,302	0	10,673	20,975	10,682	10,682	10,293
2014	10,795	0	11,100	21,895	0	0	21,895
2015	11,891	0	11,544	23,435	0	0	23,435
2016	11,994	0	12,005	23,999	0	0	23,999
2017	12,610	0	12,486	25,096	0	0	25,096
2018	13,706	0	12,985	26,691	0	0	26,691
2019	14,367	0	13,505	27,872	0	0	27,872
2020	15,376	0	14,045	29,421	0	0	29,421
2021	10,318	0	9,641	19,959	0	0	19,959
2022	5,195	0	5,165	10,360	0	0	10,360
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$249,328		$31,719	$217,609
			NPV =	$150,478		$28,998	121,480

Total NPV =	$121,480
Benefit/Cost Ratio =	5.19

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$3,074	$0	$3,355	$2,033	$8,462	$10,432	$10,000	$20,432	($11,970)
2012	6,423	0	6,773	4,298	17,494	10,605	10,000	20,605	(3,111)
2013	10,302	0	10,673	7,036	28,011	10,682	10,000	20,682	7,329
2014	10,795	0	11,100	7,565	29,460	0	0	0	29,460
2015	11,891	0	11,544	8,340	31,775	0	0	0	31,775
2016	11,994	0	12,005	8,797	32,796	0	0	0	32,796
2017	12,610	0	12,486	9,476	34,572	0	0	0	34,572
2018	13,706	0	12,985	10,380	37,071	0	0	0	37,071
2019	14,367	0	13,505	11,165	39,037	0	0	0	39,037
2020	15,376	0	14,045	12,139	41,560	0	0	0	41,560
2021	10,318	0	9,641	8,482	28,441	0	0	0	28,441
2022	5,195	0	5,165	4,535	14,895	0	0	0	14,895
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$343,574			$61,719	$281,855
				NPV =	$270,071			$59,233	210,838

Total NPV =	$210,838
Benefit/Cost Ratio =	4.56

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Partnership Program (Custom)**
Program Years: **2011 - 2013**

	Benefits														Costs			Annual
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Benefits Less Costs (P)
2011	$10,000	$0.06057	$0.06043	50,000	50,000	100,000	$6,050	15	15	$20.400	$40.800	$918	$0	$16,968	$20,422	$0	$20,422	($3,454)
2012	10,000	0.06355	0.06341	100,000	100,000	200,000	12,696	30	30	20.808	41.616	1,873	0	24,569	20,853	0	20,853	3,716
2013	10,000	0.06669	0.06654	150,000	150,000	300,000	19,985	45	45	21.224	42.448	2,865	0	32,850	21,293	0	21,293	11,557
2014	0	0.06997	0.06982	150,000	150,000	300,000	20,969	45	45	21.649	43.297	2,923	0	23,892	0	0	0	23,892
2015	0	0.07343	0.07326	150,000	150,000	300,000	22,004	45	45	22.082	44.163	2,981	0	24,985	0	0	0	24,985
2016	0	0.07705	0.07687	150,000	150,000	300,000	23,088	45	45	22.523	45.046	3,041	0	26,129	0	0	0	26,129
2017	0	0.08084	0.08066	150,000	150,000	300,000	24,225	45	45	22.974	45.947	3,101	0	27,326	0	0	0	27,326
2018	0	0.08483	0.08464	150,000	150,000	300,000	25,421	45	45	23.433	46.866	3,163	0	28,584	0	0	0	28,584
2019	0	0.08901	0.08881	150,000	150,000	300,000	26,673	45	45	23.902	47.804	3,227	0	29,900	0	0	0	29,900
2020	0	0.09340	0.09319	150,000	150,000	300,000	27,989	45	45	24.380	48.760	3,291	0	31,280	0	0	0	31,280
2021	0	0.09801	0.09779	100,000	100,000	200,000	19,580	30	30	24.867	49.735	2,238	0	21,818	0	0	0	21,818
2022	0	0.10284	0.10261	50,000	50,000	100,000	10,273	15	15	25.365	50.730	1,141	0	11,414	0	0	0	11,414
2023	0	0.10791	0.10767	0	0	0	0	0	0	25.872	51.744	0	0	0	0	0	0	0
2024	0	0.11323	0.11298	0	0	0	0	0	0	26.390	52.779	0	0	0	0	0	0	0
2025	0	0.11882	0.11855	0	0	0	0	0	0	26.917	53.835	0	0	0	0	0	0	0
2026	0	0.12468	0.12440	0	0	0	0	0	0	27.456	54.911	0	0	0	0	0	0	0
2027	0	0.13083	0.13053	0	0	0	0	0	0	28.005	56.010	0	0	0	0	0	0	0
2028	0	0.13728	0.13697	0	0	0	0	0	0	28.565	57.130	0	0	0	0	0	0	0
2029	0	0.14405	0.14372	0	0	0	0	0	0	29.136	58.272	0	0	0	0	0	0	0
2030	0	0.15115	0.15081	0	0	0	0	0	0	29.719	59.438	0	0	0	0	0	0	0
Total =				1,500,000	1,500,000			450	450					$299,715			$62,568	$237,147
													NPV =	$180,509			$56,519	123,990

Total NPV = $123,990
Benefit/Cost Ratio = 3.19

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Partnership Program (Custom)**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$3,074	$3,355	$6,429	$10,432	$10,000	$20,432	($14,003)
2012	6,423	6,773	13,196	10,605	10,000	20,605	(7,409)
2013	10,302	10,673	20,975	10,682	10,000	20,682	293
2014	10,795	11,100	21,895	0	0	0	21,895
2015	11,891	11,544	23,435	0	0	0	23,435
2016	11,994	12,005	23,999	0	0	0	23,999
2017	12,610	12,486	25,096	0	0	0	25,096
2018	13,706	12,985	26,691	0	0	0	26,691
2019	14,367	13,505	27,872	0	0	0	27,872
2020	15,376	14,045	29,421	0	0	0	29,421
2021	10,318	9,641	19,959	0	0	0	19,959
2022	5,195	5,165	10,360	0	0	0	10,360
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$249,328			$61,719	$187,609
		NPV =	$150,478			$56,445	94,033

Total NPV =	$94,033
Benefit/Cost Ratio =	2.67

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

ELECTRIC DEMAND SIDE MANAGEMENT (DSM) PROGRAMS
SOUTH DAKOTA ELECTRIC COST-EFFECTIVENESS ANALYSIS

Company: **Montana-Dakota Utilities Co.**
Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

Input Data

1) Retail Rate Summer ($/kWh) =	$0.05772
Retail Rate Winter ($/kWh) =	$0.05759
Retail Escalation Rate =	4.93%
1a) Power Supply Cost Adjustment	$0.00328
Fuel Escalation Rate =	1.00%
2) Avg. System Marginal Energy Cost ($/kWh) =	$0.00000
Escalation Rate =	0.06%
3) Retail Summer Demand Rate ($/kW/season) =	$20.00
3a) Retail Winter Demand Rate ($/kW/season) =	$40.00
Escalation Rate =	2.00%
4) Electric Margin ($/kWh) =	$0.03732
Escalation Rate =	2.00%
5) System Peak Shaving Demand Cost ($/kW/yr)	$84.67
Reserve Capacity=	12.1%
Escalation Rate =	4.00%
6) System Variable O&M ($/kWh) =	$0.00000
Escalation Rate =	0.00%
7) Environmental Damage Factor =	31%
Escalation Rate =	3.00%
8) Participant Discount Rate =	10.94%
9) Utility Discount Rate =	9.61%
10) Societal Discount Rate =	4.24%
11) General Input Data Year =	2010
12) Project Analysis Year 1 =	2011
Project Analysis Year 2 =	2012
Project Analysis Year 3 =	2013

	First Year	Second Year	Third Year
13) Utility Project Costs			
Admin & Promotion Costs =	$0	$0	$0
Incentive Costs =	0	0	0
Direct Program Costs =	0	23,016	46,032
Total Utility Project Costs =	$0	$23,016	$46,032
14) Direct Participant Costs ($/Part.) =	$0	$0	$0
Escalation Rate =	2.11%	2.11%	2.11%
14a) Other Participant Costs (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0.00%	0.00%	0.00%
14b) Other Participant Savings (Annual $/Part.) =	$0	$0	$0
Escalation Rate =	0%	0%	0%
15) Project Life (Years) =	10	10	10
16) Avg Summer kW/part. Saved =	400.000	400.000	400.000
16a) Avg Winter kW/part Saved =	0.000	0.000	0.000
17) Avg. Summer kWh/Part. Saved =	10,000	10,000	10,000
17a) Avg. Winter kWh/Part. Saved =	0	0	0
18a) System Demand Line Loss Factor	11.6500%	11.6500%	11.6500%
18b) System Energy Line Loss Factor	7.4750%	7.4750%	7.4750%
19) Number of Participants =	0	1	2
20) Incentive/Participant =	$0	$0	$0
21) Effective Federal & State Income Tax Rate =			39.39%
22) Annual Summer Kwh Saved	0	10,000	20,000
Annual Winter Kwh Saved	0	0	0
23) Annual Summer KW Saved	0	400	800
Annual Winter KW Saved	0	0	0

Test Results	NPV	B/C
Ratepayer Impact Measure Test	$555,770	2.33
Utility Cost Test	$555,770	2.33
Societal Test	$1,254,567	3.24
Participant Test	$163,276	#DIV/0!
Total Resource Cost Test	$555,770	2.33

Table 1
Ratepayer Impact Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

t	Year	Total Energy Reduction (A)	Energy Cost (B)	Energy Savings (C)	Variable O&M Sav. /kWh (D)	Variable O&M Savings (E)	Summer Demand Reduction (F1)	Winter Demand Reduction (F2)	Total Demand Reduction (F)	Demand Savings/ kW (G)	Demand Savings (H)	Total Savings (I)	Electric Margin (J)	Summer Energy Reduction (K1)	Winter Energy Reduction (K2)	Costs: Total Energy Reduction (K)	Costs: Lost Margin (L)	Costs: Program Admin Costs (M)	Costs: Incentive Costs (N)	Costs: Direct Program Costs (O)	Costs: Total Project Costs (P)	Annual Benefits Less Costs (Q)
1	2011	0	$0.02860	$0	$0.00000	$0	0	0	0	$98.68	$0	$0	$0.03807	0	0	0	$0	$0	$0	$0	$0	$0
2	2012	10,748	0.02988	321	0.00000	0	447	0	447	102.62	45,871	46,192	0.03883	10,000	0	10,000	235	0	0	23,016	23,251	22,941
3	2013	32,243	0.03195	1,030	0.00000	0	1,340	0	1,340	106.73	143,018	144,048	0.03960	30,000	0	30,000	720	0	0	69,048	69,768	74,280
4	2014	32,243	0.03348	1,079	0.00000	0	1,340	0	1,340	111.00	148,740	149,819	0.04040	30,000	0	30,000	735	0	0	69,048	69,783	80,036
5	2015	32,243	0.03688	1,189	0.00000	0	1,340	0	1,340	115.44	154,690	155,879	0.04120	30,000	0	30,000	749	0	0	69,048	69,797	86,082
6	2016	32,243	0.03720	1,199	0.00000	0	1,340	0	1,340	120.05	160,867	162,066	0.04203	30,000	0	30,000	764	0	0	69,048	69,812	92,254
7	2017	32,243	0.03911	1,261	0.00000	0	1,340	0	1,340	124.86	167,312	168,573	0.04287	30,000	0	30,000	780	0	0	69,048	69,828	98,745
8	2018	32,243	0.04251	1,371	0.00000	0	1,340	0	1,340	129.85	173,999	175,370	0.04373	30,000	0	30,000	795	0	0	69,048	69,843	105,527
9	2019	32,243	0.04456	1,437	0.00000	0	1,340	0	1,340	135.05	180,967	182,404	0.04460	30,000	0	30,000	811	0	0	69,048	69,859	112,545
10	2020	32,243	0.04769	1,538	0.00000	0	1,340	0	1,340	140.45	188,203	189,741	0.04549	30,000	0	30,000	827	0	0	69,048	69,875	119,866
11	2021	32,243	0.04800	1,548	0.00000	0	1,340	0	1,340	146.07	195,734	197,282	0.04640	30,000	0	30,000	844	0	0	69,048	69,892	127,390
12	2022	21,495	0.04834	1,039	0.00000	0	893	0	893	151.91	135,656	136,695	0.04733	20,000	0	20,000	574	0	0	69,048	69,622	67,073
13	2023	0	0.04871	0	0.00000	0	0	0	0	157.98	0	0	0.04828	0	0	0	0	0	0	0	0	0
14	2024	0	0.04911	0	0.00000	0	0	0	0	164.30	0	0	0.04924	0	0	0	0	0	0	0	0	0
15	2025	0	0.04954	0	0.00000	0	0	0	0	170.88	0	0	0.05023	0	0	0	0	0	0	0	0	0
16	2026	0	0.05000	0	0.00000	0	0	0	0	177.71	0	0	0.05123	0	0	0	0	0	0	0	0	0
17	2027	0	0.05050	0	0.00000	0	0	0	0	184.82	0	0	0.05226	0	0	0	0	0	0	0	0	0
18	2028	0	0.05103	0	0.00000	0	0	0	0	192.21	0	0	0.05330	0	0	0	0	0	0	0	0	0
19	2029	0	0.05160	0	0.00000	0	0	0	0	199.90	0	0	0.05437	0	0	0	0	0	0	0	0	0
20	2030	0	0.05220	0	0.00000	0	0	0	0	207.90	0	0	0.05546	0	0	0	0	0	0	0	0	0
Total =		322,430							13,400			$1,708,069				300,000					$721,330	$986,739
											NPV =	$974,951									$419,181	555,770

Total NPV = $555,770
Benefit/Cost Ratio = 2.33

Worksheet Calculations

(A) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15), adjusted for line losses
(B) = Avg. System Marginal Energy Cost (2), escalated
(C) = (C) x (D)
(D) = System Variable O&M Savings (6), escalated
(E) = (C) x (F)
(F) = Average Summer/Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15), adjusted for line losses
(G) = System Peak Shaving Demand Cost (5), escalated + Escalated System Peak x x Reserve Capacity
(H) = (F) + (G)
(I) = (C) + (E) + (H)
(J) = Electric Margin (4), escalated
(K) = Average Summer/Winter kWh /Participant Saved (17) x Number of Participants (19) for Project Life (15)
(L) = [(J) + (K)] x 1-Inverse of Tax Rate (21)
(M) = Program Admin Costs (13)
(N) = Incentive/Participant (20) x Number of Participants (19)
(O) = (L) + (M) + (N)
(P) = (I) - (O)

Table 2
Utility Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits				Costs		Annual
Year	Energy Savings (A)	O & M Savings (B)	Demand Savings (C)	Total Savings (D)	Total Project Costs (E)	Total Project Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	321	0	45,871	46,192	23,251	23,251	22,941
2013	1,030	0	143,018	144,048	69,768	69,768	74,280
2014	1,079	0	148,740	149,819	69,783	69,783	80,036
2015	1,189	0	154,690	155,879	69,797	69,797	86,082
2016	1,199	0	160,867	162,066	69,812	69,812	92,254
2017	1,261	0	167,312	168,573	69,828	69,828	98,745
2018	1,371	0	173,999	175,370	69,843	69,843	105,527
2019	1,437	0	180,967	182,404	69,859	69,859	112,545
2020	1,538	0	188,203	189,741	69,875	69,875	119,866
2021	1,548	0	195,734	197,282	69,892	69,892	127,390
2022	1,039	0	135,656	136,695	69,622	69,622	67,073
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
Total =				$1,708,069		$721,330	$986,739
			NPV =	$974,951		$419,181	555,770

Total NPV =	$555,770
Benefit/Cost Ratio =	2.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) = Table 1 (I)
(E) = Table 1 (M) + Table 1 (N)
(F) = (E)
(G) = (D) - (F)

Table 3
Societal Cost Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits					Costs			Annual
Year	Total Energy Savings (A)	Variable O & M Savings (B)	System Demand Savings (C)	Avoided Environmental Damage Costs (D)	Annual Total Decrease (E)	Utility Project Costs (F)	Participants' Costs Net of Rebates (G)	Annual Total Increase (H)	Benefits Less Costs (I)
2011	$0	$0	$0	$0	$0	$0	$0	$0	$0
2012	321	0	45,871	15,045	61,237	23,251	0	23,251	37,986
2013	1,030	0	143,018	48,323	192,371	69,768	0	69,768	122,603
2014	1,079	0	148,740	51,767	201,586	69,783	0	69,783	131,803
2015	1,189	0	154,690	55,477	211,356	69,797	0	69,797	141,559
2016	1,199	0	160,867	59,409	221,475	69,812	0	69,812	151,663
2017	1,261	0	167,312	63,648	232,221	69,828	0	69,828	162,393
2018	1,371	0	173,999	68,201	243,571	69,843	0	69,843	173,728
2019	1,437	0	180,967	73,065	255,469	69,859	0	69,859	185,610
2020	1,538	0	188,203	78,284	268,025	69,875	0	69,875	198,150
2021	1,548	0	195,734	83,837	281,119	69,892	0	69,892	211,227
2022	1,039	0	135,656	59,833	196,528	69,622	0	69,622	126,906
2023	0	0	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0	0	0
Total =					$2,364,958			$721,330	$1,643,628
				NPV =	$1,813,612			$559,045	1,254,567

Total NPV =	$1,254,567
Benefit/Cost Ratio =	3.24

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (E)
(C) = Table 1 (H)
(D) =[(A) + (C)] x Environmental Damage Factor (7), escalated
(E) = (A) + (B) + (C) + (D)
(F) = Table 2 (E)
(G) = [Direct Participant Costs (14) x Number of Participants (19)] - Table 1 (N)
(H) = (F) + (G)
(I) = (E) - (H)

Table 4
Participant Test

Project: **Commercial Demand Response Program**
Program Years: **2011 - 2013**

	Benefits														Costs			
Year	Incentives Received (A)	Summer Retail Rate (B)	Winter Retail Rate (C)	Summer Energy Reduction (D1)	Winter Energy Reduction (D2)	Total Energy Reduction (D)	Energy Savings Bill (E)	Summer Demand Reduction (F)	Winter Demand Reduction (G)	Summer Demand Rate (H)	Winter Demand Rate (I)	Demand Savings Bill (J)	Other Participant Savings (K)	Total Annual Benefits (L)	Direct Part. Costs (M)	Other Part. Costs (N)	Total Annual Costs (O)	Annual Benefits Less Costs (P)
2011	$0	$0.06057	$0.06043	0	0	0	$0	0	0	$20.400	$40.800	$0	$0	$0	$0	$0	$0	$0
2012	0	0.06355	0.06341	10,000	0	10,000	636	400	0	20.808	41.616	8,323	0	8,959	0	0	0	8,959
2013	0	0.06669	0.06654	30,000	0	30,000	2,001	1,200	0	21.224	42.448	25,469	0	27,470	0	0	0	27,470
2014	0	0.06997	0.06982	30,000	0	30,000	2,099	1,200	0	21.649	43.297	25,979	0	28,078	0	0	0	28,078
2015	0	0.07343	0.07326	30,000	0	30,000	2,203	1,200	0	22.082	44.163	26,498	0	28,701	0	0	0	28,701
2016	0	0.07705	0.07687	30,000	0	30,000	2,312	1,200	0	22.523	45.046	27,028	0	29,340	0	0	0	29,340
2017	0	0.08084	0.08066	30,000	0	30,000	2,425	1,200	0	22.974	45.947	27,569	0	29,994	0	0	0	29,994
2018	0	0.08483	0.08464	30,000	0	30,000	2,545	1,200	0	23.433	46.866	28,120	0	30,665	0	0	0	30,665
2019	0	0.08901	0.08881	30,000	0	30,000	2,670	1,200	0	23.902	47.804	28,682	0	31,352	0	0	0	31,352
2020	0	0.09340	0.09319	30,000	0	30,000	2,802	1,200	0	24.380	48.760	29,256	0	32,058	0	0	0	32,058
2021	0	0.09801	0.09779	30,000	0	30,000	2,940	1,200	0	24.867	49.735	29,840	0	32,780	0	0	0	32,780
2022	0	0.10284	0.10261	20,000	0	20,000	2,057	800	0	25.365	50.730	20,292	0	22,349	0	0	0	22,349
2023	0	0.10791	0.10767	0	0	0	0	0	0	25.872	51.744	0	0	0	0	0	0	0
2024	0	0.11323	0.11298	0	0	0	0	0	0	26.390	52.779	0	0	0	0	0	0	0
2025	0	0.11882	0.11855	0	0	0	0	0	0	26.917	53.835	0	0	0	0	0	0	0
2026	0	0.12468	0.12440	0	0	0	0	0	0	27.456	54.911	0	0	0	0	0	0	0
2027	0	0.13083	0.13053	0	0	0	0	0	0	28.005	56.010	0	0	0	0	0	0	0
2028	0	0.13728	0.13697	0	0	0	0	0	0	28.565	57.130	0	0	0	0	0	0	0
2029	0	0.14405	0.14372	0	0	0	0	0	0	29.136	58.272	0	0	0	0	0	0	0
2030	0	0.15115	0.15081	0	0	0	0	0	0	29.719	59.438	0	0	0	0	0	0	0
Total =				300,000	0			12,000	0					$301,746			$0	$301,746
													NPV =	$163,276			$0	163,276

Total NPV = $163,276
Benefit/Cost Ratio = #DIV/0!

Worksheet Calculations

(A) = Table 1 (N)
(B) = Retail Summer Rate, escalated.
(C) = Retail Winter Rate, escalated.
(D) = Table 1 (K)
(E) = [Retail Rate (B) or (C)] x (D)
(F) = Average Summer kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(G) = Average Winter kW /Participant Saved (16) x Number of Participants (19) for Project Life (15)
(H) = Retail Summer Demand Rate, escalated.
(I) = Retail Winter Demand Rate, escalated.
(J) = (A) + (D) + (I) + (J)
(K) = Number of Participants (20) x Other Participant Savings (14b), escalated
(M) = Number of Participants (20) x Direct Participant Costs (14), escalated
(N) = Number of Participants (20) x Other Participants Costs (11a), escalated
(O) = (L) + (M)
(P) = (K) - (N)

Table 5
Total Resource Cost Test

Company: **Commercial Demand Response Program**
Project: **2011 - 2013**

	Benefits			Costs			
Year	Total Energy Savings (A)	Total Demand Savings (B)	Total Annual Benefits (C)	Utility Program Costs (D)	Participants' Costs Net of Rebate (E)	Total Costs (F)	Benefits Less Costs (G)
2011	$0	$0	$0	$0	$0	$0	$0
2012	321	45,871	46,192	23,251	0	23,251	22,941
2013	1,030	143,018	144,048	69,768	0	69,768	74,280
2014	1,079	148,740	149,819	69,783	0	69,783	80,036
2015	1,189	154,690	155,879	69,797	0	69,797	86,082
2016	1,199	160,867	162,066	69,812	0	69,812	92,254
2017	1,261	167,312	168,573	69,828	0	69,828	98,745
2018	1,371	173,999	175,370	69,843	0	69,843	105,527
2019	1,437	180,967	182,404	69,859	0	69,859	112,545
2020	1,538	188,203	189,741	69,875	0	69,875	119,866
2021	1,548	195,734	197,282	69,892	0	69,892	127,390
2022	1,039	135,656	136,695	69,622	0	69,622	67,073
2023	0	0	0	0	0	0	0
2024	0	0	0	0	0	0	0
2025	0	0	0	0	0	0	0
2026	0	0	0	0	0	0	0
2027	0	0	0	0	0	0	0
2028	0	0	0	0	0	0	0
2029	0	0	0	0	0	0	0
2030	0	0	0	0	0	0	0
		Total =	$1,708,069			$721,330	$986,739
		NPV =	$974,951			$419,181	555,770

Total NPV =	$555,770
Benefit/Cost Ratio =	2.33

Worksheet Calculations
(A) = Table 1 (C)
(B) = Table 1 (H)
(C) = (A) + (B)
(D) = Table 2 (E)
(E) = Table 3 (G)
(F) = (D) + (E)
(G) = (C) - (F)

Appendix B

Summary of DSM Implementation Plan Results

Montana-Dakota Utilities Co.
Electric Utility - Montana
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	35	467,124	24	$13,579	$0.029	$565.79
Central Air Conditioning Tier 2 (16 SEER) - Replacement	35	564,550	22	27,157	0.048	1,234.41
Central Air Conditioning Tier 2 - New	15	92,988	10	11,536	0.124	1,153.60
Window AC Units	15	8,998	2	962	0.107	481.00
AC Tune-up	100	59,110	18	5,804	0.098	322.44
Thermal Storage with ASHP	12	856,211	234	35,708	0.042	152.60
Residential Lighting	300	45,140	2	775	0.017	387.50
Total	512	2,094,121	312	$95,521	$0.046	$306.16
Demand Response						
Residential AC Cycling	800	0	893	$448,100	NA	$501.79
Total Residential	1,312	2,094,121	1,205	$543,621	$0.260	$451.14
Commercial Programs						
Commerical Lighting	20	7,157,842	116	$73,556	$0.010	$634.10
Commercial Motors - Replacement	30	2,944,294	32	13,978	0.005	436.81
Commerical Motors - New / on Failure	30	723,427	8	3,728	0.005	466.00
Variable Speed Drives - VFD'S	20	6,842,506	196	18,637	0.003	95.09
Commercial AC - Split Systems	20	1,565,383	54	18,637	0.012	345.13
Commerical AC - Packaged Systems	17	494,955	53	15,842	0.032	298.91
Commerical AC - Water Cooled Chillers	3	264,347	17	9,318	0.035	548.12
Commercial AC - Centrifugal Chillers	3	169,195	38	9,318	0.055	245.21
Commercial Partnership Program (Custom)	10	10,747,502	334	124,250	0.012	372.01
Total Commercial	153	30,909,451	848	$287,264	$0.009	$338.75
Demand Response						
Commercial Demand Response Program	8	859,801	3,573	$172,620	$0.201	$48.31
	8	859,801	3,573	$172,620	$0.201	$48.31
Total Commercial	161	31,769,252	4,421	$459,884	$0.014	$104.02
Education and Outreach				$56,600		
Total Programs without DR	665	33,003,572	1,160	$439,385	$0.013	$378.78
Total Demand Response	808	859,801	4,466	$620,720	$0.722	$138.99
Total Programs	1,473	33,863,373	5,626	$1,060,105	$0.031	$188.43

Montana-Dakota Utilities Co.
Electric Utility - North Dakota
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Thermal Storage with ASHP	35	2,497,265	684	82,338	0.033	120.38
Total	35	2,497,265	684	$82,338	$0.033	$120.38
Demand Response						
Residential AC Cycling	3,000	0	3,350	$1,494,000	NA	$445.97
Total Residential	3,035	2,497,265	4,034	$1,576,338	$0.631	$390.76
Commercial Programs						
Commerical Lighting	60	21,473,512	696	$181,418	$0.008	$260.66
Total Commercial	60	21,473,512	696	$181,418	$0.008	$260.66
Demand Response						
Commercial Demand Response Program	27	2,901,830	12,058	$621,432	$0.214	$51.54
	27	2,901,830	12,058	$621,432	$0.214	$51.54
Total Commercial	87	24,375,342	12,754	$802,850	$0.033	$62.95
Education and Outreach				$6,000		
Total Programs without DR	95	23,970,777	1,380	$269,756	$0.011	$195.48
Total Demand Response	3,027	2,901,830	15,408	$2,115,432	$0.729	$137.29
Total Programs	3,122	26,872,607	16,788	$2,385,188	$0.089	$142.08

Montana-Dakota Utilities Co.
Electric Utility - South Dakota
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	17	232,260	13	$5,415	$0.023	$416.54
Central Air Conditioning Tier 2 (16 SEER)	17	280,855	11	10,831	0.039	984.64
Central Air Conditioning Tier 2 - New	6	38,094	4	3,803	0.100	950.75
Window AC Units	6	4,410	1	317	0.072	317.00
AC Tune-up	45	27,325	8	2,145	0.078	268.13
Total	204	582,944	37	$22,511	$0.039	$608.41
Demand Response						
Residential AC Cycling	200	0	223	$110,266	NA	$494.47
Total Residential	404	582,944	260	$132,777	$0.228	$510.68
Commercial Programs						
Commerical Lighting	10	3,578,921	116	$31,370	$0.009	$270.43
Commercial Motors - Replacement	6	588,860	6	2,386	0.004	397.67
Commerical Motors - New / on Failure	6	144,686	2	636	0.004	318.00
Variable Speed Drives - VFD'S	5	1,710,630	50	3,972	0.002	79.44
Commercial AC - Split Systems	10	256,814	27	7,949	0.031	294.41
Commerical AC - Packaged Systems	6	174,690	19	4,753	0.027	250.16
Commerical AC - Water Cooled Chillers	3	264,347	17	7,923	0.030	466.06
Commercial AC - Centrifugal Chillers	3	169,195	38	7,923	0.047	208.50
Commercial Partnership Program (Custom)	3	3,224,260	100	31,691	0.010	316.91
Total Commercial	52	10,112,403	375	$98,603	$0.010	$262.94
Demand Response						
Commercial Demand Response Program	3	322,430	1,340	$69,048	$0.214	$51.53
	3	322,430	1,340	$69,048	$0.214	$51.53
Total Commercial	55	10,434,833	1,715	$167,651	$0.016	$97.76
Education and Outreach				$34,850		
Total Programs without DR	256	10,695,347	412	$155,964	$0.015	$378.55
Total Demand Response	203	322,430	1,563	$179,314	$0.556	$114.72
Total Programs	459	11,017,777	1,975	$335,278	$0.030	$169.76

Montana-Dakota Utilities Co.
Electric Utility - Integrated System Total
Demand-Side Management and Conservation Portfolio
2011 - 2013 Program Years

Program	Participants	Lifetime Energy Reduction	2013 Demand Reduction	Total Cost	Lifetime Cost/Kwh	2013 Cost/KW
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	52	699,384	37	$18,994	$0.027	$513.35
Central Air Conditioning Tier 2 (16 SEER) - Replacement	52	845,405	33	37,988	0.045	1,151.15
Central Air Conditioning Tier 2 - New	21	131,082	14	15,339	0.117	1,095.64
Window AC Units	21	13,408	3	1,279	0.095	426.33
AC Tune-up	145	86,435	26	7,949	0.092	305.73
Thermal Storage with ASHP	160	3,353,476	918	118,046	0.035	128.59
Residential Lighting	300	45,140	2	775	0.017	387.50
Total	751	5,174,330	1,033	$200,370	$0.039	$193.97
Demand Response						
Residential AC Cycling	4,000	0	4,466	$2,052,366	NA	$459.55
Total Residential	4,751	5,174,330	5,499	$2,252,736	$0.435	$409.66
Commercial Programs						
Commerical Lighting	90	32,210,275	928	$286,344	$0.009	$308.56
Commercial Motors - Replacement	36	3,533,154	38	16,364	0.005	430.63
Commerical Motors - New / on Failure	36	868,113	10	4,364	0.005	436.40
Variable Speed Drives - VFD'S	25	8,553,136	246	22,609	0.003	91.91
Commercial AC - Split Systems	30	1,822,197	81	26,586	0.015	328.22
Commerical AC - Packaged Systems	23	669,645	72	20,595	0.031	286.04
Commerical AC - Water Cooled Chillers	6	528,694	34	17,241	0.033	507.09
Commercial AC - Centrifugal Chillers	6	338,390	76	17,241	0.051	226.86
Commercial Partnership Program (Custom)	13	13,971,762	434	155,941	0.011	359.31
Total Commercial	265	62,495,366	1,919	$567,285	$0.009	$295.61
Demand Response						
Commercial Demand Response Program	38	4,084,061	16,971	$863,100	$0.211	$50.86
	38	4,084,061	16,971	$863,100	$0.211	$50.86
Total Commercial	303	66,579,427	18,890	$1,430,385	$0.021	$75.72
Education and Outreach				$97,450		
Total Programs without DR	1,016	67,669,696	2,952	$865,105	$0.013	$293.06
Total Demand Response	4,038	4,084,061	21,437	$2,915,466	$0.714	$136.00
Total Programs	5,054	71,753,757	24,389	$3,780,571	$0.053	$155.01

Montana-Dakota Utilities Co.
Montana Electric DSM Program Summary

Benefit/Cost Ratios

DSM Program	Customer Class	RIM	Utility	Societal	Participant	Total Resource Cost
Total Portfolio		5.35	7.48	4.07	3.68	2.53
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	1.61	2.69	3.26	2.04	1.71
Central Air Conditioning Tier 2 (16 SEER) - Replacement	Residential	0.97	1.35	1.65	1.45	0.87
Central Air Conditioning Tier 2 - New	Residential	0.93	1.08	1.30	0.90	0.69
Window AC Units	Residential	1.50	1.82	2.17	1.16	1.31
AC Tune-up	Residential	1.38	1.75	2.60	1.91	1.75
Thermal Storage with ASHP	Residential	5.11	7.47	8.16	1.24	4.30
Residential Lighting	Residential	1.25	3.11	4.65	5.89	3.11
Demand Response						
Residential AC Cycling	Residential	1.24	1.24	3.85	NA	2.09
Commerical Programs						
Commerical Lighting	Commerical	2.29	3.95	5.32	2.85	2.54
Commercial Motors - Replacement	Commerical	2.84	7.26	4.83	2.44	2.27
Commerical Motors - New / on Failure	Commerical	2.77	6.75	7.91	4.19	3.73
Variable Speed Drives - VFD'S	Commerical	4.97	19.97	13.53	5.50	6.94
Commercial AC - Split Systems	Commerical	3.03	5.11	7.63	3.53	3.92
Commerical AC - Packaged Systems	Commerical	3.53	4.44	5.66	1.94	2.90
Commerical AC - Water Cooled Chillers	Commerical	2.39	2.88	7.40	3.30	3.44
Commercial AC - Centrifugal Chillers	Commerical	4.88	5.52	4.69	0.97	2.18
Commercial Partnership Program (Custom)	Commerical	2.45	4.48	4.25	2.79	2.48
Demand Response						
Commercial Demand Response Program	Commercial	2.50	2.50	3.47	NA	2.50

Montana-Dakota Utilities Co.
North Dakota Electric DSM Program Summary

Benefit/Cost Ratios

DSM Program	Customer Class	RIM	Utility	Societal	Participant	Total Resource Cost
Total Portfolio		9.29	10.48	3.96	12.28	2.54
Residential Programs						
Thermal Storage with ASHP	Residential	6.35	9.41	9.24	1.13	4.87
Demand Response						
Residential AC Cycling	Residential	1.36	1.36	4.82	NA	2.48
Commerical Programs						
Commerical Lighting	Commerical	4.23	7.20	9.03	3.44	4.30
Demand Response						
Commercial Demand Response Program	Commercial	2.34	2.34	3.26	NA	2.34

Montana-Dakota Utilities Co.
South Dakota Electric DSM Program Summary

Benefit/Cost Ratios

DSM Program	Customer Class	RIM	Utility	Societal	Participant	Total Resource Cost
Total Portfolio		5.48	9.78	4.10	4.10	2.56
Residential Programs						
Central Air Conditioning Tier 1 (14.5 SEER)	Residential	1.80	3.58	4.03	2.09	2.12
Central Air Conditioning Tier 2 (16 SEER)	Residential	1.05	1.68	1.90	1.48	1.00
Central Air Conditioning Tier 2 - New	Residential	1.08	1.33	1.49	0.91	0.79
Window AC Units	Residential	1.61	2.21	2.50	1.28	1.50
AC Tune-up	Residential	1.55	2.15	3.20	1.94	2.15
Demand Response						
Residential AC Cycling	Residential	1.33	1.33	4.55	NA	2.38
Commerical Programs						
Commerical Lighting	Commerical	2.84	6.98	8.89	3.82	4.23
Commercial Motors - Replacement	Commerical	2.04	8.39	4.96	3.02	2.34
Commerical Motors - New / on Failure	Commerical	2.19	8.47	9.33	5.32	4.34
Variable Speed Drives - VFD'S	Commerical	3.38	23.67	14.39	6.65	7.39
Commercial AC - Split Systems	Commerical	3.10	4.50	6.46	2.09	3.31
Commerical AC - Packaged Systems	Commerical	3.42	5.16	6.18	1.90	3.17
Commerical AC - Water Cooled Chillers	Commerical	2.40	3.39	9.01	3.28	4.19
Commercial AC - Centrifugal Chillers	Commerical	5.14	6.50	4.99	0.92	2.31
Commercial Partnership Program (Custom)	Commercial	1.96	5.19	4.56	3.19	2.67
Demand Response						
Commercial Demand Response Program	Commercial	2.33	2.33	3.24	NA	2.33

Appendix C

Deemed Energy Savings Database

Residential AC

The deemed database for a residential air conditioner will adjust the energy savings per participant based on the three primary factors that affect the energy savings. The first factor is the building itself. The size and construction type (building envelope) of the home is reflected in the unit size measured in tons. The second factor is the efficiency of the AC unit which is measured in the SEER (Seasonal Energy Efficiency Rating) rating. A higher SEER rating leads to more energy savings. The final factor that determines the energy savings for a residential AC unit is the weather. The weather component of the deemed database was adjusted based on the cooling degree days (CDD) for the area based on historical average weather.

Residential Compact Fluorescent (CFL) Lighting

The deemed database for residential CFL light bulbs will adjust the energy savings per participant based on the two primary factors that affect the energy savings. The first factor is the size of the light bulb. A larger bulb generally has more opportunity for energy savings when replaced with a CFL. The other factor is the time that the light bulb is on. If a bulb is used often, then there is more potential for energy savings. A rarely used bulb might offer very little energy savings. For the deemed database, a baseline average was used for the light bulb operating time that treats every bulb in the house as the average bulb. The baseline reflects diverse households and bulb locations.

Commercial Motors

The deemed database for commercial motors adjusts the energy savings per participant based on several factors that affect energy savings. The first factor is the type of motor. The deemed database recognizes different motor styles that vary according to construction type, horsepower, and rotor speed. Another factor that the deemed database considers is the building type. A hospital uses motors differently than a college. The deemed database reflects these differences. It establishes a baseline for these types of facilities as well as different motor types. The final factor that affects energy savings is whether the motor is replacing an existing (and functioning) motor, replaces a burned out motor, or is a new motor entirely. Replacing a functioning motor offers more energy savings than a new motor or a motor replacing a burned out motor.

Variable Frequency Drives (VFD's)

The deemed database for VFD's will adjust the energy savings per participant based on several factors that affect energy savings. The first factor is the motor size. A VFD connected to a large motor has more opportunity for energy savings than a VFD connected to a small motor. The

second factor to consider is the operating hours for the motor. The deemed database has suggested operating times for VFD-connected motors based on building type. The final factor is the percentage of time the motor will spend at various speeds while connected to a VFD. A VFD can save more energy if the motor is allowed to run at slower speeds more often.

Commercial Air Conditioners (AC)

The deemed database for commercial AC units will adjust the energy savings per participant based on three factors that affect the energy savings. The first factor is the building itself. The size and construction type (building envelope) of the building is reflected in the unit size measured in tons. The second factor is the efficiency of the AC unit which is measured in the SEER (Seasonal Energy Efficiency Rating) or EER (Energy Efficiency Rating) rating. A higher SEER or EER rating leads to more energy savings. The final factor that determines the energy savings for a commercial AC unit is the building type. The deemed database adjusts the operating hours depending on the buildings use. The deemed database differentiates between hospitals, schools, and other types of buildings.

Commercial Chillers

The deemed database for commercial chillers will adjust the energy savings per participant based on three factors that affect the energy savings. The first factor is the building itself. The size and construction type (building envelope) of the building is reflected in the unit size measured in tons. The second factor is the efficiency of the chiller which is measured in kW/ton rating. A lower kW/Ton rating leads to more energy savings. The final factor that determines the energy savings for a commercial chiller is the building type. The deemed database adjusts the operating hours depending on the buildings use. The deemed database differentiates between hospitals, schools, and other types of buildings.

Electric AC

Item	Inc Cost - 2 ton	Inc Cost - 2.5 ton	Inc Cost - 3 ton	Inc Cost - 4 ton	Inc Cost - 5 ton	Equipment Life	Peak Load Factor	Source
SEER 14.5 Central AC	$444.50	$594.50	$519.50	$559.25	$485.25	14 years	0.9	MN Deemed Database
SEER 15 Central AC	$592.67	$791.33	$691.33	$744.33	$645.67	14 years	0.9	MN Deemed Database
SEER 16 Central AC	$889.00	$1,187.00	$1,037.00	$1,116.50	$968.50	14 years	0.9	MN Deemed Database
SEER 14.5 ASHP	$2,124.79	$2,841.81	$2,483.30	$2,673.31	$2,319.58	14 years	0.9	MN Deemed Database
SEER 15 ASHP	$2,329.55	$3,110.44	$2,717.38	$2,925.70	$2,537.88	14 years	0.9	MN Deemed Database
SEER 16 ASHP	$2,739.09	$3,657.26	$3,195.09	$3,440.04	$2,984.04	14 years	0.9	MN Deemed Database
Quality Installation (all equipment)	$100.00	$100.00	$100.00	$100.00	$100.00	7 years	0.9	MN Deemed Database

Residential CFL Lighting

Item	Inc Cost	Equipment Life	Peak Load Factor	Source
15 Watt CFL Bulb	$2.49	8,000 hours/9.4 years	0.08	MN Deemed Database
26 Watt CFL Bulb	$3.76	8,000 hours/9.4 years	0.08	MN Deemed Database

New Construction Bundle

Item	Inc Cost	Equipment Life	Peak Load Factor	Source
Energy Star Dishwasher	$12.00	10 years	N/A	Energy Star
Energy Star Refrigerator	$30.00	12 years	0.35	Energy Star
Energy Star Clothes Washer	$258.00	11 years	0.35	Energy Star

Residential Room AC

Item	Inc Cost - 6,000 BTU	Inc Cost - 8,000 BTU	Inc Cost - 10,000 BTU	Inc Cost - 12,000 BTU	Equipment Life	Peak Load Factor	Source
Window Mount AC	$25.00	$50.00	$50.00	$75.00	9 years	0.9	MN Deemed Database
Through-Wall AC	$25.00	$50.00	$50.00	$75.00	9 years	0.9	MN Deemed Database

Residential AC Tune-Up

Item	Inc Cost	Equipment Life	Peak Load Factor	Source
AC Tune-Up	$45.00	4.5 years	0.9	MN Deemed Database

Commercial Motors

Item	Efficiency	Inc Cost -Replace on Failure/New	Inc Cost - Retrofit	Equipment Life	Peak Load Factor	Source
Premium Efficiency Motor 1 HP 1200 RPM ODP	82.5	$52	$ 271.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1.5 HP 1200 RPM ODP	86.5	$60	$ 300.05	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 2 HP 1200 RPM ODP	87.5	$61	$ 327.80	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 3 HP 1200 RPM ODP	88.5	$54	$ 434.20	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 5 HP 1200 RPM ODP	89.5	$63	$ 546.45	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 7.5 HP 1200 RPM ODP	90.2	$123	$ 682.75	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 10 HP 1200 RPM ODP	91.7	$116	$ 803.45	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 15 HP 1200 RPM ODP	91.7	$115	$ 1,041.80	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 20 HP 1200 RPM ODP	92.4	$115	$ 1,250.90	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 25 HP 1200 RPM ODP	93	$201	$ 1,532.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 30 HP 1200 RPM ODP	93.6	$231	$ 1,660.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 40 HP 1200 RPM ODP	94.1	$249	$ 2,409.25	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 50 HP 1200 RPM ODP	94.1	$273	$ 2,794.30	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 60 HP 1200 RPM ODP	94.5	$431	$ 3,338.60	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 75 HP 1200 RPM ODP	94.5	$554	$ 3,923.40	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 100 HP 1200 RPM ODP	95	$658	$ 4,700.60	20 years	0.75	MN Deemed Database

Premium Efficiency Motor 125 HP 1200 RPM ODP	95	$841	$ 5,410.20	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 150 HP 1200 RPM ODP	95.4	$908	$ 6,108.55	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 200 HP 1200 RPM ODP	95.4	$964	$ 8,231.25	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1 HP 1800 RPM ODP	85.5	$52	$ 243.70	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1.5 HP 1800 RPM ODP	86.5	$60	$ 248.05	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 2 HP 1800 RPM ODP	86.5	$61	$ 279.05	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 3 HP 1800 RPM ODP	89.5	$54	$ 293.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 5 HP 1800 RPM ODP	89.5	$63	$ 337.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 7.5 HP 1800 RPM ODP	91	$123	$ 466.95	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 10 HP 1800 RPM ODP	91.7	$116	$ 533.70	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 15 HP 1800 RPM ODP	93	$115	$ 701.20	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 20 HP 1800 RPM ODP	93	$115	$ 881.05	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 25 HP 1800 RPM ODP	93.6	$201	$ 1,027.10	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 30 HP 1800 RPM ODP	94.1	$231	$ 1,151.70	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 40 HP 1800 RPM ODP	94.1	$249	$ 1,464.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 50 HP 1800 RPM ODP	94.5	$273	$ 2,033.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 60 HP 1800 RPM ODP	95	$431	$ 2,017.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 75 HP 1800 RPM ODP	95	$554	$ 2,360.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 100 HP 1800 RPM ODP	95.4	$658	$ 3,106.80	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 125 HP 1800 RPM ODP	95.4	$841	$ 3,566.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 150 HP 1800 RPM ODP	95.8	$908	$ 5,135.50	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 200 HP 1800 RPM ODP	95.8	$964	$ 6,129.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1 HP 3600 RPM ODP	77	$52	$ 50.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1.5 HP 3600 RPM ODP	84	$60	$ 240.90	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 2 HP 3600 RPM ODP	85.5	$61	$ 273.85	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 3 HP 3600 RPM ODP	85.5	$54	$ 295.10	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 5 HP 3600 RPM ODP	86.5	$63	$ 344.30	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 7.5 HP 3600 RPM ODP	88.5	$123	$ 453.30	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 10 HP 3600 RPM ODP	89.5	$116	$ 544.75	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 15 HP 3600 RPM ODP	90.2	$115	$ 695.35	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 20 HP 3600 RPM ODP	91	$115	$ 831.65	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 25 HP 3600 RPM ODP	91.7	$201	$ 1,030.35	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 30 HP 3600 RPM ODP	91.7	$231	$ 1,142.60	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 40 HP 3600 RPM ODP	92.4	$249	$ 1,475.85	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 50 HP 3600 RPM ODP	93	$273	$ 1,741.95	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 60 HP 3600 RPM ODP	93.6	$431	$ 2,105.55	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 75 HP 3600 RPM ODP	93.6	$554	$ 2,616.90	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 100 HP 3600 RPM ODP	93.6	$658	$ 3,310.90	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 125 HP 3600 RPM ODP	94.1	$841	$ 4,186.25	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 150 HP 3600 RPM ODP	94.1	$908	$ 5,256.40	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 200 HP 3600 RPM ODP	95	$964	$ 7,455.80	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1 HP 1200 RPM TEFC	82.5	$52	$ 373.70	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1.5 HP 1200 RPM TEFC	87.5	$60	$ 435.25	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 2 HP 1200 RPM TEFC	88.5	$61	$ 408.40	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 3 HP 1200 RPM TEFC	89.5	$54	$ 593.45	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 5 HP 1200 RPM TEFC	89.5	$63	$ 736.90	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 7.5 HP 1200 RPM TEFC	91	$123	$ 860.20	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 10 HP 1200 RPM TEFC	91	$116	$ 1,129.75	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 15 HP 1200 RPM TEFC	91.7	$115	$ 1,566.35	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 20 HP 1200 RPM TEFC	91.7	$115	$ 1,803.40	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 25 HP 1200 RPM TEFC	93	$201	$ 2,158.75	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 30 HP 1200 RPM TEFC	93	$231	$ 2,356.80	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 40 HP 1200 RPM TEFC	94.1	$249	$ 3,316.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 50 HP 1200 RPM TEFC	94.1	$273	$ 3,651.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 60 HP 1200 RPM TEFC	94.5	$431	$ 4,203.75	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 75 HP 1200 RPM TEFC	94.5	$554	$ 5,024.50	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 100 HP 1200 RPM TEFC	95	$658	$ 7,197.25	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 125 HP 1200 RPM TEFC	95	$841	$ 8,244.20	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 150 HP 1200 RPM TEFC	95.8	$908	$ 9,028.35	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 200 HP 1200 RPM TEFC	95.8	$964	$ 11,508.55	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1 HP 1800 RPM TEFC	85.5	$52	$ 271.65	20 years	0.75	MN Deemed Database

Premium Efficiency Motor 1.5 HP 1800 RPM TEFC	86.5	$60	$ 342.95	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 2 HP 1800 RPM TEFC	86.5	$61	$ 364.20	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 3 HP 1800 RPM TEFC	89.5	$54	$ 390.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 5 HP 1800 RPM TEFC	89.5	$63	$ 452.85	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 7.5 HP 1800 RPM TEFC	91.7	$123	$ 621.65	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 10 HP 1800 RPM TEFC	91.7	$116	$ 699.45	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 15 HP 1800 RPM TEFC	92.4	$115	$ 928.05	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 20 HP 1800 RPM TEFC	93	$115	$ 1,011.70	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 25 HP 1800 RPM TEFC	93.6	$201	$ 1,398.90	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 30 HP 1800 RPM TEFC	93.6	$231	$ 1,576.80	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 40 HP 1800 RPM TEFC	94.1	$249	$ 2,176.55	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 50 HP 1800 RPM TEFC	94.5	$273	$ 2,477.75	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 60 HP 1800 RPM TEFC	95	$431	$ 3,366.55	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 75 HP 1800 RPM TEFC	95.4	$554	$ 3,843.45	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 100 HP 1800 RPM TEFC	95.4	$658	$ 4,687.60	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 125 HP 1800 RPM TEFC	95.4	$841	$ 6,874.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 150 HP 1800 RPM TEFC	95.8	$908	$ 7,723.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 200 HP 1800 RPM TEFC	96.2	$964	$ 9,316.10	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1 HP 3600 RPM TEFC	77	$52	$ 252.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 1.5 HP 3600 RPM TEFC	84	$60	$ 301.35	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 2 HP 3600 RPM TEFC	85.5	$61	$ 345.35	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 3 HP 3600 RPM TEFC	86.5	$54	$ 400.40	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 5 HP 3600 RPM TEFC	88.5	$63	$ 502.90	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 7.5 HP 3600 RPM TEFC	89.5	$123	$ 643.10	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 10 HP 3600 RPM TEFC	90.2	$116	$ 683.85	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 15 HP 3600 RPM TEFC	91	$115	$ 914.40	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 20 HP 3600 RPM TEFC	91	$115	$ 1,143.00	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 25 HP 3600 RPM TEFC	91.7	$201	$ 1,336.50	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 30 HP 3600 RPM TEFC	91.7	$231	$ 1,598.25	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 40 HP 3600 RPM TEFC	92.4	$249	$ 2,117.40	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 50 HP 3600 RPM TEFC	93	$273	$ 2,553.15	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 60 HP 3600 RPM TEFC	93.6	$431	$ 3,550.50	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 75 HP 3600 RPM TEFC	93.6	$554	$ 4,305.60	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 100 HP 3600 RPM TEFC	94.1	$658	$ 5,183.55	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 125 HP 3600 RPM TEFC	95	$841	$ 7,033.25	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 150 HP 3600 RPM TEFC	95	$908	$ 8,509.65	20 years	0.75	MN Deemed Database
Premium Efficiency Motor 200 HP 3600 RPM TEFC	95.4	$964	$ 10,825.40	20 years	0.75	MN Deemed Database

Commercial AC - Split Systems

Size	Incremental Cost ($/ton)	Avg Unit Size (tons)	Unit Inc'l Cost ($/unit)	Equipment Life	Peak Load Factor	Source
Split System < 65 kBTU/h (5.42 tons)	$115.00	4	$460.00	15 years	0.9	MN Deemed Database
Split System => 65 and < 135 kBTU/h (5.42 to 11.3 tons)	$115.00	9	$1,035.00	15 years	0.9	MN Deemed Database
Split System => 135 and < 239 kBTU/h (11.25 to 20 tons)	$91.00	15	$1,365.00	15 years	0.9	MN Deemed Database
Split System => 240 and < 759 kBTU/h (20 to 63.3 tons)	$99.00	40	$3,960.00	15 years	0.9	MN Deemed Database
Split System => 760 kBTU/h (63.3 tons)	$99.00	70	$6,930.00	15 years	0.9	MN Deemed Database

Commercial AC - Rooftop Units

Size	Incremental Cost	Equipment Life	Peak Load Factor	Source
High Eff Rooftop Unit <65 kBTU/h (5.42 tons)	$703.42	15 years	0.9	MN Deemed Database
High Eff Rooftop Unit => 65 and < 135 kBtu/h (5.42 to 11.25 tons)	$1,245.85	15 years	0.9	MN Deemed Database
High Eff Rooftop Unit =>135 and < 239 KBTU/h (11.25 to 20 tons)	$1,728.04	15 years	0.9	MN Deemed Database
High Eff Rooftop Unit =>240 and < 759 kBTU/h (20 to 63.33 tons)	$4,821.73	15 years	0.9	MN Deemed Database
High Eff Rooftop Unit => 760 kBTU/h (63.33 tons)	$6,870.78	15 years	0.9	MN Deemed Database

Commercial AC - Air-cooled Chillers

Size	Incremental Cost ($/ton)	Equipment Life	Peak Load Factor	Source
High Eff Air-Cooled Chiller < 150 tons	$39.94	25 years	0.9	MN Deemed Database
High Eff Air-Cooled Chiller > 150 tons	$39.94	25 years	0.9	MN Deemed Database

Commercial AC - Centrifugal Chillers

Size	Incremental Cost ($/ton)	Equipment Life	Peak Load Factor	Source
High Eff Centrifugal Chiller, <150 ton	$145.52	20 years	0.9	MN Deemed Database
High Eff Centrifugal Chiller, 150 - 300 ton	$93.84	20 years	0.9	MN Deemed Database
High Eff Centrifugal Chiller, =>300 ton	$65.58	20 years	0.9	MN Deemed Database

Commercial Lighting

Building Type	**Peak Load Factor**	**Annual Operating Hours**	**Source**
Office	78%	3435	MN Deemed Database
Restaurant	94%	4156	MN Deemed Database
Retail	94%	3068	MN Deemed Database
Grocery/Supermarket	94%	4612	MN Deemed Database
Warehouse	96%	2388	MN Deemed Database
Elemen./Second. School	73%	2080	MN Deemed Database
College	71%	5010	MN Deemed Database
Health	84%	3392	MN Deemed Database
Hospital	84%	4532	MN Deemed Database
Hotel/Motel	51%	2697	MN Deemed Database
Manufacturing	96%	5913	MN Deemed Database
Other/Misc.	96%	2278	MN Deemed Database
24-Hour Facility	94%	8234	MN Deemed Database
Safety or Code Required	100%	8760	MN Deemed Database

Electric AC

Item	Inc Cost - 2 ton	Inc Cost - 2.5 ton	Inc Cost - 3 ton	Inc Cost - 4 ton	Inc Cost - 5 ton	Equipment Life	Peak Load Factor	Source
SEER 14.5 Central AC	$1,988.50	$2,636.31	$2,310.43	$2,483.14	$2,161.61	14 years	0.9	MN Deemed Database
SEER 15 Central AC	$2,156.35	$2,856.73	$2,504.34	$2,691.10	$2,343.41	14 years	0.9	MN Deemed Database
SEER 16 Central AC	$2,324.21	$3,077.15	$2,698.24	$2,899.06	$2,525.21	14 years	0.9	MN Deemed Database
SEER 14.5 ASHP	$2,492.06	$3,297.57	$2,892.15	$3,107.02	$2,707.01	14 years	0.9	MN Deemed Database
SEER 15 ASHP	$2,659.91	$3,517.99	$3,086.06	$3,314.98	$2,888.81	14 years	0.9	MN Deemed Database
SEER 16 ASHP	$2,827.76	$3,738.41	$3,279.96	$3,522.94	$3,070.61	14 years	0.9	MN Deemed Database
Quality Installation (all equipment)	$2,995.62	$3,958.83	$3,473.87	$3,730.90	$3,252.41	7 years	0.9	MN Deemed Database

Residential CFL Lighting

Item	Inc Cost	Equipment Life	Peak Load Factor	Source

Electric AC Replacement - Montana

Demand Reduction kw — **Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**

New — **Choose Replacement or New from Drop-Down Menu to the left**

Calculator

AC Size (Tons)	3
SEER	16
Reduction (kw)	**0.63**

AC Size (Tonnes)	SEER 14.5	SEER 15.0	SEER 15.5	SEER 16.0	SEER 16.5	SEER 17.0	SEER 17.5	SEER 18.0	SEER 18.5	SEER 19.0	SEER 19.5	SEER 20.0
1.0	0.230	0.222	0.215	0.208	0.202	0.196	0.191	0.185	0.180	0.176	0.171	0.167
1.5	0.345	0.334	0.323	0.313	0.303	0.294	0.286	0.278	0.270	0.263	0.257	0.250
2.0	0.460	0.445	0.430	0.417	0.404	0.392	0.381	0.371	0.361	0.351	0.342	0.334
2.5	0.575	0.556	0.538	0.521	0.505	0.490	0.476	0.463	0.451	0.439	0.428	0.417
3.0	0.690	0.667	0.645	0.625	0.606	0.589	0.572	0.556	0.541	0.527	0.513	0.500
3.5	0.805	0.778	0.753	0.730	0.707	0.687	0.667	0.648	0.631	0.614	0.599	0.584
4.0	0.920	0.889	0.861	0.834	0.809	0.785	0.762	0.741	0.721	0.702	0.684	0.667
4.5	1.035	1.001	0.968	0.938	0.910	0.883	0.858	0.834	0.811	0.790	0.770	0.750
5.0	1.150	1.112	1.076	1.042	1.011	0.981	0.953	0.926	0.901	0.878	0.855	0.834
5.5	1.265	1.223	1.183	1.146	1.112	1.079	1.048	1.019	0.992	0.965	0.941	0.917

Demand Reduction = (12/SEER*(1-((1-Non_Quality_Installation_Loss_Factor)/(1-Quality_Installation_Loss_Factor_On_Existing_Homes))))*Size_of_Unit

Source: MN OES Deemed Savings Database

Electric AC Tune Up - Montana

Energy Savings per Tune-up

Energy Savings (kwh/yr)	110

Demand Reduction per Tune-up

Demand Reduction (kw)	0.18

Source: MN OES Deemed Savings Database

Electric Room AC Replacement - Montana

Calculator

Window Unit		Choose Unit Type from Drop-Down Menu to the left
AC Size (BTU)	12,000	Select Unit Size from Drop-Down Menu to the left
Savings (kwh/yr)	62	
Demand Reduction (kw)	0.10	

Source: MN OES Deemed Savings Database

New Construction Bundle - Montana

Total Energy Savings (kwh/yr)	**1,168**
Total Demand Reduction (kw)	**0.69**

Calculator - Lightbulbs		**Coincident factor**				
Energy Saved per CFL Lightbulb (kwh/yr)	37.8					
Demand Reduction per CFL Lighbulb (kw)	0.0036		**summer**	**Winter**		
Number of CFL Lightbulbs	10		**Net KW**	**Net kW**	**Summer kWH**	**Winter kWh**
Total Energy Savings (kwh/yr)	**378**				126	252
Total Demand Reduction (kw)	**0.036**	0.08	0.00288	0.00288		
Calculator - AC						
AC Size (Tons)	3					
SEER	16					
Savings (kwh/yr)	**412**				412	-
Reduction (kw)	**0.63**	0.9	0.562792208	0		
Dishwasher						
Energy Savings (kwh/yr)	**137**				46	91
Demand Reduction (kw)	**0.00**					
Washer						
Energy Savings (kwh/yr)	**158**				53	105
Demand Reduction (kw)	**0.0215**	0.35	0.007525	0.007525		
Refrigerator						
Energy Savings (kwh/yr)	**83**				28	55
Demand Reduction (kw)	**0.009**	0.35	0.00315	0.00315		
			0.58	**0.003**	**664**	**504**

Source: MN OES Deemed Savings Database

New Construction Bundle (must have all three applicances)

	Inc Cost	**Non-energy**	
	$2	0	
Central AC 16 SEER	$1,037	0	
Energy Star Refriderator	$30	0	
Energy Star Dish Washer (Gas Water Heating)	$12	450	Gallons (gas .29 dk)
Energy Star Closthes Washer (Gas Water Heating)	$258	6,630	Gallons (.61 dk gas)
	$1,337	7,080.00	

Residential CFL Lightbulbs - Montana

Incandescent Bulb Wattage	60				
CFL Replacement Wattage	15	Quantity	Summer	Winter	
Energy Saved from CFL Lightbulb (kwh/yr)	**37.8**	15	13	25	
Demand Reduction (kw)	**0.0036**	15	0.0036	0.0036	

Common Name

CFL

Algorithms (impacts per unit)

Electrical Energy Savings (kWh/yr) = (kW_EE - kW_Base) x Hrs x HVAC_cooling_kWhsavings_factor

Electrical Demand Savings (kW) = (kW_EE - kW_Base) x CF x HVAC_cooling_kWsavings_factor

Natural Gas Savings (MCF) = (kW_EE - kW_Base) x Hrs x HVAC_heating_penalty_factor

Where:

kW_EE = Stipulated fixture wattage (kW per fixture) from standard wattage table for post-retrofit fixture.

kW_Base = Stipulated fixture wattage (kW per fixture) from standard wattage table for pre-retrofit fixture.

Hrs = Estimated annual operational hours per year of the fixture; if site specific hours are not available, building level stipulated annual operation hours in Table 3 are used.

HVAC_cooling_kWhsavings_factor = Stipulated cooling system energy savings factor resulting from efficient lighting.

CF = Stipulated coincident demand factor based on building type from Table 3.

HVAC_cooling_kWsavings_factor = Stipulated cooling system demand savings factor resulting from efficient lighting.

HVAC_heating_penalty_factor = Stipulated heating system energy increase factor resulting from efficient lighting.

Source: MN OES Deemed Savings Database

Input Assumptions for Typical Applications

Table 1: Pre- and Post-retrofit Fixture Types and Wattages (1)

Post-retrofit Fixture	kW_EE	pre-retrofit fixture	kW_Base
CFL 1-story	0.019	Incandescent 1-story	0.06525
CFL Multi-story	0.019	Incandescent 2-story	0.06525
CFL Multi-family	0.019	Incandescent Multi-family	0.06525
CFL Mobile Home	0.019	Incandescent Multi-family	0.06525

Table 2: HVAC Interactive Factors(2)

HVAC system	HVAC_cooling_kWhsavings_factor	HVAC_cooling_kWsavings_factor	HVAC_heating_penalty_factor
Heating only	1.00	1.00	-0.000887
Heating and cooling	1.11	1.33	-0.000887

Table 3: Lighting Coincident Peak Demand Factors and Annual Operating Hours by Building Type (3)

Building Type	Hrs	CF	Hours of Use per Day	SqFt
Single-family 1-story	840	8%	2.30	1850
Single-family Multi-story	840	8%	2.30	2400
Multi-family	840	8%	2.30	1100
Mobile Home	840	8%	2.30	1300

Thermal Storage - Montana

Heating Savings

	Efficiency	kWh	Connected	Peak	Off-Peak
Standard Resistance Heating w/heatpump	1.31	18,732	38.4	38.4	38.4
ETS Heating Uncontrolled AHSP operation	1.74	13,990	38.4	3.6	38.4
Savings		4,742	-	35	-

As Per Steffes Manufacturing

Commercial Lighting - Montana

Lighting (will be customer Specific)

Rebate Level	$0.40	per wattt
Cost per Fixture	$50.00	
Average Fixtures / participant	100	
Hrs per yer	2,500	
Total kWh Saved	18,500	
Total kW Saved	7.4	

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Program: Lighting Efficiency

Prescriptive rebates will be offered for replacement lighting equipment. New Construction rebates will be offered for new facilities or spaces overhauled for a new purpose.
Custom rebates are available for lighting-related improvements that are not prescriptive.

Algorithms:

Electrical Demand Savings (Customer kW)	= (kW_Base - kW_EE) x HVAC_cooling_kWsavings_factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Base - kW_EE) x Hrs x HVAC_cooling_kWhsavings_factor
Natural Gas Savings (Dth)	= (kW_Base - kW_EE) x Hrs x HVAC_heating_penalty_factor
Lighting Controls -Electrical Energy Savings (Customer kWh/yr)	=(kW connected) x (1-PAF) x Hrs x HVAC_cooling_kWhsavings_factor
Lighting Controls -Electrical Demand Savings (Customer kW)	=(kW connected) x (1-PAF) x HVAC_cooling_kWsavings_factor
Lighting Controls -Natural Gas Savings (Dth)	=(kW connected) x (1-PAF) x Hrs x HVAC_heating_penalty_factor
Electrical Energy Savings (Gross Generator kWh)	= Customer kWh / (1-TDLF)
Electrical Demand Savings (Gross Generator kW)	= Customer kW x CF / (1-TDLF)
Electrical Energy Savings (Net Generator kWh)	= Gross Generator kWh x NTG
Electrical Demand Savings (Net Generator kW)	= Gross Generator kW x NTG

Variables:

Hrs	= Annual Operating Hours. Hours to be obtained from Table 2. The type of facility is to be supplied by the customer.
kW_Base	= Baseline fixture wattage (kW per fixture) determined from deemed fixture table.
kW_EE	= High Efficiency fixture wattage (kW per fixture) determined from deemed fixture table
HVAC_cooling_kWhsavings_factor	= Cooling system energy savings factor resulting from efficient lighting from Table 1. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence
HVAC_cooling_kWsavings_factor	= Cooling system demand savings factor resulting from efficient lighting from Table 1. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning to be provided by customer.
HVAC_heating_kWsavings_factor	= Heating system penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has air conditioning. A value of -0.00088738 Dth/kWh given by (Reference 4).
CF	= Coincidence Factor, the probability that peak demand of the lights will coincide with peak utility system demand. CF will be determined based on customer provided building type in table 2.
Measure Life	= Length of time the lighting equipment will be operational, see Table 6 for Measure Lifetimes
Baseline Cost	= Cost of the baseline technology. For Retrofit, the cost is 0 since the baseline is to continue to operate the existing system. For New Construction, the cost is given in the deemed fixture table. (Reference 5)
High Efficiency Cost	= Cost of the High Efficiency technology. Costs given in Deemed Fixture Table (Reference 4)
kW connected	Total connected fixture load, determined as the sum of stipulated fixture wattages from Deemed Fixture Table.
PAF	Stipulated power adjustment factor based on control type from Table 4.
TDLF	Transmission Distribution Loss Factor = 6.39%, the percentage loss of electricity as it flows from the power plant to the customer, calculated using factors from Enhanced DSM Filing SRD-2
NTG	Net-to-gross = 96% (Reference 5)
Incremental operation and maintenance cost	= Other annual savings or costs associated with the electrical savings. For Lighting, this consists of additional natural gas for heating. Methodology given by (Reference 4).

Provided by Customer:	**Verified during M&V:**
Number of Fixtures	Yes
Lighting equipment type	Yes
Building type	Yes
Existence of air conditioning	Yes

Assumptions:
- Each replacement lighting fixture is going in on a one-for-one basis for existing fixtures. New construction fixtures are put in on a one-for-one basis instead of lower efficiency options.

- In the Technical Assumptions, one will note that the Operating Hours does not appear, but rather a modified version. The methodology defines kW Savings on the basis of difference in kW with the HVAC Cooling demand factor. The Annual Energy Savings takes into account any heating that has to be added.

Table 1: HVAC Interactive Factors (Reference 2)

HVAC system	HVAC_cooling_kWhsavings_factor	HVAC_cooling_kW savings_factor
Heating only	1.00	1.00
Heating and cooling	1.11	1.33

Table 2: Coincident Peak Demand Factors and Annual Operating Hours by Building Type (Reference 1 and 3)

Building Type	CF	Annual Operating Hours
Office	78%	3435
Restaurant	94%	4156
Retail	94%	3068
Grocery/Supermarket	94%	4612
Warehouse	96%	2388
Elemen./Second. School	73%	2080
College	71%	5010
Health	84%	3392
Hospital	84%	4532
Hotel/Motel	51%	2697
Manufacturing	96%	5913
Other/Misc.	96%	2278
24-Hour Facility	94%	8234
Safety or Code Required	100%	8760

Table 3: Measure Lifetimes in Years (Reference 4)

Measure	Lifetime in Years
CFL less than 19W	5
Low Wattage T8 Lamps	8
Integrated 25W Ceramic Metal Halide	7
T8 Lighting Systems	18
T5 Lighting Systems	18
Lighting Controls	18

Table 4: Stipulated Power Adjustment Factors (Reference 1 and 7)

Control Type	PAF
no controls	1.00
Occupancy Sensor - Wall Mount	0.70
Occupancy Sensor - Ceiling Mount	0.70
Daylighting - Continuous Dimming	0.57
Daylighting - Multiple Step Dimming	0.65
Daylighting - On/Off	0.73

Changes from 2008

Baseline efficiencies updated. High efficiency values updated. More measures added to program. Cost information updated from various sources. Methodology now looks at market segment rather than a single operating hours value for all participants.

References

1. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures Final Report, Nexant. CF and hours

2. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method for Minnesota, presented on page 28 of the 11/93 issue of the ASHRAE Journal - "Calculating lighting and HVAC interactions".
3. Technical Reference User Manual No. 2004-31, Efficiency Vermont, 12/31/04. CF and Hours
4. Deemed Savings Database, Minnesota Office of Energy Security, 2008. CF, Hours, kW, Costs, Measure life
5. Net-to-Gross factor from National Energy Efficiency Best Practices Study(http://www.eebestpractices.com)
6. Lighting Efficiency input wattage guide, Xcel Energy, July, 2008, kW
7. CL&P and UI program Savings Documentation modified for 3022 Daylight Hours in Denver CO

Electric Motors - Montana

Office Ventilation Fan Retrofit

Choose Motor Type from Drop-Down Menu to the left
Choose Motor Type from Drop-Down Menu to the left

Electrical Energy Savings (kWh / yr) = HP x LF x Conversion x (1/Standard_Eff - 1/ High_Eff) x Hrs

Electrical Demand Savings (kW) = HP x LF x Conversion x (1/Standard_Eff - 1/ High_Eff) x Coincidence Factor

Where:

Hrs = Annual operational hours per year of the motor; if site specific hours are not available, stipulated annual operating hours by building in Table 2 and Table 3 are used.

LF = Motor load factor as percentage (0 - 100); if motor specific load factor is not available, use default 75% load factor.

HP = Rated motor horsepower.

High_Eff = Efficiency of high efficiency replacement motor as percentage (0 - 100); use efficiency of 'Premium Efficiency Motor' for motor size and type (TEFC or ODP) as specified in Table 1 unless motor is specified otherwise.

Standard_Eff = Efficiency of standard replacement motor (0 - 100) ; use efficiency of 'Existing Efficiency Motor' for motor size, speed, and type (TEFC or ODP) as specified in Table 1, unless motor is specified otherwise.

Conversion = .746 (1 HP = .746 kW)

Coincidence Factor = 0.78

Source: MN OES Deemed Savings Database

Unit Size (Tons)	Motor Size (HP)	Replacement Standard Efficiency (%)	Retrofit Standard Efficiency (%)	High Efficiency (%)	Energy Savings kwh/yr	Demand Reduction kw
Existing Efficiency Motor 1 HP 1200 RPM ODP	1.0	80.0%	76.3%	82.5%	341	0.04
Existing Efficiency Motor 1.5 HP 1200 RPM ODP	1.5	84.0%	77.4%	86.5%	706	0.09
Existing Efficiency Motor 2 HP 1200 RPM ODP	2.0	85.5%	78.5%	87.5%	908	0.11
Existing Efficiency Motor 3 HP 1200 RPM ODP	3.0	86.5%	80.6%	88.5%	1,151	0.14
Existing Efficiency Motor 5 HP 1200 RPM ODP	5.0	87.5%	83.2%	89.5%	1,466	0.18
Existing Efficiency Motor 7.5 HP 1200 RPM ODP	7.5	88.5%	85.3%	90.2%	1,655	0.21
Existing Efficiency Motor 10 HP 1200 RPM ODP	10.0	90.2%	86.3%	91.7%	2,364	0.30
Existing Efficiency Motor 15 HP 1200 RPM ODP	15.0	90.2%	87.2%	91.7%	2,924	0.37
Existing Efficiency Motor 20 HP 1200 RPM ODP	20.0	91.0%	88.1%	92.4%	3,660	0.46
Existing Efficiency Motor 25 HP 1200 RPM ODP	25.0	91.7%	88.9%	93.0%	4,295	0.54
Existing Efficiency Motor 30 HP 1200 RPM ODP	30.0	92.4%	89.4%	93.6%	5,217	0.66
Existing Efficiency Motor 40 HP 1200 RPM ODP	40.0	93.0%	89.7%	94.1%	7,224	0.91
Existing Efficiency Motor 50 HP 1200 RPM ODP	50.0	93.0%	89.9%	94.1%	8,600	1.08
Existing Efficiency Motor 60 HP 1200 RPM ODP	60.0	93.6%	90.4%	94.5%	9,976	1.26
Existing Efficiency Motor 75 HP 1200 RPM ODP	75.0	93.6%	90.9%	94.5%	10,889	1.37
Existing Efficiency Motor 100 HP 1200 RPM ODP	100.0	94.1%	90.9%	95.0%	16,449	2.07
Existing Efficiency Motor 125 HP 1200 RPM ODP	125.0	94.1%	91.3%	95.0%	18,473	2.33
Existing Efficiency Motor 150 HP 1200 RPM ODP	150.0	94.5%	91.7%	95.4%	21,979	2.77
Existing Efficiency Motor 200 HP 1200 RPM ODP	200.0	94.5%	92.5%	95.4%	22,770	2.87
Existing Efficiency Motor 1 HP 1800 RPM ODP	1.0	82.5%	76.3%	85.5%	489	0.06
Existing Efficiency Motor 1.5 HP 1800 RPM ODP	1.5	84.0%	77.4%	86.5%	706	0.09
Existing Efficiency Motor 2 HP 1800 RPM ODP	2.0	84.0%	78.5%	86.5%	816	0.10
Existing Efficiency Motor 3 HP 1800 RPM ODP	3.0	86.5%	80.6%	89.5%	1,282	0.16
Existing Efficiency Motor 5 HP 1800 RPM ODP	5.0	87.5%	83.2%	89.5%	1,466	0.18
Existing Efficiency Motor 7.5 HP 1800 RPM ODP	7.5	88.5%	85.3%	91.0%	1,908	0.24
Existing Efficiency Motor 10 HP 1800 RPM ODP	10.0	89.5%	86.3%	91.7%	2,364	0.30
Existing Efficiency Motor 15 HP 1800 RPM ODP	15.0	91.0%	87.2%	93.0%	3,717	0.47
Existing Efficiency Motor 20 HP 1800 RPM ODP	20.0	91.0%	88.1%	93.0%	4,144	0.52
Existing Efficiency Motor 25 HP 1800 RPM ODP	25.0	91.7%	88.9%	93.6%	4,892	0.62
Existing Efficiency Motor 30 HP 1800 RPM ODP	30.0	92.4%	89.4%	94.1%	5,807	0.73
Existing Efficiency Motor 40 HP 1800 RPM ODP	40.0	93.0%	89.7%	94.1%	7,224	0.91
Existing Efficiency Motor 50 HP 1800 RPM ODP	50.0	93.0%	89.9%	94.5%	9,379	1.18
Existing Efficiency Motor 60 HP 1800 RPM ODP	60.0	93.6%	90.4%	95.0%	11,134	1.40
Existing Efficiency Motor 75 HP 1800 RPM ODP	75.0	94.1%	90.9%	95.0%	12,336	1.55
Existing Efficiency Motor 100 HP 1800 RPM ODP	100.0	94.1%	90.9%	95.4%	17,978	2.26
Existing Efficiency Motor 125 HP 1800 RPM ODP	125.0	94.5%	91.3%	95.4%	20,385	2.57
Existing Efficiency Motor 150 HP 1800 RPM ODP	150.0	95.0%	91.7%	95.8%	24,253	3.06
Existing Efficiency Motor 200 HP 1800 RPM ODP	200.0	95.0%	92.5%	95.8%	25,803	3.25
Existing Efficiency Motor 1 HP 3600 RPM ODP	1.0	N/A	76.3%	77.0%	41	0.01
Existing Efficiency Motor 1.5 HP 3600 RPM ODP	1.5	82.5%	77.4%	84.0%	528	0.07
Existing Efficiency Motor 2 HP 3600 RPM ODP	2.0	84.0%	78.5%	85.5%	723	0.09
Existing Efficiency Motor 3 HP 3600 RPM ODP	3.0	84.0%	80.6%	85.5%	739	0.09
Existing Efficiency Motor 5 HP 3600 RPM ODP	5.0	85.5%	83.2%	86.5%	794	0.10

Existing Efficiency Motor 7.5 HP 3600 RPM ODP	7.5	87.5%	85.3%	88.5%	1,101	0.14
Existing Efficiency Motor 10 HP 3600 RPM ODP	10.0	88.5%	86.3%	89.5%	1,435	0.18
Existing Efficiency Motor 15 HP 3600 RPM ODP	15.0	89.5%	87.2%	90.2%	1,982	0.25
Existing Efficiency Motor 20 HP 3600 RPM ODP	20.0	90.2%	88.1%	91.0%	2,506	0.32
Existing Efficiency Motor 25 HP 3600 RPM ODP	25.0	91.0%	88.9%	91.7%	2,975	0.37
Existing Efficiency Motor 30 HP 3600 RPM ODP	30.0	91.0%	89.4%	91.7%	2,916	0.37
Existing Efficiency Motor 40 HP 3600 RPM ODP	40.0	91.7%	89.7%	92.4%	4,514	0.57
Existing Efficiency Motor 50 HP 3600 RPM ODP	50.0	92.4%	89.9%	93.0%	6,423	0.81
Existing Efficiency Motor 60 HP 3600 RPM ODP	60.0	93.0%	90.4%	93.6%	7,861	0.99
Existing Efficiency Motor 75 HP 3600 RPM ODP	75.0	93.0%	90.9%	93.6%	8,245	1.04
Existing Efficiency Motor 100 HP 3600 RPM ODP	100.0	93.0%	90.9%	93.6%	10,994	1.38
Existing Efficiency Motor 125 HP 3600 RPM ODP	125.0	93.6%	91.3%	94.1%	14,114	1.78
Existing Efficiency Motor 150 HP 3600 RPM ODP	150.0	93.6%	91.7%	94.1%	14,454	1.82
Existing Efficiency Motor 200 HP 3600 RPM ODP	200.0	94.5%	92.5%	95.0%	19,712	2.48
Existing Efficiency Motor 1 HP 1200 RPM TEFC	1.0	80.0%	76.3%	82.5%	341	0.04
Existing Efficiency Motor 1.5 HP 1200 RPM TEFC	1.5	85.5%	77.4%	87.5%	775	0.10
Existing Efficiency Motor 2 HP 1200 RPM TEFC	2.0	86.5%	78.5%	88.5%	997	0.13
Existing Efficiency Motor 3 HP 1200 RPM TEFC	3.0	87.5%	80.6%	89.5%	1,282	0.16
Existing Efficiency Motor 5 HP 1200 RPM TEFC	5.0	87.5%	83.2%	89.5%	1,466	0.18
Existing Efficiency Motor 7.5 HP 1200 RPM TEFC	7.5	89.5%	85.3%	91.0%	1,908	0.24
Existing Efficiency Motor 10 HP 1200 RPM TEFC	10.0	89.5%	86.3%	91.0%	2,073	0.26
Existing Efficiency Motor 15 HP 1200 RPM TEFC	15.0	90.2%	87.2%	91.7%	2,924	0.37
Existing Efficiency Motor 20 HP 1200 RPM TEFC	20.0	90.2%	88.1%	91.7%	3,088	0.39
Existing Efficiency Motor 25 HP 1200 RPM TEFC	25.0	91.7%	88.9%	93.0%	4,295	0.54
Existing Efficiency Motor 30 HP 1200 RPM TEFC	30.0	91.7%	89.4%	93.0%	4,500	0.57
Existing Efficiency Motor 40 HP 1200 RPM TEFC	40.0	93.0%	89.7%	94.1%	7,224	0.91
Existing Efficiency Motor 50 HP 1200 RPM TEFC	50.0	93.0%	89.9%	94.1%	8,600	1.08
Existing Efficiency Motor 60 HP 1200 RPM TEFC	60.0	93.6%	90.4%	94.5%	9,976	1.26
Existing Efficiency Motor 75 HP 1200 RPM TEFC	75.0	93.6%	90.9%	94.5%	10,889	1.37
Existing Efficiency Motor 100 HP 1200 RPM TEFC	100.0	94.1%	90.9%	95.0%	16,449	2.07
Existing Efficiency Motor 125 HP 1200 RPM TEFC	125.0	94.1%	91.3%	95.0%	18,473	2.33
Existing Efficiency Motor 150 HP 1200 RPM TEFC	150.0	95.0%	91.7%	95.8%	24,253	3.06
Existing Efficiency Motor 200 HP 1200 RPM TEFC	200.0	95.0%	92.5%	95.8%	25,803	3.25
Existing Efficiency Motor 1 HP 1800 RPM TEFC	1.0	82.5%	76.3%	85.5%	489	0.06
Existing Efficiency Motor 1.5 HP 1800 RPM TEFC	1.5	84.0%	77.4%	86.5%	706	0.09
Existing Efficiency Motor 2 HP 1800 RPM TEFC	2.0	84.0%	78.5%	86.5%	816	0.10
Existing Efficiency Motor 3 HP 1800 RPM TEFC	3.0	87.5%	80.6%	89.5%	1,282	0.16
Existing Efficiency Motor 5 HP 1800 RPM TEFC	5.0	87.5%	83.2%	89.5%	1,466	0.18
Existing Efficiency Motor 7.5 HP 1800 RPM TEFC	7.5	89.5%	85.3%	91.7%	2,126	0.27
Existing Efficiency Motor 10 HP 1800 RPM TEFC	10.0	89.5%	86.3%	91.7%	2,364	0.30
Existing Efficiency Motor 15 HP 1800 RPM TEFC	15.0	91.0%	87.2%	92.4%	3,354	0.42
Existing Efficiency Motor 20 HP 1800 RPM TEFC	20.0	91.0%	88.1%	93.0%	4,144	0.52
Existing Efficiency Motor 25 HP 1800 RPM TEFC	25.0	92.4%	88.9%	93.6%	4,892	0.62
Existing Efficiency Motor 30 HP 1800 RPM TEFC	30.0	92.4%	89.4%	93.6%	5,217	0.66
Existing Efficiency Motor 40 HP 1800 RPM TEFC	40.0	93.0%	89.7%	94.1%	7,224	0.91
Existing Efficiency Motor 50 HP 1800 RPM TEFC	50.0	93.0%	89.9%	94.5%	9,379	1.18
Existing Efficiency Motor 60 HP 1800 RPM TEFC	60.0	93.6%	90.4%	95.0%	11,134	1.40
Existing Efficiency Motor 75 HP 1800 RPM TEFC	75.0	94.1%	90.9%	95.4%	13,483	1.70
Existing Efficiency Motor 100 HP 1800 RPM TEFC	100.0	94.5%	90.9%	95.4%	17,978	2.26
Existing Efficiency Motor 125 HP 1800 RPM TEFC	125.0	94.5%	91.3%	95.4%	20,385	2.57
Existing Efficiency Motor 150 HP 1800 RPM TEFC	150.0	95.0%	91.7%	95.8%	24,253	3.06
Existing Efficiency Motor 200 HP 1800 RPM TEFC	200.0	95.0%	92.5%	96.2%	28,810	3.63
Existing Efficiency Motor 1 HP 3600 RPM TEFC	1.0	75.5%	76.3%	77.0%	41	0.01
Existing Efficiency Motor 1.5 HP 3600 RPM TEFC	1.5	82.5%	77.4%	84.0%	528	0.07
Existing Efficiency Motor 2 HP 3600 RPM TEFC	2.0	84.0%	78.5%	85.5%	723	0.09
Existing Efficiency Motor 3 HP 3600 RPM TEFC	3.0	85.5%	80.6%	86.5%	880	0.11
Existing Efficiency Motor 5 HP 3600 RPM TEFC	5.0	87.5%	83.2%	88.5%	1,247	0.16
Existing Efficiency Motor 7.5 HP 3600 RPM TEFC	7.5	88.5%	85.3%	89.5%	1,429	0.18
Existing Efficiency Motor 10 HP 3600 RPM TEFC	10.0	89.5%	86.3%	90.2%	1,736	0.22
Existing Efficiency Motor 15 HP 3600 RPM TEFC	15.0	90.2%	87.2%	91.0%	2,489	0.31
Existing Efficiency Motor 20 HP 3600 RPM TEFC	20.0	90.2%	88.1%	91.0%	2,506	0.32
Existing Efficiency Motor 25 HP 3600 RPM TEFC	25.0	91.0%	88.9%	91.7%	2,975	0.37
Existing Efficiency Motor 30 HP 3600 RPM TEFC	30.0	91.0%	89.4%	91.7%	2,916	0.37
Existing Efficiency Motor 40 HP 3600 RPM TEFC	40.0	91.7%	89.7%	92.4%	4,514	0.57
Existing Efficiency Motor 50 HP 3600 RPM TEFC	50.0	92.4%	89.9%	93.0%	6,423	0.81
Existing Efficiency Motor 60 HP 3600 RPM TEFC	60.0	93.0%	90.4%	93.6%	7,861	0.99
Existing Efficiency Motor 75 HP 3600 RPM TEFC	75.0	93.0%	90.9%	93.6%	8,245	1.04
Existing Efficiency Motor 100 HP 3600 RPM TEFC	100.0	93.6%	90.9%	94.1%	12,961	1.63
Existing Efficiency Motor 125 HP 3600 RPM TEFC	125.0	94.5%	91.3%	95.0%	18,473	2.33
Existing Efficiency Motor 150 HP 3600 RPM TEFC	150.0	94.5%	91.7%	95.0%	19,685	2.48

Existing Efficiency Motor 200 HP 3600 RPM TEFC	200.0	95.0%	92.5%	95.4%	22,770	2.87

Electric Split System - Montana

Energy Savings	**kwh/yr**	**Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**
Office		**Choose Building Type from Drop-Down Menu to the left**

If the size of the unit in kBtu is unknown, please enter the size of the unit in tons in the space below

1	Unit Size in Tons
12	**Unit Size in kBtu/hr**

Calculator

AC Size (kBtu/hr)	120	
SEER or EER	11.2	**For 5.5 ton units or less, use SEER Value. For over 5.5 use EER value**
Savings (kwh/yr)	**1,593**	

Electrical Energy Savings (kWh/yr) = (kBtu/hr_cool) x [(1/EER_base - 1/EER_EE)] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (kBtu/hr_cool) x [1/EER_base - 1/EER_EE] x CF

Where:

kBtu/hr_cool	= nominal rating of the equipment cooling capacity
EER_EE	= energy efficiency ratio of the baseline equipment (Btuh/W)
EER_base	= energy efficiency ratio of the high efficiency equipment (Btuh/W)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
CF	= Stipulated coincident demand factor, equal to 0.90. (4)

Source: MN OES Deemed Savings Database

Electric Rooftop Units Table

Energy Savings kwh/yr — **Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**

Education - Community College — **Choose Building Type from Drop-Down Menu to the left**

If the size of the unit in kBtu is unknown, please enter the size of the unit in tons in the space below

1	Unit Size in Tons
12	**Unit Size in kBtu/hr**

Calculator

AC Size (kBtu/hr)	100	
EER/SEER	14.5	**For 5.5 ton units or less, use SEER Value. For over 5.5 use EER value**
Savings (kwh/yr)	**1,749**	

Electrical Energy Savings (kWh/yr) = (kBtu/hr_cool) x [(1/EER_EE - 1/EER_base)] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (kBtu/hr_cool) x [(1/EER_EE - 1/EER_base)] x CF

Where:

kBtu/hr_cool	= the nominal rating of the cooling capacity of the rooftop unit
EER_base	= energy efficiency ratio of the baseline equipment (Btu/W-hr)
EER_EE	= energy efficiency ratio of the high efficiency equipment (Btu/W-hr)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
Oversize Factor_heat	= the oversize factor of the heating equipment, assumed to be 0.65
CF	= Stipulated coincident demand factor, equal to 0.90. (3)

Source: MN OES Deemed Savings Database

Electric Air Cooled Chillers - Montana

Education - Community College **Choose Building Type from Drop-Down Menu to the left**

Calculator

AC Size (Tons)	50
IPLV	1.15
Savings (kwh/yr)	**3023**
FLV	1.23
Reduction (kw)	**4.95**

Everything from here down is used for the tables only

Energy Savings **kwh/yr** **Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**

Electrical Energy Savings (kWh/yr) = (Capacity) x [IPLV_base - IPLV_EE] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (Capacity) x [(Eff_base - Eff_EE)] x CF

Where:

Capacity	= the nominal rating of equipment cooling capacity (tons)
IPLV_EE	= the integrated part load ratio of the energy efficiency equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 4)
IPLV_base	= the integrated part load ratio of the baseline equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 3)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
Eff_base	= the full load efficiency of the baseline chiller (kW/ton)
Eff_EE	= the full load efficiency of the energy efficient chiller (kW/ton)
CF	= Stipulated coincident demand factor, equal to 0.90 (4)

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - Montana

Education - Community College **Choose Building Type from Drop-Down Menu to the left**

Calculator

AC Size (Tons)	150
IPLV	0.534
Savings (kwh/yr)	**5805**
FLV	0.59
Reduction (kw)	**33.75**

Everything from here down is used for the tables only

Demand Reduction **kw** **Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**

Electrical Energy Savings (kWh/yr) = (Capacity) x [IPLV_base - IPLV_EE] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (Capacity) x [(Eff_base - Eff_EE)] x CF

Where:

Capacity	= the nominal rating of equipment cooling capacity (tons)
IPLV_EE	= the integrated part load ratio of the energy efficiency equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 4)
IPLV_base	= the integrated part load ratio of the baseline equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 3)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
Eff_base	= the full load efficiency of the baseline chiller (kW/ton)
Eff_EE	= the full load efficiency of the energy efficient chiller (kW/ton)
CF	= Stipulated coincident demand factor, equal to 0.90 (4)

Source: MN OES Deemed Savings Database

Electric VFDs - Montana

Calculator

Motor Size (HP)	25
Total Hours Of Operation	3621

% Speed	% Hours	kwh usage at speed
10%	0%	0
20%	0%	0
30%	0%	0
40%	5%	216
50%	5%	422
60%	15%	2,188
70%	15%	3,475
80%	50%	17,288
90%	5%	2,462
100%	5%	3,377

Total Percentage of Hours Used 100.0%

Usage Before VFD	50,649
Usage After VFD	29,427
Savings (kwh/yr)	**21,222**
Demand Reduction (kw)	**5.86**

Usage Before VFD = Motor_Size_(HP) * .746 * Hours_of_Operation * Load_Factor

Energy Usage at Each Speed = Motor_Size_(HP) * %_Speed^3 * .746 * %_Hours_at_Speed * Total_Hours_of_Operation

Usage After VFD = Sum of Energy Usage at each speed

Savings (kwh/yr) = Usage_Before_VFD - Usage_After_VFD

Demand Reduction (kw) = Savings_(kwh/yr) / Total_Hours_of_Operation

Notes - Montana

For Adjustments for Heating Degree Days:

Billings - Population 89847 - 6930 HDD - 85% Weight
Miles City: Population 8487 - 7618 HDD - 5% Weight
Sidney: Population 4774 - 8455 HDD - 5% Weight
Glendive: Population 4729 - 7906 HDD - 5% Weight
Total HDD = (6930*85%)+(7618*5%)+(8455*5%)+(7906*5%) = **7090 HDD**
Minneapolis HDD = **7981 HDD**

For Adjustments for Cooling Degree Days:

Miles City: Population 8487 - 748 CDD - 50% Weight
Sidney: Population 4774 - 447 CDD - 25% Weight
Glendive: Population 4729 - 721 CDD - 25% Weight
Total CDD = (748*50%)+(447*25%)+(721*25%) = **666 CDD**
Minneapolis CDD = **682 CDD**

Electric Centrifugal Chillers - North Dakota

Energy Savings kwh/yr — **Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**

Replacement — **Choose Replacement or New from Drop-Down Menu to the left**

Calculator

AC Size (Tons)	2
SEER	16
Savings (kwh/yr)	**731.7**

AC Size (Tonnes)	SEER 14.5	SEER 15.0	SEER 15.5	SEER 16.0	SEER 16.5	SEER 17.0	SEER 17.5	SEER 18.0	SEER 18.5	SEER 19.0	SEER 19.5	SEER 20.0
1.0	302.754	325.180	346.159	365.827	384.303	401.693	418.088	433.573	448.221	462.098	475.263	487.770
1.5	454.130	487.770	519.239	548.741	576.455	602.539	627.133	650.360	672.331	693.147	712.894	731.655
2.0	605.507	650.360	692.318	731.655	768.607	803.386	836.177	867.146	896.442	924.195	950.526	975.540
2.5	756.884	812.950	865.398	914.568	960.759	1004.232	1045.221	1083.933	1120.552	1155.244	1188.157	1219.424
3.0	908.261	975.540	1038.478	1097.482	1152.910	1205.078	1254.265	1300.719	1344.663	1386.293	1425.789	1463.309
3.5	1059.638	1138.129	1211.557	1280.396	1345.062	1405.925	1463.309	1517.506	1568.773	1617.342	1663.420	1707.194
4.0	1211.015	1300.719	1384.637	1463.309	1537.214	1606.771	1672.354	1734.293	1792.884	1848.391	1901.051	1951.079
4.5	1362.391	1463.309	1557.716	1646.223	1729.366	1807.617	1881.398	1951.079	2016.994	2079.440	2138.683	2194.964
5.0	1513.768	1625.899	1730.796	1829.137	1921.517	2008.464	2090.442	2167.866	2241.104	2310.488	2376.314	2438.849
5.5	1665.145	1788.489	1903.876	2012.050	2113.669	2209.310	2299.486	2384.652	2465.215	2541.537	2613.946	2682.734

Annual Savings = (Heating_Load_Hours * (12/Initial_SEER - 12/New_SEER)/(1-Non_Quality_Installation_Loss_Factor))*Size_of_Unit

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - North Dakota

Energy Savings per Tune-up

Energy Savings (kwh/yr)	113

Demand Reduction per Tune-up

Demand Reduction (kw)	0.18

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - North Dakota

Calculator

Through-Wall Unit		Choose Unit Type from Drop-Down Menu to the left
AC Size (BTU)	12,000	Select Unit Size from Drop-Down Menu to the left
Savings (kwh/yr)	76	
Demand Reduction (k	0.12	

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - North Dakota

Total Energy Savings (kwh/yr)	**989**					
Total Demand Reduction (kw)	**0.76**					
Calculator - Lightbulbs		**Coincident factor**				
Energy Saved per CFL Lightbulb (kwh/yr)	37.8					
Demand Reduction per CFL Lighbulb (kw)	0.0036		**summer**	**Winter**		
Number of CFL Lightbulbs	10		**Net KW**	**Net kW**	**Summer kWH**	**Winter kWh**
Total Energy Savings (kwh/yr)	**378**				126	252
Total Demand Reduction (kw)	**0.036**	0.08	0.00288	0.00288		
Calculator - AC						
AC Size (Tons)	3					
SEER	14.5					
Savings (kwh/yr)	**233**				233	-
Reduction (kw)	**0.69**	0.9	0.621012091	0		
Dishwasher						
Energy Savings (kwh/yr)	**137**				46	91
Demand Reduction (kw)	**0**					
Washer						
Energy Savings (kwh/yr)	**158**				53	105
Demand Reduction (kw)	**0.0215**	0.35	0.007525	0.007525		
Refrigerator						
Energy Savings (kwh/yr)	**83**				28	55
Demand Reduction (kw)	**0.009**	0.35	0.00315	0.00315		
			0.63	**0.003**	**485**	**504**

Electric Centrifugal Chillers - North Dakota

Heating Savings

	Efficiency	kWh	Connected	Peak	Off-Peak
Standard Resistance Heating w/heatpump	1.31	18,732	38.4	38.4	38.4
ETS Heating Uncontrolled AHSP operation	1.74	13,990	38.4	3.6	38.4
Savings		4,742	-	35	-

As Per Steffes Manufacturing

Electric Centrifugal Chillers - North Dakota

Lighting (will be customer Specific)

Rebate Level	$0.40	per wattt
Cost per Fixture	$50.00	
Average Fixtures / participant	100	
Hrs per yer	2,500	
Total kWh Saved	18,500	
Total kW Saved	7.4	

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Program: Lighting Efficiency

Prescriptive rebates will be offered for replacement lighting equipment. New Construction rebates will be offered for new facilities or spaces overhauled for a new purpose.
Custom rebates are available for lighting-related improvements that are not prescriptive.

Algorithms:

Electrical Demand Savings (Customer kW)	= (kW_Base - kW_EE) x HVAC_cooling_kWsavings_factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Base - kW_EE) x Hrs x HVAC_cooling_kWhsavings_factor
Natural Gas Savings (Dth)	= (kW_Base - kW_EE) x Hrs x HVAC_heating_penalty_factor
Lighting Controls -Electrical Energy Savings (Customer kWh/yr)	=(kW connected) x (1-PAF) x Hrs x HVAC_cooling_kWhsavings_factor
Lighting Controls -Electrical Demand Savings (Customer kW)	=(kW connected) x (1-PAF) x HVAC_cooling_kWsavings_factor
Lighting Controls -Natural Gas Savings (Dth)	=(kW connected) x (1-PAF) x Hrs x HVAC_heating_penalty_factor
Electrical Energy Savings (Gross Generator kWh)	= Customer kWh / (1-TDLF)
Electrical Demand Savings (Gross Generator kW)	= Customer kW x CF / (1-TDLF)
Electrical Energy Savings (Net Generator kWh)	= Gross Generator kWh x NTG
Electrical Demand Savings (Net Generator kW)	= Gross Generator kW x NTG

Variables:

Hrs	= Annual Operating Hours. Hours to be obtained from Table 2. The type of facility is to be supplied by the customer.
kW_Base	= Baseline fixture wattage (kW per fixture) determined from deemed fixture table.
kW_EE	= High Efficiency fixture wattage (kW per fixture) determined from deemed fixture table
HVAC_cooling_kWhsavings_factor	= Cooling system energy savings factor resulting from efficient lighting from Table 1. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence
HVAC_cooling_kWsavings_factor	= Cooling system demand savings factor resulting from efficient lighting from Table 1. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning to be provided by customer.
HVAC_heating_kWsavings_factor	= Heating system penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has air conditioning. A value of -0.00088738 Dth/kWh given by (Reference 4).
CF	= Coincidence Factor, the probability that peak demand of the lights will coincide with peak utility system demand. CF will be determined based on customer provided building type in table 2.
Measure Life	= Length of time the lighting equipment will be operational, see Table 6 for Measure Lifetimes
Baseline Cost	= Cost of the baseline technology. For Retrofit, the cost is 0 since the baseline is to continue to operate the existing system. For New Construction, the cost is given in the deemed fixture table. (Reference 5)
High Efficiency Cost	= Cost of the High Efficiency technology. Costs given in Deemed Fixture Table (Reference 4)
kW connected	Total connected fixture load, determined as the sum of stipulated fixture wattages from Deemed Fixture Table.
PAF	Stipulated power adjustment factor based on control type from Table 4.
TDLF	Transmission Distribution Loss Factor = 6.39%, the percentage loss of electricity as it flows from the power plant to the customer, calculated using factors from Enhanced DSM Filing SRD-2
NTG	Net-to-gross = 96% (Reference 5)
Incremental operation and maintenance cost	= Other annual savings or costs associated with the electrical savings. For Lighting, this consists of additional natural gas for heating. Methodology given by (Reference 4).

Provided by Customer:	**Verified during M&V:**
Number of Fixtures	Yes
Lighting equipment type	Yes
Building type	Yes
Existence of air conditioning	Yes

Assumptions:
- Each replacement lighting fixture is going in on a one-for-one basis for existing fixtures. New construction fixtures are put in on a one-for-one basis instead of lower efficiency options.

- In the Technical Assumptions, one will note that the Operating Hours does not appear, but rather a modified version. The methodology defines kW Savings on the basis of difference in kW with the HVAC Cooling demand factor. The Annual Energy Savings takes into account any heating that has to be added.

Table 1: HVAC Interactive Factors (Reference 2)

HVAC system	HVAC_cooling_kWhsavings_factor	HVAC_cooling_kW savings_factor
Heating only	1.00	1.00
Heating and cooling	1.11	1.33

Table 2: Coincident Peak Demand Factors and Annual Operating Hours by Building Type (Reference 1 and 3)

Building Type	CF	Annual Operating Hours
Office	78%	3435
Restaurant	94%	4156
Retail	94%	3068
Grocery/Supermarket	94%	4612
Warehouse	96%	2388
Elemen./Second. School	73%	2080
College	71%	5010
Health	84%	3392
Hospital	84%	4532
Hotel/Motel	51%	2697
Manufacturing	96%	5913
Other/Misc.	96%	2278
24-Hour Facility	94%	8234
Safety or Code Required	100%	8760

Table 3: Measure Lifetimes in Years (Reference 4)

Measure	Lifetime in Years
CFL less than 19W	5
Low Wattage T8 Lamps	8
Integrated 25W Ceramic Metal Halide	7
T8 Lighting Systems	18
T5 Lighting Systems	18
Lighting Controls	18

Table 4: Stipulated Power Adjustment Factors (Reference 1 and 7)

Control Type	PAF
no controls	1.00
Occupancy Sensor - Wall Mount	0.70
Occupancy Sensor - Ceiling Mount	0.70
Daylighting - Continuous Dimming	0.57
Daylighting - Multiple Step Dimming	0.65
Daylighting - On/Off	0.73

Changes from 2008

Baseline efficiencies updated. High efficiency values updated. More measures added to program. Cost information updated from various sources. Methodology now looks at market segment rather than a single operating hours value for all participants.

References

1. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures Final Report, Nexant. CF and hours

2. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method for Minnesota, presented on page 28 of the 11/93 issue of the ASHRAE Journal - "Calculating lighting and HVAC interactions".
3. Technical Reference User Manual No. 2004-31, Efficiency Vermont, 12/31/04. CF and Hours
4. Deemed Savings Database, Minnesota Office of Energy Security, 2008. CF, Hours, kW, Costs, Measure life
5. Net-to-Gross factor from National Energy Efficiency Best Practices Study(http://www.eebestpractices.com)
6. Lighting Efficiency input wattage guide, Xcel Energy, July, 2008, kW
7. CL&P and UI program Savings Documentation modified for 3022 Daylight Hours in Denver CO

Electric Centrifugal Chillers - North Dakota

College/Univ HVAC Pump Retrofit

Choose Motor Type from Drop-Down Menu to the left
Choose Motor Type from Drop-Down Menu to the left

Electrical Energy Savings (kWh / yr) = HP x LF x Conversion x (1/Standard_Eff - 1/ High_Eff) x Hrs

Electrical Demand Savings (kW) = HP x LF x Conversion x (1/Standard_Eff - 1/ High_Eff) x Coincidence Factor

Where:

Hrs = Annual operational hours per year of the motor; if site specific hours are not available, stipulated annual operating hours by building in Table 2 and Table 3 are used.

LF = Motor load factor as percentage (0 - 100); if motor specific load factor is not available, use default 75% load factor.

HP = Rated motor horsepower.

High_Eff = Efficiency of high efficiency replacement motor as percentage (0 - 100); use efficiency of 'Premium Efficiency Motor' for motor size and type (TEFC or ODP) as specified in Table 1 unless motor is specified otherwise.

Standard_Eff = Efficiency of standard replacement motor (0 - 100) ; use efficiency of 'Existing Efficiency Motor' for motor size, speed, and type (TEFC or ODP) as specified in Table 1, unless motor is specified otherwise.

Conversion = .746 (1 HP = .746 kW)

Coincidence Factor = 0.78

Unit Size (Tons)	Motor Size (HP)	Replacement Standard Efficiency (%)	Retrofit Standard Efficiency (%)	High Efficiency (%)	Energy Savings kwh/yr	Demand Reduction kw
Existing Efficiency Motor 1 HP 1200 RPM ODP	1.0	80.0%	76.3%	82.5%	200.65	0.04298
Existing Efficiency Motor 1.5 HP 1200 RPM ODP	1.5	84.0%	77.4%	86.5%	415.33	0.08898
Existing Efficiency Motor 2 HP 1200 RPM ODP	2.0	85.5%	78.5%	87.5%	533.85	0.11436
Existing Efficiency Motor 3 HP 1200 RPM ODP	3.0	86.5%	80.6%	88.5%	676.85	0.14500
Existing Efficiency Motor 5 HP 1200 RPM ODP	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1200 RPM ODP	7.5	88.5%	85.3%	90.2%	973.02	0.20845
Existing Efficiency Motor 10 HP 1200 RPM ODP	10.0	90.2%	86.3%	91.7%	1,390.06	0.29779
Existing Efficiency Motor 15 HP 1200 RPM ODP	15.0	90.2%	87.2%	91.7%	1,719.64	0.36839
Existing Efficiency Motor 20 HP 1200 RPM ODP	20.0	91.0%	88.1%	92.4%	2,152.14	0.46105
Existing Efficiency Motor 25 HP 1200 RPM ODP	25.0	91.7%	88.9%	93.0%	2,525.57	0.54105
Existing Efficiency Motor 30 HP 1200 RPM ODP	30.0	92.4%	89.4%	93.6%	3,067.45	0.65713
Existing Efficiency Motor 40 HP 1200 RPM ODP	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1200 RPM ODP	50.0	93.0%	89.9%	94.1%	5,056.97	1.08334
Existing Efficiency Motor 60 HP 1200 RPM ODP	60.0	93.6%	90.4%	94.5%	5,866.18	1.25669
Existing Efficiency Motor 75 HP 1200 RPM ODP	75.0	93.6%	90.9%	94.5%	6,403.08	1.37171
Existing Efficiency Motor 100 HP 1200 RPM ODP	100.0	94.1%	90.9%	95.0%	9,672.02	2.07201
Existing Efficiency Motor 125 HP 1200 RPM ODP	125.0	94.1%	91.3%	95.0%	10,862.71	2.32708
Existing Efficiency Motor 150 HP 1200 RPM ODP	150.0	94.5%	91.7%	95.4%	12,923.97	2.76866
Existing Efficiency Motor 200 HP 1200 RPM ODP	200.0	94.5%	92.5%	95.4%	13,389.32	2.86835
Existing Efficiency Motor 1 HP 1800 RPM ODP	1.0	82.5%	76.3%	85.5%	287.29	0.06154
Existing Efficiency Motor 1.5 HP 1800 RPM ODP	1.5	84.0%	77.4%	86.5%	415.33	0.08898
Existing Efficiency Motor 2 HP 1800 RPM ODP	2.0	84.0%	78.5%	86.5%	480.02	0.10283
Existing Efficiency Motor 3 HP 1800 RPM ODP	3.0	86.5%	80.6%	89.5%	754.00	0.16153
Existing Efficiency Motor 5 HP 1800 RPM ODP	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1800 RPM ODP	7.5	88.5%	85.3%	91.0%	1,121.93	0.24035
Existing Efficiency Motor 10 HP 1800 RPM ODP	10.0	89.5%	86.3%	91.7%	1,390.06	0.29779
Existing Efficiency Motor 15 HP 1800 RPM ODP	15.0	91.0%	87.2%	93.0%	2,185.45	0.46818
Existing Efficiency Motor 20 HP 1800 RPM ODP	20.0	91.0%	88.1%	93.0%	2,436.62	0.52199
Existing Efficiency Motor 25 HP 1800 RPM ODP	25.0	91.7%	88.9%	93.6%	2,876.61	0.61625
Existing Efficiency Motor 30 HP 1800 RPM ODP	30.0	92.4%	89.4%	94.1%	3,414.39	0.73145
Existing Efficiency Motor 40 HP 1800 RPM ODP	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1800 RPM ODP	50.0	93.0%	89.9%	94.5%	5,515.15	1.18149
Existing Efficiency Motor 60 HP 1800 RPM ODP	60.0	93.6%	90.4%	95.0%	6,546.93	1.40253
Existing Efficiency Motor 75 HP 1800 RPM ODP	75.0	94.1%	90.9%	95.0%	7,254.01	1.55400
Existing Efficiency Motor 100 HP 1800 RPM ODP	100.0	94.1%	90.9%	95.4%	10,571.12	2.26462
Existing Efficiency Motor 125 HP 1800 RPM ODP	125.0	94.5%	91.3%	95.4%	11,986.59	2.56785
Existing Efficiency Motor 150 HP 1800 RPM ODP	150.0	95.0%	91.7%	95.8%	14,261.36	3.05517
Existing Efficiency Motor 200 HP 1800 RPM ODP	200.0	95.0%	92.5%	95.8%	15,172.51	3.25036
Existing Efficiency Motor 1 HP 3600 RPM ODP	1.0	N/A	76.3%	77.0%	24.27	0.00520
Existing Efficiency Motor 1.5 HP 3600 RPM ODP	1.5	82.5%	77.4%	84.0%	310.20	0.06645
Existing Efficiency Motor 2 HP 3600 RPM ODP	2.0	84.0%	78.5%	85.5%	424.93	0.09103
Existing Efficiency Motor 3 HP 3600 RPM ODP	3.0	84.0%	80.6%	85.5%	434.55	0.09309
Existing Efficiency Motor 5 HP 3600 RPM ODP	5.0	85.5%	83.2%	86.5%	467.05	0.10006
Existing Efficiency Motor 7.5 HP 3600 RPM ODP	7.5	87.5%	85.3%	88.5%	647.65	0.13874
Existing Efficiency Motor 10 HP 3600 RPM ODP	10.0	88.5%	86.3%	89.5%	843.99	0.18081
Existing Efficiency Motor 15 HP 3600 RPM ODP	15.0	89.5%	87.2%	90.2%	1,165.49	0.24968

Existing Efficiency Motor 20 HP 3600 RPM ODP	20.0	90.2%	88.1%	91.0%	1,473.78	0.31572
Existing Efficiency Motor 25 HP 3600 RPM ODP	25.0	91.0%	88.9%	91.7%	1,749.23	0.37473
Existing Efficiency Motor 30 HP 3600 RPM ODP	30.0	91.0%	89.4%	91.7%	1,714.60	0.36731
Existing Efficiency Motor 40 HP 3600 RPM ODP	40.0	91.7%	89.7%	92.4%	2,654.48	0.56866
Existing Efficiency Motor 50 HP 3600 RPM ODP	50.0	92.4%	89.9%	93.0%	3,776.68	0.80907
Existing Efficiency Motor 60 HP 3600 RPM ODP	60.0	93.0%	90.4%	93.6%	4,622.51	0.99027
Existing Efficiency Motor 75 HP 3600 RPM ODP	75.0	93.0%	90.9%	93.6%	4,848.49	1.03868
Existing Efficiency Motor 100 HP 3600 RPM ODP	100.0	93.0%	90.9%	93.6%	6,464.65	1.38490
Existing Efficiency Motor 125 HP 3600 RPM ODP	125.0	93.6%	91.3%	94.1%	8,299.05	1.77788
Existing Efficiency Motor 150 HP 3600 RPM ODP	150.0	93.6%	91.7%	94.1%	8,498.93	1.82070
Existing Efficiency Motor 200 HP 3600 RPM ODP	200.0	94.5%	92.5%	95.0%	11,591.12	2.48313
Existing Efficiency Motor 1 HP 1200 RPM TEFC	1.0	80.0%	76.3%	82.5%	200.65	0.04298
Existing Efficiency Motor 1.5 HP 1200 RPM TEFC	1.5	85.5%	77.4%	87.5%	455.71	0.09762
Existing Efficiency Motor 2 HP 1200 RPM TEFC	2.0	86.5%	78.5%	88.5%	586.46	0.12564
Existing Efficiency Motor 3 HP 1200 RPM TEFC	3.0	87.5%	80.6%	89.5%	754.00	0.16153
Existing Efficiency Motor 5 HP 1200 RPM TEFC	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1200 RPM TEFC	7.5	89.5%	85.3%	91.0%	1,121.93	0.24035
Existing Efficiency Motor 10 HP 1200 RPM TEFC	10.0	89.5%	86.3%	91.0%	1,219.18	0.26118
Existing Efficiency Motor 15 HP 1200 RPM TEFC	15.0	90.2%	87.2%	91.7%	1,719.64	0.36839
Existing Efficiency Motor 20 HP 1200 RPM TEFC	20.0	90.2%	88.1%	91.7%	1,815.55	0.38894
Existing Efficiency Motor 25 HP 1200 RPM TEFC	25.0	91.7%	88.9%	93.0%	2,525.57	0.54105
Existing Efficiency Motor 30 HP 1200 RPM TEFC	30.0	91.7%	89.4%	93.0%	2,646.21	0.56689
Existing Efficiency Motor 40 HP 1200 RPM TEFC	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1200 RPM TEFC	50.0	93.0%	89.9%	94.1%	5,056.97	1.08334
Existing Efficiency Motor 60 HP 1200 RPM TEFC	60.0	93.6%	90.4%	94.5%	5,866.18	1.25669
Existing Efficiency Motor 75 HP 1200 RPM TEFC	75.0	93.6%	90.9%	94.5%	6,403.08	1.37171
Existing Efficiency Motor 100 HP 1200 RPM TEFC	100.0	94.1%	90.9%	95.0%	9,672.02	2.07201
Existing Efficiency Motor 125 HP 1200 RPM TEFC	125.0	94.1%	91.3%	95.0%	10,862.71	2.32708
Existing Efficiency Motor 150 HP 1200 RPM TEFC	150.0	95.0%	91.7%	95.8%	14,261.36	3.05517
Existing Efficiency Motor 200 HP 1200 RPM TEFC	200.0	95.0%	92.5%	95.8%	15,172.51	3.25036
Existing Efficiency Motor 1 HP 1800 RPM TEFC	1.0	82.5%	76.3%	85.5%	287.29	0.06154
Existing Efficiency Motor 1.5 HP 1800 RPM TEFC	1.5	84.0%	77.4%	86.5%	415.33	0.08898
Existing Efficiency Motor 2 HP 1800 RPM TEFC	2.0	84.0%	78.5%	86.5%	480.02	0.10283
Existing Efficiency Motor 3 HP 1800 RPM TEFC	3.0	87.5%	80.6%	89.5%	754.00	0.16153
Existing Efficiency Motor 5 HP 1800 RPM TEFC	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1800 RPM TEFC	7.5	89.5%	85.3%	91.7%	1,250.10	0.26780
Existing Efficiency Motor 10 HP 1800 RPM TEFC	10.0	89.5%	86.3%	91.7%	1,390.06	0.29779
Existing Efficiency Motor 15 HP 1800 RPM TEFC	15.0	91.0%	87.2%	92.4%	1,972.09	0.42247
Existing Efficiency Motor 20 HP 1800 RPM TEFC	20.0	91.0%	88.1%	93.0%	2,436.62	0.52199
Existing Efficiency Motor 25 HP 1800 RPM TEFC	25.0	92.4%	88.9%	93.6%	2,876.61	0.61625
Existing Efficiency Motor 30 HP 1800 RPM TEFC	30.0	92.4%	89.4%	93.6%	3,067.45	0.65713
Existing Efficiency Motor 40 HP 1800 RPM TEFC	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1800 RPM TEFC	50.0	93.0%	89.9%	94.5%	5,515.15	1.18149
Existing Efficiency Motor 60 HP 1800 RPM TEFC	60.0	93.6%	90.4%	95.0%	6,546.93	1.40253
Existing Efficiency Motor 75 HP 1800 RPM TEFC	75.0	94.1%	90.9%	95.4%	7,928.34	1.69846
Existing Efficiency Motor 100 HP 1800 RPM TEFC	100.0	94.5%	90.9%	95.4%	10,571.12	2.26462
Existing Efficiency Motor 125 HP 1800 RPM TEFC	125.0	94.5%	91.3%	95.4%	11,986.59	2.56785
Existing Efficiency Motor 150 HP 1800 RPM TEFC	150.0	95.0%	91.7%	95.8%	14,261.36	3.05517
Existing Efficiency Motor 200 HP 1800 RPM TEFC	200.0	95.0%	92.5%	96.2%	16,940.87	3.62919
Existing Efficiency Motor 1 HP 3600 RPM TEFC	1.0	75.5%	76.3%	77.0%	24.27	0.00520
Existing Efficiency Motor 1.5 HP 3600 RPM TEFC	1.5	82.5%	77.4%	84.0%	310.20	0.06645
Existing Efficiency Motor 2 HP 3600 RPM TEFC	2.0	84.0%	78.5%	85.5%	424.93	0.09103
Existing Efficiency Motor 3 HP 3600 RPM TEFC	3.0	85.5%	80.6%	86.5%	517.18	0.11079
Existing Efficiency Motor 5 HP 3600 RPM TEFC	5.0	87.5%	83.2%	88.5%	733.16	0.15706
Existing Efficiency Motor 7.5 HP 3600 RPM TEFC	7.5	88.5%	85.3%	89.5%	840.54	0.18007
Existing Efficiency Motor 10 HP 3600 RPM TEFC	10.0	89.5%	86.3%	90.2%	1,020.63	0.21865
Existing Efficiency Motor 15 HP 3600 RPM TEFC	15.0	90.2%	87.2%	91.0%	1,463.31	0.31348
Existing Efficiency Motor 20 HP 3600 RPM TEFC	20.0	90.2%	88.1%	91.0%	1,473.78	0.31572
Existing Efficiency Motor 25 HP 3600 RPM TEFC	25.0	91.0%	88.9%	91.7%	1,749.23	0.37473
Existing Efficiency Motor 30 HP 3600 RPM TEFC	30.0	91.0%	89.4%	91.7%	1,714.60	0.36731
Existing Efficiency Motor 40 HP 3600 RPM TEFC	40.0	91.7%	89.7%	92.4%	2,654.48	0.56866
Existing Efficiency Motor 50 HP 3600 RPM TEFC	50.0	92.4%	89.9%	93.0%	3,776.68	0.80907
Existing Efficiency Motor 60 HP 3600 RPM TEFC	60.0	93.0%	90.4%	93.6%	4,622.51	0.99027
Existing Efficiency Motor 75 HP 3600 RPM TEFC	75.0	93.0%	90.9%	93.6%	4,848.49	1.03868
Existing Efficiency Motor 100 HP 3600 RPM TEFC	100.0	93.6%	90.9%	94.1%	7,621.09	1.63264
Existing Efficiency Motor 125 HP 3600 RPM TEFC	125.0	94.5%	91.3%	95.0%	10,862.71	2.32708
Existing Efficiency Motor 150 HP 3600 RPM TEFC	150.0	94.5%	91.7%	95.0%	11,575.32	2.47974
Existing Efficiency Motor 200 HP 3600 RPM TEFC	200.0	95.0%	92.5%	95.4%	13,389.32	2.86835

Electric Centrifugal Chillers - North Dakota

Calculator

Motor Size (HP)	25
Total Hours Of Operation	4000

% Speed	% Hours	kwh usage at speed
10%	0%	0
20%	0%	0
30%	0%	0
40%	50%	2,387
50%	0%	0
60%	0%	0
70%	0%	0
80%	50%	19,098
90%	0%	0
100%	0%	0

Total Percentage of Hours Used 100.0%

Usage Before VFD	55,950
Usage After VFD	21,485
Savings (kwh/yr)	**34,465**
Demand Reduction (kw)	**8.62**

Usage Before VFD = Motor_Size_(HP) * .746 * Hours_of_Operation * Load_Factor

Energy Usage at Each Speed = Motor_Size_(HP) * %_Speed^3 * .746 * %_Hours_at_Speed * Total_Hours_of_Operation

Usage After VFD = Sum of Energy Usage at each speed

Savings (kwh/yr) = Usage_Before_VFD - Usage_After_VFD

Demand Reduction (kw) = Savings_(kwh/yr) / Total_Hours_of_Operation

Electric Centrifugal Chillers - North Dakota

Energy Savings	**kwh/yr**	**Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**
Office		**Choose Building Type from Drop-Down Menu to the left**

If the size of the unit in kBtu is unknown, please enter the size of the unit in tons in the space below

1	Unit Size in Tons
12	**Unit Size in kBtu/hr**

Calculator

AC Size (kBtu/hr)	120	
SEER or EER	11.2	**For 5.5 ton units or less, use SEER Value. For over 5.5 use EER value**
Savings (kwh/yr)	**1,593**	

Electrical Energy Savings (kWh/yr) = (kBtu/hr_cool) x [(1/EER_base - 1/EER_EE)] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (kBtu/hr_cool) x [1/EER_base - 1/EER_EE] x CF

Where:

kBtu/hr_cool	= nominal rating of the equipment cooling capacity
EER_EE	= energy efficiency ratio of the baseline equipment (Btuh/W)
EER_base	= energy efficiency ratio of the high efficiency equipment (Btuh/W)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
CF	= Stipulated coincident demand factor, equal to 0.90. (4)

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - North Dakota

Energy Savings	**kwh/yr**	**Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**
Education - Community College		**Choose Building Type from Drop-Down Menu to the left**

If the size of the unit in kBtu is unknown, please enter the size of the unit in tons in the space below

1	Unit Size in Tons
12	**Unit Size in kBtu/hr**

Calculator

AC Size (kBtu/hr)	100	
EER/SEER	14.5	**For 5.5 ton units or less, use SEER Value. For over 5.5 use EER value**
Savings (kwh/yr)	**1,749**	

Electrical Energy Savings (kWh/yr) = (kBtu/hr_cool) x [(1/EER_EE - 1/EER_base)] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (kBtu/hr_cool) x [(1/EER_EE - 1/EER_base)] x CF

Where:

kBtu/hr_cool	= the nominal rating of the cooling capacity of the rooftop unit
EER_base	= energy efficiency ratio of the baseline equipment (Btu/W-hr)
EER_EE	= energy efficiency ratio of the high efficiency equipment (Btu/W-hr)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
CF	= Stipulated coincident demand factor, equal to 0.90. (3)

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - North Dakota

Education - Community College

Choose Building Type from Drop-Down Menu to the left

Calculator

AC Size (Tons)	50
IPLV	1.15
Savings (kwh/yr)	**3023**
FLV	1.23
Reduction (kw)	**4.95**

Everything from here down is used for the tables only

Energy Savings **kwh/yr**

Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left

Electrical Energy Savings (kWh/yr) = (Capacity) x [IPLV_base - IPLV_EE] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (Capacity) x [(Eff_base - Eff_EE)] x CF

Where:

Capacity	= the nominal rating of equipment cooling capacity (tons)
IPLV_EE	= the integrated part load ratio of the energy efficiency equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 4)
IPLV_base	= the integrated part load ratio of the baseline equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 3)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
Eff_base	= the full load efficiency of the baseline chiller (kW/ton)
Eff_EE	= the full load efficiency of the energy efficient chiller (kW/ton)
CF	= Stipulated coincident demand factor, equal to 0.90 (4)

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - North Dakota

Education - Community College **Choose Building Type from Drop-Down Menu to the left**

Calculator

AC Size (Tons)	150
IPLV	0.534
Savings (kwh/yr)	**5805**
FLV	0.59
Reduction (kw)	**33.75**

Everything from here down is used for the tables only

Demand Reduction **kw** **Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**

Electrical Energy Savings (kWh/yr) = (Capacity) x [IPLV_base - IPLV_EE] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (Capacity) x [(Eff_base - Eff_EE)] x CF

Where:

Capacity	= the nominal rating of equipment cooling capacity (tons)
IPLV_EE	= the integrated part load ratio of the energy efficiency equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 4)
IPLV_base	= the integrated part load ratio of the baseline equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 3)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
Eff_base	= the full load efficiency of the baseline chiller (kW/ton)
Eff_EE	= the full load efficiency of the energy efficient chiller (kW/ton)
CF	= Stipulated coincident demand factor, equal to 0.90 (4)

Source: MN OES Deemed Savings Database

Electric AC - South Dakota

Energy Savings	**kwh/yr**	**Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**
Replacement		**Choose Replacement or New from Drop-Down Menu to the left**

Calculator

AC Size (Tons)	3
SEER	16
Savings (kwh/yr)	**1,097.5**

AC Size (Tonnes)	SEER 14.5	SEER 15.0	SEER 15.5	SEER 16.0	SEER 16.5	SEER 17.0	SEER 17.5	SEER 18.0	SEER 18.5	SEER 19.0	SEER 19.5	SEER 20.0
1.0	302.754	325.180	346.159	365.827	384.303	401.693	418.088	433.573	448.221	462.098	475.263	487.770
1.5	454.130	487.770	519.239	548.741	576.455	602.539	627.133	650.360	672.331	693.147	712.894	731.655
2.0	605.507	650.360	692.318	731.655	768.607	803.386	836.177	867.146	896.442	924.195	950.526	975.540
2.5	756.884	812.950	865.398	914.568	960.759	1004.232	1045.221	1083.933	1120.552	1155.244	1188.157	1219.424
3.0	908.261	975.540	1038.478	1097.482	1152.910	1205.078	1254.265	1300.719	1344.663	1386.293	1425.789	1463.309
3.5	1059.638	1138.129	1211.557	1280.396	1345.062	1405.925	1463.309	1517.506	1568.773	1617.342	1663.420	1707.194
4.0	1211.015	1300.719	1384.637	1463.309	1537.214	1606.771	1672.354	1734.293	1792.884	1848.391	1901.051	1951.079
4.5	1362.391	1463.309	1557.716	1646.223	1729.366	1807.617	1881.398	1951.079	2016.994	2079.440	2138.683	2194.964
5.0	1513.768	1625.899	1730.796	1829.137	1921.517	2008.464	2090.442	2167.866	2241.104	2310.488	2376.314	2438.849
5.5	1665.145	1788.489	1903.876	2012.050	2113.669	2209.310	2299.486	2384.652	2465.215	2541.537	2613.946	2682.734

Annual Savings = (Heating_Load_Hours * (12/Initial_SEER - 12/New_SEER)/(1-Non_Quality_Installation_Loss_Factor))*Size_of_Unit

Electric AC Tune Up - South Dakota

Energy Savings per Tune-up

Energy Savings (kwh/yr)	113

Demand Reduction per Tune-up

Demand Reduction (kw)	0.18

Source: MN OES Deemed Savings Database

Electric AC - South Dakota

Calculator

Through-Wall Unit		Choose Unit Type from Drop-Down Menu to the left
AC Size (BTU)	12,000	Select Unit Size from Drop-Down Menu to the left
Savings (kwh/yr)	76	
Demand Reduction (k	0.12	

Source: MN OES Deemed Savings Database

New Construction Bundle - South Dakota

Total Energy Savings (kwh/yr)	**989**					
Total Demand Reduction (kw)	**0.76**					
Calculator - Lightbulbs		**Coincident factor**				
Energy Saved per CFL Lightbulb (kwh/yr)	37.8					
Demand Reduction per CFL Lighbulb (kw)	0.0036		**summer**	**Winter**		
Number of CFL Lightbulbs	10		**Net KW**	**Net kW**	**Summer kWH**	**Winter kWh**
Total Energy Savings (kwh/yr)	**378**				126	252
Total Demand Reduction (kw)	**0.036**	0.08	0.00288	0.00288		
Calculator - AC						
AC Size (Tons)	3					
SEER	14.5					
Savings (kwh/yr)	**233**				233	-
Reduction (kw)	**0.69**	0.9	0.621012091	0		
Dishwasher						
Energy Savings (kwh/yr)	**137**				46	91
Demand Reduction (kw)	**0**					
Washer						
Energy Savings (kwh/yr)	**158**				53	105
Demand Reduction (kw)	**0.0215**	0.35	0.007525	0.007525		
Refrigerator						
Energy Savings (kwh/yr)	**83**				28	55
Demand Reduction (kw)	**0.009**	0.35	0.00315	0.00315		
			0.63	**0.003**	**485**	**504**

Commercial Lighting - South Dakota

Lighting (will be customer Specific)

Rebate Level	$0.40	per wattt
Cost per Fixture	$50.00	
Average Fixtures / participant	100	
Hrs per yer	2,500	
Total kWh Saved	18,500	
Total kW Saved	7.4	

DEEMED SAVINGS TECHNICAL ASSUMPTIONS

Program: Lighting Efficiency

Prescriptive rebates will be offered for replacement lighting equipment. New Construction rebates will be offered for new facilities or spaces overhauled for a new purpose.
Custom rebates are available for lighting-related improvements that are not prescriptive.

Algorithms:

Electrical Demand Savings (Customer kW)	= (kW_Base - kW_EE) x HVAC_cooling_kWsavings_factor
Electrical Energy Savings (Customer kWh/yr)	= (kW_Base - kW_EE) x Hrs x HVAC_cooling_kWhsavings_factor
Natural Gas Savings (Dth)	= (kW_Base - kW_EE) x Hrs x HVAC_heating_penalty_factor
Lighting Controls -Electrical Energy Savings (Customer kWh/yr)	=(kW connected) x (1-PAF) x Hrs x HVAC_cooling_kWhsavings_factor
Lighting Controls -Electrical Demand Savings (Customer kW)	=(kW connected) x (1-PAF) x HVAC_cooling_kWsavings_factor
Lighting Controls -Natural Gas Savings (Dth)	=(kW connected) x (1-PAF) x Hrs x HVAC_heating_penalty_factor
Electrical Energy Savings (Gross Generator kWh)	= Customer kWh / (1-TDLF)
Electrical Demand Savings (Gross Generator kW)	= Customer kW x CF / (1-TDLF)
Electrical Energy Savings (Net Generator kWh)	= Gross Generator kWh x NTG
Electrical Demand Savings (Net Generator kW)	= Gross Generator kW x NTG

Variables:

Hrs	= Annual Operating Hours. Hours to be obtained from Table 2. The type of facility is to be supplied by the customer.
kW_Base	= Baseline fixture wattage (kW per fixture) determined from deemed fixture table.
kW_EE	= High Efficiency fixture wattage (kW per fixture) determined from deemed fixture table
HVAC_cooling_kWhsavings_factor	= Cooling system energy savings factor resulting from efficient lighting from Table 1. Reduction in lighting energy results in a reduction in cooling energy, if the customer has air conditioning. Existence
HVAC_cooling_kWsavings_factor	= Cooling system demand savings factor resulting from efficient lighting from Table 1. Reduction in lighting demand results in a reduction in cooling demand, if the customer has air conditioning. Existence of air conditioning to be provided by customer.
HVAC_heating_kWsavings_factor	= Heating system penalty factor resulting from efficient lighting. Reduction in lighting demand results in an increase in heating usage, if the customer has air conditioning. A value of -0.00088738 Dth/kWh given by (Reference 4).
CF	= Coincidence Factor, the probability that peak demand of the lights will coincide with peak utility system demand. CF will be determined based on customer provided building type in table 2.
Measure Life	= Length of time the lighting equipment will be operational, see Table 6 for Measure Lifetimes
Baseline Cost	= Cost of the baseline technology. For Retrofit, the cost is 0 since the baseline is to continue to operate the existing system. For New Construction, the cost is given in the deemed fixture table. (Reference 5)
High Efficiency Cost	= Cost of the High Efficiency technology. Costs given in Deemed Fixture Table (Reference 4)
kW connected	Total connected fixture load, determined as the sum of stipulated fixture wattages from Deemed Fixture Table.
PAF	Stipulated power adjustment factor based on control type from Table 4.
TDLF	Transmission Distribution Loss Factor = 6.39%, the percentage loss of electricity as it flows from the power plant to the customer, calculated using factors from Enhanced DSM Filing SRD-2
NTG	Net-to-gross = 96% (Reference 5)
Incremental operation and maintenance cost	= Other annual savings or costs associated with the electrical savings. For Lighting, this consists of additional natural gas for heating. Methodology given by (Reference 4).

Provided by Customer:	**Verified during M&V:**
Number of Fixtures	Yes
Lighting equipment type	Yes
Building type	Yes
Existence of air conditioning	Yes

Assumptions:
- Each replacement lighting fixture is going in on a one-for-one basis for existing fixtures. New construction fixtures are put in on a one-for-one basis instead of lower efficiency options.

- In the Technical Assumptions, one will note that the Operating Hours does not appear, but rather a modified version. The methodology defines kW Savings on the basis of difference in kW with the HVAC Cooling demand factor. The Annual Energy Savings takes into account any heating that has to be added.

Table 1: HVAC Interactive Factors (Reference 2)

HVAC system	HVAC_cooling_kWhsavings_factor	HVAC_cooling_kW savings_factor
Heating only	1.00	1.00
Heating and cooling	1.11	1.33

Table 2: Coincident Peak Demand Factors and Annual Operating Hours by Building Type (Reference 1 and 3)

Building Type	CF	Annual Operating Hours
Office	78%	3435
Restaurant	94%	4156
Retail	94%	3068
Grocery/Supermarket	94%	4612
Warehouse	96%	2388
Elemen./Second. School	73%	2080
College	71%	5010
Health	84%	3392
Hospital	84%	4532
Hotel/Motel	51%	2697
Manufacturing	96%	5913
Other/Misc.	96%	2278
24-Hour Facility	94%	8234
Safety or Code Required	100%	8760

Table 3: Measure Lifetimes in Years (Reference 4)

Measure	Lifetime in Years
CFL less than 19W	5
Low Wattage T8 Lamps	8
Integrated 25W Ceramic Metal Halide	7
T8 Lighting Systems	18
T5 Lighting Systems	18
Lighting Controls	18

Table 4: Stipulated Power Adjustment Factors (Reference 1 and 7)

Control Type	PAF
no controls	1.00
Occupancy Sensor - Wall Mount	0.70
Occupancy Sensor - Ceiling Mount	0.70
Daylighting - Continuous Dimming	0.57
Daylighting - Multiple Step Dimming	0.65
Daylighting - On/Off	0.73

Changes from 2008

Baseline efficiencies updated. High efficiency values updated. More measures added to program. Cost information updated from various sources. Methodology now looks at market segment rather than a single operating hours value for all participants.

References

1. Arkansas Deemed Savings Quick Start Program Draft Report Commercial Measures Final Report, Nexant. CF and hours

2. HVAC Interactive Factors developed based on the Rundquist Simplified HVAC Interaction Factor method for Minnesota, presented on page 28 of the 11/93 issue of the ASHRAE Journal - "Calculating lighting and HVAC interactions".
3. Technical Reference User Manual No. 2004-31, Efficiency Vermont, 12/31/04. CF and Hours
4. Deemed Savings Database, Minnesota Office of Energy Security, 2008. CF, Hours, kW, Costs, Measure life
5. Net-to-Gross factor from National Energy Efficiency Best Practices Study(http://www.eebestpractices.com)
6. Lighting Efficiency input wattage guide, Xcel Energy, July, 2008, kW
7. CL&P and UI program Savings Documentation modified for 3022 Daylight Hours in Denver CO

Electric Motors - South Dakota

College/Univ HVAC Pump Retrofit

Choose Motor Type from Drop-Down Menu to the left
Choose Motor Type from Drop-Down Menu to the left

Electrical Energy Savings (kWh / yr) = HP x LF x Conversion x (1/Standard_Eff - 1/ High_Eff) x Hrs

Electrical Demand Savings (kW) = HP x LF x Conversion x (1/Standard_Eff - 1/ High_Eff) x Coincidence Factor

Where:

Hrs = Annual operational hours per year of the motor; if site specific hours are not available, stipulated annual operating hours by building in Table 2 and Table 3 are used.

LF = Motor load factor as percentage (0 - 100); if motor specific load factor is not available, use default 75% load factor.

HP = Rated motor horsepower.

High_Eff = Efficiency of high efficiency replacement motor as percentage (0 - 100); use efficiency of 'Premium Efficiency Motor' for motor size and type (TEFC or ODP) as specified in Table 1 unless motor is specified otherwise.

Standard_Eff = Efficiency of standard replacement motor (0 - 100) ; use efficiency of 'Existing Efficiency Motor' for motor size, speed, and type (TEFC or ODP) as specified in Table 1, unless motor is specified otherwise.

Conversion = .746 (1 HP = .746 kW)

Coincidence Factor = 0.78

Unit Size (Tons)	Motor Size (HP)	Replacement Standard Efficiency (%)	Retrofit Standard Efficiency (%)	High Efficiency (%)	Energy Savings kwh/yr	Demand Reduction kw
Existing Efficiency Motor 1 HP 1200 RPM ODP	1.0	80.0%	76.3%	82.5%	200.65	0.04298
Existing Efficiency Motor 1.5 HP 1200 RPM ODP	1.5	84.0%	77.4%	86.5%	415.33	0.08898
Existing Efficiency Motor 2 HP 1200 RPM ODP	2.0	85.5%	78.5%	87.5%	533.85	0.11436
Existing Efficiency Motor 3 HP 1200 RPM ODP	3.0	86.5%	80.6%	88.5%	676.85	0.14500
Existing Efficiency Motor 5 HP 1200 RPM ODP	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1200 RPM ODP	7.5	88.5%	85.3%	90.2%	973.02	0.20845
Existing Efficiency Motor 10 HP 1200 RPM ODP	10.0	90.2%	86.3%	91.7%	1,390.06	0.29779
Existing Efficiency Motor 15 HP 1200 RPM ODP	15.0	90.2%	87.2%	91.7%	1,719.64	0.36839
Existing Efficiency Motor 20 HP 1200 RPM ODP	20.0	91.0%	88.1%	92.4%	2,152.14	0.46105
Existing Efficiency Motor 25 HP 1200 RPM ODP	25.0	91.7%	88.9%	93.0%	2,525.57	0.54105
Existing Efficiency Motor 30 HP 1200 RPM ODP	30.0	92.4%	89.4%	93.6%	3,067.45	0.65713
Existing Efficiency Motor 40 HP 1200 RPM ODP	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1200 RPM ODP	50.0	93.0%	89.9%	94.1%	5,056.97	1.08334
Existing Efficiency Motor 60 HP 1200 RPM ODP	60.0	93.6%	90.4%	94.5%	5,866.18	1.25669
Existing Efficiency Motor 75 HP 1200 RPM ODP	75.0	93.6%	90.9%	94.5%	6,403.08	1.37171
Existing Efficiency Motor 100 HP 1200 RPM ODP	100.0	94.1%	90.9%	95.0%	9,672.02	2.07201
Existing Efficiency Motor 125 HP 1200 RPM ODP	125.0	94.1%	91.3%	95.0%	10,862.71	2.32708
Existing Efficiency Motor 150 HP 1200 RPM ODP	150.0	94.5%	91.7%	95.4%	12,923.97	2.76866
Existing Efficiency Motor 200 HP 1200 RPM ODP	200.0	94.5%	92.5%	95.4%	13,389.32	2.86835
Existing Efficiency Motor 1 HP 1800 RPM ODP	1.0	82.5%	76.3%	85.5%	287.29	0.06154
Existing Efficiency Motor 1.5 HP 1800 RPM ODP	1.5	84.0%	77.4%	86.5%	415.33	0.08898
Existing Efficiency Motor 2 HP 1800 RPM ODP	2.0	84.0%	78.5%	86.5%	480.02	0.10283
Existing Efficiency Motor 3 HP 1800 RPM ODP	3.0	86.5%	80.6%	89.5%	754.00	0.16153
Existing Efficiency Motor 5 HP 1800 RPM ODP	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1800 RPM ODP	7.5	88.5%	85.3%	91.0%	1,121.93	0.24035
Existing Efficiency Motor 10 HP 1800 RPM ODP	10.0	89.5%	86.3%	91.7%	1,390.06	0.29779
Existing Efficiency Motor 15 HP 1800 RPM ODP	15.0	91.0%	87.2%	93.0%	2,185.45	0.46818
Existing Efficiency Motor 20 HP 1800 RPM ODP	20.0	91.0%	88.1%	93.0%	2,436.62	0.52199
Existing Efficiency Motor 25 HP 1800 RPM ODP	25.0	91.7%	88.9%	93.6%	2,876.61	0.61625
Existing Efficiency Motor 30 HP 1800 RPM ODP	30.0	92.4%	89.4%	94.1%	3,414.39	0.73145
Existing Efficiency Motor 40 HP 1800 RPM ODP	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1800 RPM ODP	50.0	93.0%	89.9%	94.5%	5,515.15	1.18149
Existing Efficiency Motor 60 HP 1800 RPM ODP	60.0	93.6%	90.4%	95.0%	6,546.93	1.40253
Existing Efficiency Motor 75 HP 1800 RPM ODP	75.0	94.1%	90.9%	95.0%	7,254.01	1.55400
Existing Efficiency Motor 100 HP 1800 RPM ODP	100.0	94.1%	90.9%	95.4%	10,571.12	2.26462
Existing Efficiency Motor 125 HP 1800 RPM ODP	125.0	94.5%	91.3%	95.4%	11,986.59	2.56785
Existing Efficiency Motor 150 HP 1800 RPM ODP	150.0	95.0%	91.7%	95.8%	14,261.36	3.05517
Existing Efficiency Motor 200 HP 1800 RPM ODP	200.0	95.0%	92.5%	95.8%	15,172.51	3.25036
Existing Efficiency Motor 1 HP 3600 RPM ODP	1.0	N/A	76.3%	77.0%	24.27	0.00520
Existing Efficiency Motor 1.5 HP 3600 RPM ODP	1.5	82.5%	77.4%	84.0%	310.20	0.06645
Existing Efficiency Motor 2 HP 3600 RPM ODP	2.0	84.0%	78.5%	85.5%	424.93	0.09103
Existing Efficiency Motor 3 HP 3600 RPM ODP	3.0	84.0%	80.6%	85.5%	434.55	0.09309
Existing Efficiency Motor 5 HP 3600 RPM ODP	5.0	85.5%	83.2%	86.5%	467.05	0.10006

Existing Efficiency Motor 7.5 HP 3600 RPM ODP	7.5	87.5%	85.3%	88.5%	647.65	0.13874
Existing Efficiency Motor 10 HP 3600 RPM ODP	10.0	88.5%	86.3%	89.5%	843.99	0.18081
Existing Efficiency Motor 15 HP 3600 RPM ODP	15.0	89.5%	87.2%	90.2%	1,165.49	0.24968
Existing Efficiency Motor 20 HP 3600 RPM ODP	20.0	90.2%	88.1%	91.0%	1,473.78	0.31572
Existing Efficiency Motor 25 HP 3600 RPM ODP	25.0	91.0%	88.9%	91.7%	1,749.23	0.37473
Existing Efficiency Motor 30 HP 3600 RPM ODP	30.0	91.0%	89.4%	91.7%	1,714.60	0.36731
Existing Efficiency Motor 40 HP 3600 RPM ODP	40.0	91.7%	89.7%	92.4%	2,654.48	0.56866
Existing Efficiency Motor 50 HP 3600 RPM ODP	50.0	92.4%	89.9%	93.0%	3,776.68	0.80907
Existing Efficiency Motor 60 HP 3600 RPM ODP	60.0	93.0%	90.4%	93.6%	4,622.51	0.99027
Existing Efficiency Motor 75 HP 3600 RPM ODP	75.0	93.0%	90.9%	93.6%	4,848.49	1.03868
Existing Efficiency Motor 100 HP 3600 RPM ODP	100.0	93.0%	90.9%	93.6%	6,464.65	1.38490
Existing Efficiency Motor 125 HP 3600 RPM ODP	125.0	93.6%	91.3%	94.1%	8,299.05	1.77788
Existing Efficiency Motor 150 HP 3600 RPM ODP	150.0	93.6%	91.7%	94.1%	8,498.93	1.82070
Existing Efficiency Motor 200 HP 3600 RPM ODP	200.0	94.5%	92.5%	95.0%	11,591.12	2.48313
Existing Efficiency Motor 1 HP 1200 RPM TEFC	1.0	80.0%	76.3%	82.5%	200.65	0.04298
Existing Efficiency Motor 1.5 HP 1200 RPM TEFC	1.5	85.5%	77.4%	87.5%	455.71	0.09762
Existing Efficiency Motor 2 HP 1200 RPM TEFC	2.0	86.5%	78.5%	88.5%	586.46	0.12564
Existing Efficiency Motor 3 HP 1200 RPM TEFC	3.0	87.5%	80.6%	89.5%	754.00	0.16153
Existing Efficiency Motor 5 HP 1200 RPM TEFC	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1200 RPM TEFC	7.5	89.5%	85.3%	91.0%	1,121.93	0.24035
Existing Efficiency Motor 10 HP 1200 RPM TEFC	10.0	89.5%	86.3%	91.0%	1,219.18	0.26118
Existing Efficiency Motor 15 HP 1200 RPM TEFC	15.0	90.2%	87.2%	91.7%	1,719.64	0.36839
Existing Efficiency Motor 20 HP 1200 RPM TEFC	20.0	90.2%	88.1%	91.7%	1,815.55	0.38894
Existing Efficiency Motor 25 HP 1200 RPM TEFC	25.0	91.7%	88.9%	93.0%	2,525.57	0.54105
Existing Efficiency Motor 30 HP 1200 RPM TEFC	30.0	91.7%	89.4%	93.0%	2,646.21	0.56689
Existing Efficiency Motor 40 HP 1200 RPM TEFC	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1200 RPM TEFC	50.0	93.0%	89.9%	94.1%	5,056.97	1.08334
Existing Efficiency Motor 60 HP 1200 RPM TEFC	60.0	93.6%	90.4%	94.5%	5,866.18	1.25669
Existing Efficiency Motor 75 HP 1200 RPM TEFC	75.0	93.6%	90.9%	94.5%	6,403.08	1.37171
Existing Efficiency Motor 100 HP 1200 RPM TEFC	100.0	94.1%	90.9%	95.0%	9,672.02	2.07201
Existing Efficiency Motor 125 HP 1200 RPM TEFC	125.0	94.1%	91.3%	95.0%	10,862.71	2.32708
Existing Efficiency Motor 150 HP 1200 RPM TEFC	150.0	95.0%	91.7%	95.8%	14,261.36	3.05517
Existing Efficiency Motor 200 HP 1200 RPM TEFC	200.0	95.0%	92.5%	95.8%	15,172.51	3.25036
Existing Efficiency Motor 1 HP 1800 RPM TEFC	1.0	82.5%	76.3%	85.5%	287.29	0.06154
Existing Efficiency Motor 1.5 HP 1800 RPM TEFC	1.5	84.0%	77.4%	86.5%	415.33	0.08898
Existing Efficiency Motor 2 HP 1800 RPM TEFC	2.0	84.0%	78.5%	86.5%	480.02	0.10283
Existing Efficiency Motor 3 HP 1800 RPM TEFC	3.0	87.5%	80.6%	89.5%	754.00	0.16153
Existing Efficiency Motor 5 HP 1800 RPM TEFC	5.0	87.5%	83.2%	89.5%	861.76	0.18461
Existing Efficiency Motor 7.5 HP 1800 RPM TEFC	7.5	89.5%	85.3%	91.7%	1,250.10	0.26780
Existing Efficiency Motor 10 HP 1800 RPM TEFC	10.0	89.5%	86.3%	91.7%	1,390.06	0.29779
Existing Efficiency Motor 15 HP 1800 RPM TEFC	15.0	91.0%	87.2%	92.4%	1,972.09	0.42247
Existing Efficiency Motor 20 HP 1800 RPM TEFC	20.0	91.0%	88.1%	93.0%	2,436.62	0.52199
Existing Efficiency Motor 25 HP 1800 RPM TEFC	25.0	92.4%	88.9%	93.6%	2,876.61	0.61625
Existing Efficiency Motor 30 HP 1800 RPM TEFC	30.0	92.4%	89.4%	93.6%	3,067.45	0.65713
Existing Efficiency Motor 40 HP 1800 RPM TEFC	40.0	93.0%	89.7%	94.1%	4,247.68	0.90997
Existing Efficiency Motor 50 HP 1800 RPM TEFC	50.0	93.0%	89.9%	94.5%	5,515.15	1.18149
Existing Efficiency Motor 60 HP 1800 RPM TEFC	60.0	93.6%	90.4%	95.0%	6,546.93	1.40253
Existing Efficiency Motor 75 HP 1800 RPM TEFC	75.0	94.1%	90.9%	95.4%	7,928.34	1.69846
Existing Efficiency Motor 100 HP 1800 RPM TEFC	100.0	94.5%	90.9%	95.4%	10,571.12	2.26462
Existing Efficiency Motor 125 HP 1800 RPM TEFC	125.0	94.5%	91.3%	95.4%	11,986.59	2.56785
Existing Efficiency Motor 150 HP 1800 RPM TEFC	150.0	95.0%	91.7%	95.8%	14,261.36	3.05517
Existing Efficiency Motor 200 HP 1800 RPM TEFC	200.0	95.0%	92.5%	96.2%	16,940.87	3.62919
Existing Efficiency Motor 1 HP 3600 RPM TEFC	1.0	75.5%	76.3%	77.0%	24.27	0.00520
Existing Efficiency Motor 1.5 HP 3600 RPM TEFC	1.5	82.5%	77.4%	84.0%	310.20	0.06645
Existing Efficiency Motor 2 HP 3600 RPM TEFC	2.0	84.0%	78.5%	85.5%	424.93	0.09103
Existing Efficiency Motor 3 HP 3600 RPM TEFC	3.0	85.5%	80.6%	86.5%	517.18	0.11079
Existing Efficiency Motor 5 HP 3600 RPM TEFC	5.0	87.5%	83.2%	88.5%	733.16	0.15706
Existing Efficiency Motor 7.5 HP 3600 RPM TEFC	7.5	88.5%	85.3%	89.5%	840.54	0.18007
Existing Efficiency Motor 10 HP 3600 RPM TEFC	10.0	89.5%	86.3%	90.2%	1,020.63	0.21865
Existing Efficiency Motor 15 HP 3600 RPM TEFC	15.0	90.2%	87.2%	91.0%	1,463.31	0.31348
Existing Efficiency Motor 20 HP 3600 RPM TEFC	20.0	90.2%	88.1%	91.0%	1,473.78	0.31572
Existing Efficiency Motor 25 HP 3600 RPM TEFC	25.0	91.0%	88.9%	91.7%	1,749.23	0.37473
Existing Efficiency Motor 30 HP 3600 RPM TEFC	30.0	91.0%	89.4%	91.7%	1,714.60	0.36731
Existing Efficiency Motor 40 HP 3600 RPM TEFC	40.0	91.7%	89.7%	92.4%	2,654.48	0.56866
Existing Efficiency Motor 50 HP 3600 RPM TEFC	50.0	92.4%	89.9%	93.0%	3,776.68	0.80907
Existing Efficiency Motor 60 HP 3600 RPM TEFC	60.0	93.0%	90.4%	93.6%	4,622.51	0.99027
Existing Efficiency Motor 75 HP 3600 RPM TEFC	75.0	93.0%	90.9%	93.6%	4,848.49	1.03868
Existing Efficiency Motor 100 HP 3600 RPM TEFC	100.0	93.6%	90.9%	94.1%	7,621.09	1.63264
Existing Efficiency Motor 125 HP 3600 RPM TEFC	125.0	94.5%	91.3%	95.0%	10,862.71	2.32708
Existing Efficiency Motor 150 HP 3600 RPM TEFC	150.0	94.5%	91.7%	95.0%	11,575.32	2.47974

Existing Efficiency Motor 200 HP 3600 RPM TEFC	200.0	95.0%	92.5%	95.4%	13,389.32	2.86835

Electric VFDs - South Dakota

Calculator

Motor Size (HP)	25
Total Hours Of Operation	4000

% Speed	% Hours	kwh usage at speed
10%	0%	0
20%	0%	0
30%	0%	0
40%	50%	2,387
50%	0%	0
60%	0%	0
70%	0%	0
80%	50%	19,098
90%	0%	0
100%	0%	0

Total Percentage of Hours Used 100.0%

Usage Before VFD	55,950
Usage After VFD	21,485
Savings (kwh/yr)	**34,465**
Demand Reduction (kw)	**8.62**

Usage Before VFD = Motor_Size_(HP) * .746 * Hours_of_Operation * Load_Factor
Energy Usage at Each Speed = Motor_Size_(HP) * %_Speed^3 * .746 * %_Hours_at_Speed * Total_Hours_of_Operation
Usage After VFD = Sum of Energy Usage at each speed
Savings (kwh/yr) = Usage_Before_VFD - Usage_After_VFD
Demand Reduction (kw) = Savings_(kwh/yr) / Total_Hours_of_Operation

Electric Split System - South Dakota

Energy Savings	**kwh/yr**	**Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**
Office		**Choose Building Type from Drop-Down Menu to the left**

If the size of the unit in kBtu is unknown, please enter the size of the unit in tons in the space below

1	Unit Size in Tons
12	**Unit Size in kBtu/hr**

Calculator

AC Size (kBtu/hr)	120	
SEER or EER	11.2	**For 5.5 ton units or less, use SEER Value. For over 5.5 use EER value**
Savings (kwh/yr)	**1,593**	

Electrical Energy Savings (kWh/yr) = (kBtu/hr_cool) x [(1/EER_base - 1/EER_EE)] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (kBtu/hr_cool) x [1/EER_base - 1/EER_EE] x CF

Where:

kBtu/hr_cool	= nominal rating of the equipment cooling capacity
EER_EE	= energy efficiency ratio of the baseline equipment (Btuh/W)
EER_base	= energy efficiency ratio of the high efficiency equipment (Btuh/W)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
CF	= Stipulated coincident demand factor, equal to 0.90. (4)

Source: MN OES Deemed Savings Database

Electric Rooftop Units - South Dakota

Energy Savings	**kwh/yr**	**Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**
Education - Community College		**Choose Building Type from Drop-Down Menu to the left**

If the size of the unit in kBtu is unknown, please enter the size of the unit in tons in the space below

1	Unit Size in Tons
12	**Unit Size in kBtu/hr**

Calculator

AC Size (kBtu/hr)	100	
EER/SEER	14.5	**For 5.5 ton units or less, use SEER Value. For over 5.5 use EER value**
Savings (kwh/yr)	**1,749**	

Electrical Energy Savings (kWh/yr) = (kBtu/hr_cool) x [(1/EER_EE - 1/EER_base)] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (kBtu/hr_cool) x [(1/EER_EE - 1/EER_base)] x CF

Where:

kBtu/hr_cool	= the nominal rating of the cooling capacity of the rooftop unit
EER_base	= energy efficiency ratio of the baseline equipment (Btu/W-hr)
EER_EE	= energy efficiency ratio of the high efficiency equipment (Btu/W-hr)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
CF	= Stipulated coincident demand factor, equal to 0.90. (3)

Source: MN OES Deemed Savings Database

Electric Air Cooled Chillers - South Dakota

Education - Community College

Choose Building Type from Drop-Down Menu to the left

Calculator

AC Size (Tons)	50
IPLV	1.15
Savings (kwh/yr)	**3023**
FLV	1.23
Reduction (kw)	**4.95**

Everything from here down is used for the tables only

Energy Savings **kwh/yr**

Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left

Electrical Energy Savings (kWh/yr) = (Capacity) x [IPLV_base - IPLV_EE] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (Capacity) x [(Eff_base - Eff_EE)] x CF

Where:

Capacity	= the nominal rating of equipment cooling capacity (tons)
IPLV_EE	= the integrated part load ratio of the energy efficiency equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 4)
IPLV_base	= the integrated part load ratio of the baseline equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 3)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
Eff_base	= the full load efficiency of the baseline chiller (kW/ton)
Eff_EE	= the full load efficiency of the energy efficient chiller (kW/ton)
CF	= Stipulated coincident demand factor, equal to 0.90 (4)

Source: MN OES Deemed Savings Database

Electric Centrifugal Chillers - South Dakota

Education - Community College **Choose Building Type from Drop-Down Menu to the left**

Calculator

AC Size (Tons)	150
IPLV	0.534
Savings (kwh/yr)	**5805**
FLV	0.59
Reduction (kw)	**33.75**

Everything from here down is used for the tables only

Demand Reduction **kw** **Choose Energy Savings or Demand Reduction from Drop-Down Menu to the left**

Electrical Energy Savings (kWh/yr) = (Capacity) x [IPLV_base - IPLV_EE] x (EFLH_cool)

Summer Electrical Demand Savings (kW) = (Capacity) x [(Eff_base - Eff_EE)] x CF

Where:

Capacity	= the nominal rating of equipment cooling capacity (tons)
IPLV_EE	= the integrated part load ratio of the energy efficiency equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 4)
IPLV_base	= the integrated part load ratio of the baseline equipment (Btu/W-h) (if equipment values are unavailable, refer to Table 3)
EFLH _cool	= the equivalent full load hours of cooling per zone from Table 1
Eff_base	= the full load efficiency of the baseline chiller (kW/ton)
Eff_EE	= the full load efficiency of the energy efficient chiller (kW/ton)
CF	= Stipulated coincident demand factor, equal to 0.90 (4)

Source: MN OES Deemed Savings Database