DEPARTMENT OF PUBLIC SERVICE REGULATION
BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MONTANA

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IN THE MATTER OF NorthWestern Energy's 2011-2012 Electricity Supply Tracker	))	REGULATORY DIVISION DOCKET NO. D2012.5.49

Direct Testimony of

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1. Introduction and Outline of Testimony

Q. Please state your name and occupation.

A. My name is Thomas Michael Power. I am a Research Professor and Professor Emeritus in the Economics Department at the University of Montana, Missoula, Montana. I am appearing in these proceedings, however, as an independent consulting economist, a principal in Power Consulting, Inc., on behalf of Human Resource Council, District XI, and the Natural Resources Defense Council.

Q. Have you previously testified before this and other regulatory commissions as an expert witness?

A. Yes. I have testified before this Commission on numerous occasions over the past 40 years. I have also testified before federal and state regulatory authorities throughout the United States and Canada on more than seventy-five occasions. A brief summary of my professional experience and training can be found in the last section of this testimony.

Q. What is the purpose of your testimony?

A. As in other electric tracker cases before this Commission, NorthWestern Energy (NWE) is seeking to recover the costs associated with the customer energy efficiency programs that are a part of its electric supply portfolio. In addition it seeks to recover the fixed costs revenues it would have collected in its authorized rates if those revenues had not been depressed by the reduction in electric consumption due to NWE's customer energy efficiency programs.

This makes NWE's customer energy efficiency programs an important part of this Electric Supply Tracker case.

My testimony will discuss:

a. The important role of energy efficiency in an integrated public energy policy including the policies of the Montana Public Service Commission (MPSC).
b. Electric supply portfolio planning on the NWE system in Montana.
c. The economic logic of utility-run customer energy efficiency programs.

d. The origins of the NWE customer energy efficiency programs and the important role the MPSC played in the establishment of those programs.

e. The productivity of the NWE customer energy efficiency programs that are part of NWE's electric supply portfolio.

f. The differences between the customer programs funded by the legislatively mandated Universal Systems Benefit Charge and the cost-effective customer energy efficiency programs pursued by NWE as part of its electric supply portfolio.

g. The broad range of barriers that keep utility customers from pursuing all cost-effective electric efficiency measures on their own without utility or other support.

h. The disincentives created by utility regulation to utilities pursuing customer electric efficiency programs and the need to remove those disincentives.

i. The various ways of measuring the economic rationality of utility customer efficiency programs.

j. The conclusions reached by SBW in its review of NWE's customer energy efficiency programs and SBW's approach to measuring the impact of each of those efficiency programs.

2. The Role of Energy Efficiency in the Development of Public Energy Policy

Q. Why are you focusing your testimony on the importance of improving the efficiency with which utility customers use electricity?

A. As I will discuss in more detail below, improving the efficiency with which we use electricity to obtain the energy services we desire represents the "lowest hanging fruit" when it comes to serving utility customers' energy needs.

Investing in the efficient use of electricity lowers energy costs and provides social benefits across the board:

- It reduces the overall dollar cost of the electric supply portfolio that NWE has to purchase.

- It avoids the broad range of environmental costs associated with the production and consumption of energy, including, to name a few:
  - The sulfur, particulate, mercury, NO_x, and CO_2 associated with burning coal.
  - The landscape and ground water disturbance associated with surface mining coal.
  - The concerns about ground water pollution associated with the hydraulic fracturing of shale formations and the air emissions associated with dense natural gas drilling and development.
  - The threat to global climate stability associated with greenhouse gas emissions from the burning of fossil fuels.
- It increases our energy independence and security.
- It helps build jobs and improve state economies by directing economic activity in-state where it is subject to a multiplier effect.
- It provides opportunities for all customer classes to adopt energy efficiency measures that lower bills saving customers money and giving them greater control over their expenditures and greater satisfaction.

Q. Are these important advantages of improving the efficiency with which we use electricity widely recognized?

A. Yes.

For almost four decades the Montana Public Service Commission has recognized utility customer energy efficiency programs as one of the lowest cost sources of serving utility customers' energy needs. That is why NWE and, before it, the Montana Power Company offered such energy efficiency programs to their customers.

The Montana Public Service Commission is not alone in supporting ratepayer-supported customer energy efficiency programs. Such programs are operated in almost every state of the Union. The National Association of Utility

Regulatory Commissions has also long recognized the legitimacy of such utility customer energy efficiency programs.

Over thirty years ago the Northwest Power and Conservation Council (NPCC) was established to help coordinate the activities in the states of Washington, Oregon, Idaho, and Montana to meet the electric needs of their residents in a least cost manner while also minimizing the environmental impacts of serving those electrical needs. The NPCC is made up of two representatives of each of those four states appointed by each governor.

The electric supply analysis provided by the professional staff of the NPCC has regularly documented the major role that electric efficiency measures can play in reducing the overall cost of electric supply in the region. Every five years the NPCC publishes a detailed "Northwest Conservation and Electric Power Plan." The sixth such plan was published in 2010 and the NPCC is preparing to begin work on the seventh such 20-year plan to be published in 2015.

Those plans analyze the electric energy needs of the region, the existing portfolio of electric generating facilities in the region, and the costs associated with alternative way of meeting projected electric demands given the technologies, energy resources, and generating costs associated with each. Those plans also carefully study the role that improvements in the efficiency with which electricity is used can play in meeting the region's electric needs at the least overall long-run cost. NPCC's analysis has repeatedly demonstrated the critical and economically beneficial role of energy efficiency in meeting regional energy needs.

Our National Energy Laboratories, such as the Idaho, Los Alamos, Oak Ridge, Brookhaven, and Lawrence Livermore and Berkeley Laboratories, which originally focused on the development of nuclear weapons and nuclear energy, are now also engaged in the analysis of improving the efficiency with which we use energy so that we can stretch our energy supplies further at low customer and social costs.

The U.S. Department of Energy, of course, also focuses much of its efforts on the development of new technologies to reduce the costs associated with meeting the nation's energy needs and also emphasizes the advantages associated with exploiting the available energy efficiency potential of the nation.

Investments in energy efficiency have long been part of a business-like, economics-based, approach to meeting our energy needs.

3. Customer Energy Efficiency Programs in NWE's Electric Supply Portfolio

Q. What is NWE's electric supply obligation to its customers?

A. Under MPSC regulations, NWE has to plan and procure a portfolio of electric supply resources to serve the needs of its customers. The goal of resource planning and procurement is to provide "adequate and reliable …electricity supply services, stably and reasonably priced, at the lowest long – term cost." The planning and procurement process is also designed to "promote economic efficiency and environmental responsibility," and "facilitate" NWE's "on-going financial health." (A.R.M. §38.5.8203)

The regulations define the "supply resources" that NWE is supposed to consider to include "demand-side management activity, including energy efficiency and conservation programs, load control programs and pricing mechanisms." This electric supply resource is listed just after: "wholesale power transaction, including bilateral contracts…and spot energy purchases." (§38.5.8202) The range of supply resources that NWE can include in its supply portfolio has since been expanded to include self-owned generating facilities.

In defining the electric supply costs that NWE can recover from ratepayers, if they are prudently incurred, the regulations include "demand-side management and energy efficiency costs." (§38.5.802)

Q. There appear to a variety of terms used to describe utility programs that are aimed at improving the efficiency with which customers use electricity. Could you explain these terms?

A. To a certain extent “conservation,” “demand side management,” and “improved customer energy efficiency” are all used to refer to the same thing. However, in the context of a regulated energy utility like NWE there are some important distinctions.

In common usage the word “conservation” can refer to simply reducing one’s consumption of a particular good or resource. In that sense, “conservation” includes “just going without” or being more frugal. In the context of utility customer energy efficiency programs, the focus is not on that. Rather it is on providing the same benefits that flow from using energy but doing so in a way that both requires less energy use and where the cost of the improved energy use is justified by the cost of the energy saved. That is, the customer gets the energy services desired but at a lower energy and dollar cost. The energy is used “more efficiently.”

“Demand-side management” refers to a broad set of steps the utility and customers might take to reduce the cost to the utility of satisfying the customers’ needs for energy services. This could involve shifting electric loads from peak hours when they are more costly to serve to off-peak hours. It might involve reducing demand surges at any time. It could involve agreements with customers to allow electricity delivery to certain equipment or machinery to be interrupted at times when it would be costly for the utility to serve the load. However, in all cases these would be voluntary agreements where the customer is rewarded with lower rates for accepting this modified service. Both the utility and customer save enough money to allow a voluntary agreement to be reached. That is, the change in the character and cost of electric service are cost effective to both the utility and customer.

For the purposes of this testimony, the terms efficiency and demand-side management are used interchangeably.

It is important to note also that utility customer efficiency programs also focus on cost-effective choices. That is, situations where it would be cheaper for the utility to meet a customer’s need for energy services by improving the efficiency of the customer's energy-using structures and equipment rather than by purchasing additional energy to supply the customer's current usage.

When it would cost the utility more to purchase additional electricity to serve a customer's demand than it would cost to improve the efficiency of a customer's energy-using structures and equipment, the lowest cost way of meeting the customer's electrical needs would be for the utility to facilitate the improvement in the efficiency of the customer's electricity usage. That could leave the utility, its other customers, and this particular customer all better off. It is that type of cost-effective efficiency improvement in customers' electric usage that utility customer energy efficiency programs pursue as part of a least-cost electric portfolio.

Q. Are you saying that the customer energy efficiency programs that NWE runs are no different that its purchases of electricity from PPL Montana, the regional spot market at Mid-C, or NWE's electric generation at Colstrip 4 or the Dave Gates Station or any other source of electricity?

A. That is exactly what I am saying. The MPSC electric supply and procurement rules instruct NWE to pursue the long-term least cost mix of resources available to meet its customers' needs, considering market purchases, long term contracts with electric generators, self-generation, and customer energy efficiency programs. If customer energy efficiency programs are a cheaper source of supply in meeting customer needs than other electricity supplies available, responsible, prudent, and business-like behavior calls for NWE to pursue the customer energy efficiency programs.

Q. NWE appears to run customer energy efficiency programs in two separate sets of programs: One set is funded by electric supply activities and the other is funded by the Universal System Benefits program. Can you explain the difference between these?

A. The USB program was established by statute as part of the utility "restructuring" law that was passed in the late 1990s. Because restructuring was expected to lead to many different natural gas and electric suppliers competing to serve Montana customers, it was also expected that that competition would make many existing utility customer programs non-viable. Energy efficiency, low income, and “infant industry” renewable energy programs, and other utility initiatives, were considered vulnerable to elimination due to those expected competitive pressures. For that reason, utility customers were required to pay a Universal System Benefit Charge to maintain those utility programs.

Over the years, with this Commission’s approval, utility energy efficiency programs that met a cost-effectiveness test that demonstrated that they were less costly than other sources of energy supply migrated from being funded by USB to become part of the utility’s energy supply portfolio. The idea was that they should be treated the same as any other energy supply purchase that NWE made in developing its portfolio to serve customers.

It is instructive, in this regard, to talk about the low-income programs that are funded by USB, which are a critical aspect of the overall USB program. The low income programs funded by USB are not solely focused on obtaining an optimal energy supply portfolio to serve all customers. The low income discount, for instance, attempts to reduce the burden of high utility costs on those least able to pay and, in that sense, meet the social objective of assuring access to utility services for all residents. That is not to say that there are not benefits of these programs to the utility and other customers. Unpaid bills, bill collection efforts, and utility service disconnects and reconnects are costly to the utility and, therefore, to all customers. Various low income programs seek to minimize some of those utility costs while also pursuing straightforward social objectives such as protecting access to utility services for all households and avoiding the social costs associated with inadequate access.

The free Low Income Weatherization Program seeks to make low and moderate income homes more energy efficient, thus reducing household energy bills. In that sense low income weatherization contributes to energy savings on the NWE system and reduces the amount of energy resources NWE has to obtain from other sources. However, this low income program also pursues health and safety objectives that are not related to a least cost energy supply. NWE recognized this function of the low income weatherization program as long ago as 1988. In testimony at that time a NWE witness described the low income weatherization program as "further[ing] important social goals." (Docket No. D2001.10.144,Hauser direct testimony at 6) Unsafe heating systems are replaced as are broken windows, doors, and other structural elements of the home, for example. Because of the multiple social objectives that low income weatherization pursues, it is not subject to an exclusively energy supply benefit-cost test. This does not mean that the program elements are not evaluated in a broader cost-effective framework in which alternative ways of meeting those multiple objectives at lower costs are explored.

In fact, in the past I have advocated for a fuller accounting of the non-energy benefits provided by various low-income programs. Not fully accounting for these benefits, which research has shown can be substantial, results in the programs being undervalued and not funded and undertaken to the extent they should be given the benefits they provide.

At any rate it is because of the multi-purpose objectives of the low income programs that they continue to be funded through USB rather than utility energy supply. It is important to realize, however, that there remains a practical utility cost-reduction side to these low income programs. In a pragmatic way, they seek to both reduce costs to the utility and its customers while also providing essential services to low and moderate income households.

It is also important to point out that low income weatherization programs provide customer energy efficiency measures to reduce both electricity and natural gas consumption. As noted above, the benefit-cost test for these programs account only for energy savings, not for any of the other services provided. In addition those benefit-cost tests usually show the electric side not to be cost-effective while the natural gas side is very cost effective. This is partially tied to how the costs of traveling to those low income households, setting up, carrying out an audit of both gas and electric usage, and then installing both gas and electric energy efficiency measures are divided between electric and natural gas savings. That division of costs can be quite arbitrary. If the natural gas and electric low income weatherization programs are combined, the utility benefit cost test across the last five years indicates that the Low Income Weatherization program has been quite cost-effective. The ratio of benefits to costs under the Program Administrator Cost test (as well as the Total Resource Cost test) was 1.37. The Societal Cost test ratio was 1.51. The Ratepayer Impact Measure was 1.14. Overall the low income weatherization program met the conventional cost-effectiveness tests despite its broader focus on health and safety, and the failure to fully account for non-energy benefits, in addition to energy savings.

Q. Are there different budgetary constraints on the cost-effective customer efficiency programs that are part of the electricity supply portfolio compared to the budget constraints on the USB programs?

A. Yes. The budget for the electric supply portfolio is largely dictated by the electricity demand of NWE's customers and NWE's skill in crafting a portfolio of resources that minimizes the cost of meeting customers' demands given market conditions and other regulatory objectives such as controlling risk to customers, adequacy of supply, etc. The budget for customer efficiency programs within that electric supply portfolio should be determined by the range of cost-effective customer efficiency opportunities. The larger that potential is, the more of the electric supply should be served by those programs. The smaller that potential is, the less will be spent on those customer energy efficiency programs.

For the USB programs, the restructuring legislation in the late 1990s specified the dollar amount that the utility was to spend on the USB programs. As the demands of low income programs have increased, less and less of the USB budget has been spent on programs whose primary purpose is to help serve the demand for electricity.

4. The Origins of NWE's Customer Energy Efficiency Programs

Q. Did the customer energy efficiency programs that NWE now runs as part of its electric supply portfolio originate from NWE shareholders pressuring NWE personnel to pursue these programs as a profit center for the utility?

A. Not at all. After NWE bought the Montana Power Company transmission and distribution system, it inherited the obligation to assemble an electric supply portfolio to serve residential and small commercial customers. NWE, however, took the position that customer energy efficiency programs were <u>not</u> "electric supply" and were not appropriate resources for its electric supply portfolio.

NWE acknowledged that there was a significant untapped potential of cost-effective customer energy efficiency measures that could help meet customers' electric needs at a lower cost than increased electric generation. But, instead of identifying energy efficiency as a resource that should be acquired, it argued that since it was purely a transmission and distribution system operator, without its own generation, it should not get involved in pursuing that energy efficiency potential. As a result, the first electric supply portfolio post-restructuring that NWE proposed did not include customer energy efficiency programs.

HRC and NRDC argue emphatically that this was an incorrect reading of both the law and good utility and regulatory policy. The Montana Commission overruled NWE's objections to running customer energy efficiency programs and ordered "that NWE should consider demand- and supply-side resources on an equivalent basis when procuring resources to serve default loads and managing the total cost of providing default service." (Docket D2001.10.144, Order 638d, p. 19) ["Default loads" and "default service" in this quote referred to the electric loads of customers who were not being served by an unregulated "competitive supplier." This was largely the residential and small commercial customers.]

The point is that NWE did not want to run energy efficiency programs other than those funded by the legislatively-mandated USB programs. In particular, it did not want to pursue customer energy efficiency programs as part of its electric supply portfolio. It was the Montana Public Service Commission that *ordered* NWE to do so.

This is not to say that since then NWE has been reluctant to comply with the Commission's order. The leadership of NWE has embraced that broader view of a least-cost energy supply portfolio and has become a leader in the state of Montana in developing cost-effective customer energy efficiency programs.

Q. In your professional opinion, has NWE's customer energy efficiency programs spent money too freely in its support of customer electric efficiency measures?

A. Not at all. In the past I have been critical of how cautious and "penny-pinching" NWE's approach to its customer electric efficiency programs has been. I have asked the Montana Commission to push NWE to invest more and pursue the available energy efficiency potential at an accelerated rate. I even recommended, at one point, that the Montana Commission initiate a discussion about whether it made sense to turn the customer energy efficiency programs over to a utility-funded third party organization so that the energy efficiency potential could be more aggressively pursued.

I still think that my characterization of the management of NWE's customer electric efficiency programs as *overly* cautious, conservative, and frugal was correct. NWE, while making a clear commitment to the pursuit of customer efficiency measures as a part of its electric supply portfolio, has been very careful to spend no more than was necessary to obtain the cost-effective customer efficiency resources. The programs have been professionally managed and very careful in their use of ratepayer funds in obtaining this particular part of the electric supply portfolio. That is clear in the benefit-cost ratios calculated from the utility's perspective, that is, the ratio of the avoided conventional electric cost to the cost of the utility running these customer electric efficiency programs. Overall, as will be discussed below, the electric supply costs avoided were almost four times the cost of running the customer electric efficiency programs.

5. The Productivity of NWE's Customer Energy Efficiency Programs in the Electric Supply Portfolio

Q. Have NWE's investments in customer energy efficiency as part of its electric supply portfolio reduced the present and future cost of meeting customers' electric needs?

A. Yes.

That should not be surprising. NWE funds customer energy efficiency programs as part of its electric supply portfolio **only** if those programs provide electricity at a lower cost than its alternative source of electricity supply, such as the cost of purchasing that electricity from electric generators, from the regional electricity market, or by investing in generation of its own.

The energy consulting firm, SBW, recently completed an extensive evaluation of the customer energy efficiency programs that NWE funded as part of its energy supply portfolio ("DSM" programs) as well as energy savings programs funded by USB funds ("USB" programs). Although SBW usually reported the economic efficiency of those programs in terms of different types of benefit-cost ratios, SBW also stated the projected benefits and costs separately so that the *net benefits* (benefits minus costs) could be calculated for the various NWE customer electric efficiency programs run in each of the last five years, 2007 through 2011.

The gross benefits of those customer energy efficiency programs were the estimated realized energy savings valued at what it would have cost NWE to supply that additional electricity if the energy efficiency measures had not reduced customer electricity consumption. The costs of the customer energy efficiency programs, from the utility's perspective, were the cost of organizing and running the efficiency programs and the cost of any incentives the utility provided to motivate customers to participate. This particular comparison of benefits and costs is called the Program Administrator Cost test, where, in this case, NWE is the program administrator.

The customer energy efficiency programs that were part of NWE's electric supply portfolio over that five-year period were projected to save electricity that would have cost NWE about $108 million if it had had to be obtained from conventional generation. The costs NWE incurred to put those energy efficiency measures in place cost about $29 million for a net cost savings to the utility and its customers of over $78 million. That is, almost four dollars in benefits were projected to be generated for each dollar of cost (3.7:1). See the table below.

The Net Benefits of NorthWestern's Electric Customer Efficiency Programs in Its Electric Supply Portfolio: 2007 through 2011				
Year	Electricity Savings (kwh)	Gross Benefits Value of Electricity Saved $s	Costs of Running the Efficiency Programs $s	Net Benefits $s
2007	32,746,481	$10,931,772	$3,098,600	$7,833,172
2008	40,705,978	$16,323,623	$3,956,356	$12,367,267
2009	58,868,587	$27,134,619	$6,579,236	$20,555,383
2010	53,673,132	$23,532,175	$7,202,025	$16,330,150
2011	62,468,837	$29,821,051	$8,595,795	$21,225,256
2007-2011	248,463,014	$107,743,241	$29,432,011	$78,311,230

Sources: SBW Impact Result Tables - Calendar Final 01-29-13.xls Tab PortfolioCE20##

Q. How did the per unit cost of saving this energy through customer efficiency investments compare to the cost of obtaining the additional electric supply to serve these customer loads in the absence of the efficiency improvements?

A SBW calculated that the levelized cost of the saved energy from the measures put in place over those five years was 1.6 cents per kwh. (See footnote on the above table, tab PortfolioLevCostAllYears, AP40) The cost to the utility to provide replacement electricity if these electric efficiency measures were not put in place was projected to be about 6 cents per kwh. Clearly the investments in improving the efficiency with which customers used the electricity was a more cost-effective way of meeting their needs than having the utility purchase or generate that electricity. To not have made those investments in customer energy efficiency over the last five years would have unnecessarily burdened NWE’s customers with tens of millions of dollars of unnecessary costs. That certainly would have been un-business-like if not imprudent.

Q. The estimated cost savings you just cited come from calculations that discount future costs and the future value of energy savings. If costs avoided in the future were not treated as being less important than costs avoided today, what would the projected total value of the customer energy efficiency programs have been?

A. The value of the customer energy efficiency programs would be much higher. In NWE's 2011 Electric Resource Portfolio Plan that covered a 20 year planning horizon, customer electric efficiency was included as one of the sources of electric supply. It was projected to "provide" (i.e. save) 11,253,043 megawatt-hours. Valued at a levelized utility avoided cost of about 5.4 cents per kwh, those savings would be worth almost $606 million. The cost of those energy savings programs over the 20 year period was projected to be about $277 million. The net benefit to NWE and its customers of the investments in customer energy efficiency would have been $329 million.[1]

Q. In your discussion above you have used the Program Administrator Cost test to compare the benefits and costs. That is not the only approach to analyzing the benefits and costs of such customer efficiency programs. Why are you emphasizing that particular measure of cost-effectiveness?

A. The Program Administrator Cost test looks at the customer efficiency programs from the point of view of the utility. The utility makes an investment in energy efficiency to expand the electric supply portfolio to serve customers and this test asks what the utility got in the way of benefits (avoided conventional supply costs) and what it cost the utility to get those savings.

Economists would typically urge that a benefit-cost analysis consider *all* benefits and all costs associated with a particular action, regardless of who paid the costs and who received the benefits. In that broader societal view of an investment, the analyst would look outside of the utility to see if there were other costs avoided and if there were other cost incurred. Of course, the broader the view, the more likely it is that other benefits and costs would be seen. For instance, one societal benefit of investing in energy efficiency is that many of the environmental costs associated with producing and consuming more energy are avoided; another benefit are the non-energy benefits associated with low-income energy efficiency that I mentioned earlier. In addition, in utility customer efficiency programs, customers are asked to bear some of the costs associated with the

[1] Electricity Supply Resource Procurement Plan, December 2011, Volume 2, Chapter 3, pages 9 and 17. Levelization of avoided cost: Docket No. D2012.1.3, John Bushnell Testimony, Exhibit_(JBB), page 1 of 9, 2012-2031 levelization.

measures installed. Those costs are also real. The Total Resource Cost test would take into account the customer contribution to covering the cost of installed measures. The Societal Cost test would seek to include the avoided environmental costs and non-energy benefits. Although, it must be noted, that these other benefits, because they are difficult to quantify, and often ignored or undervalued, even though research has shown that they can be substantial. The point I am trying to make here is that from the point of view of overall public energy policy, it is certainly appropriate to at least consider how customer efficiency programs look from those broader perspectives.

One can also look at these utility customer efficiency programs from the different perspectives of participant and non-participants in the programs. Customers who participate in the programs not only get the benefit of the utility's electric supply costs being lower, a benefit all customers receive, but the participants also see their consumption of electricity fall, reducing their electric bills even more. Of course, participants are typically asked to pay part of the cost of the efficiency measures too.

It is also true that effective customer energy efficiency programs reduce electric consumption below what it otherwise would have been. That means that in general rate cases the utility's fixed costs have to be collected over a smaller volume of energy consumption and those per-unit rates will rise whether or not there is a mechanism in place, like a lost revenue adjustment mechanism (LRAM) that NWE has, which seeks to ensure the utility recovers its authorized fixed costs. With an LRAM in place the per-unit rate increase is not delayed until the next rate case. The Ratepayer Impact Measure test takes these inevitable lost revenue adjustments to rates into account. This is intended to reflect impacts on per-unit rates. The Ratepayer Impact Measure is somewhat misnamed in the sense that what probably matters to most customers is their overall electric bill, not the per unit rates they pay. If electric consumption has been reduced by the energy efficiency measures and the overall cost of electric supply is lower than it otherwise would have been, electric bills will decline as a result of the energy efficiency measures despite the adjustment of rates upward to take into account the need to recover the fixed costs over a smaller volume of electricity consumption.

6. Barriers to Customers' Pursuit of Cost-Effective Efficiency Measures

Q. If such cost-effective opportunities to invest in customer electric efficiency are prevalent why cannot those investments simply be left to customers who have a self-interest in minimizing their energy bills by making those investments themselves? Why does the electric utility and the Montana Commission have to get involved in promoting customer energy efficiency?

A. Many cost-effective energy efficiency investments are, in fact, made by individual households and businesses although often it is building codes, appliance efficiency standards, and public education programs, including labeling requirements, that inform customers of the cost-effective alternatives available that actually lead to the end result of private investment in energy saving technologies.

However, studies over the last half-century have highlighted a broad range of barriers to households and businesses investing up to the cost-effective level in energy efficiency measures.

These barriers include the fact that households highly discount future savings associated with energy efficiency investments because of stress on household budgets. As a result, they require a very short pay-back period before they will make that energy efficiency investment. The very high interest rates many households pay on their credit card debt, reflects household's emphasis on current consumption over future costs. Electric utilities, operating with a discount rate set by their cost of capital can and do take a much longer-run view of the investments they make. Electric generating facilities, for instance, are planned based on economic lives that can be 35 years or longer. It is unclear why when the cost of money to the utility is, say 10 percent, electric generation should be planned using 10 percent as the discount rate but when customer energy efficiency is evaluated a 30 to 50 percent discount rate should be used. One of the reasons for the dramatic differences in discount rates is that many households cannot gain access to credit markets on reasonable terms to fund long-run investments in energy efficiency. A financially stable utility is likely to have much more ready access to capital on more favorable terms for such long run investments.

Another barrier is the technical character of making cost-effective energy efficiency decisions. Households often do not have the technical expertise, information, or experience to evaluate the many different ways of saving household energy and coming to a conclusion as to what the reliable technologies are, what reasonable costs are, what the savings will be, etc. so that they can come to a rational decision about the investment.

There is also often a separation between the person who makes decisions about the characteristics of energy using structures and appliances and the person who ultimately has to pay the energy bills. This is clear with rental properties when renters are not the ones who made the decisions about the energy efficiency of the structure or the major energy-using appliances. It also would not be rational for a renter to make a long-run investment in improving the property owned by another person. Yet the renters are often the ones who have to pay the energy bills. The same sort of division among decision makers exists between home builders and home buyers. Part of the problem here is also related to the buyer or renter being able to accurately evaluate the energy using characteristics of the building and major appliances and relate that to the cost of renting or buying the home.

There is also simple inertia that leads people to focus on more immediate decisions that have to be made while accepting a familiar status quo in other areas despite the fact that there are costs associated with that passive acceptance of the status quo.

Utility regulation and ratemaking also can contribute to the problem by setting rates on the basis of *average* cost rather than the *incremental* cost of expanding electric supply. This can keep customers from realizing the actual value of the energy savings they have facilitated. That is, average cost pricing may provide a price signal that understates the value of electricity saved and discourages customer energy saving investments that are actually cost-effective.

What research has repeatedly made clear is that there is a large backlog of cost-effective energy efficiency investment opportunities in both households and businesses. This creates an opening for utility investments and can help meet customers' energy needs at a lower cost than if the utility were limited to only expenditures that expand the supply of electricity.

7. Barriers to Utilities Pursuing Cost-Effective Investments in Customer Energy Efficiency

Q. Do you support the continued use of the Lost Revenue Adjustment Mechanism (LRAM) in this electric supply tracker?

A. Yes.

As this Commission, the Northwest Regional Power and Conservation Council, and most other public energy regulatory bodies have recognized, improvements in the efficiency with which we use electricity can save significant amounts of money for consumers, help stabilize their bills in the face of volatile electric and natural gas markets, and reduce the environmental damage associated with the production of electricity.

It is unusual, however, for a private business to invest money in helping its customers avoid purchasing that business's products. In some ways that is the opposite of marketing. Of course, a business with a longer-term vision might realize that helping customers use their product efficiently and reducing the cost of using the product could be a good competitive and public relations strategy. A regulated utility such as NWE, however, faces a serious disincentive when it comes to encouraging customers to be efficient in the use of energy. A significant part of the utility's fixed costs are collected in usage-related charges. The part of utility rates that collect those fixed costs are set in general rate cases and not adjusted for many years thereafter. If, during the years following a general rate case, the utility runs effective efficiency programs for its customers, usage will decline, all things being equal, and the utility will not receive as much revenue to cover its fixed costs. Since it cannot adjust its prices between rate cases to protect its fixed cost recovery, it is, in effect, penalized for running those customer energy efficiency programs. Because the utility's revenues are tied to the volume of throughput on its delivery system, normal regulation rewards the utility for increasing that throughput, i.e., increasing energy consumption by its customers. That *throughput incentive* is not an appropriate incentive scheme for regulators to maintain. It punishes good business-like behavior, behavior in which the Commission has actually ordered the utility to engage.

Q. Are you not exaggerating the situation a regulated utility is actually in? Between rate cases utility loads often grow, generating additional revenues that were not built into existing rates. In addition, the utility is able to cut costs through better management and technological innovations that boost productivity. These changes allow the utility to earn "unexpected" revenues and profits. The utility, of course, does not want an automatic adjustment to eliminate these "windfalls." Why have an adjustment to eliminate just this one type of negative impact on a utility's revenues between rate cases?

A. First, as this tracker case indicates, a broad set of adjustments are made between rate cases to keep rates more current. The LRAM is just one part of that set of adjustments.

Second, the "regulatory lag" between general rate cases is part of the incentive structure that encourages business-like behavior on the part of the utility. If the utility's rates were automatically adjusted to reflect actual costs, including a return on investments, such cost-plus regulation would eliminate any incentive for the utility to minimize costs and improve service to customers. In that type of incentive setting, we would expect inefficient and inattentive behavior on the part of the utility. "Regulatory lag" provides incentives for utilities to try to "beat" the cost and revenue "targets" implicitly built in to rates. In the next general rate case, rates are adjusted to take into account actual costs and revenues, but utilities get to keep what has been gained through their entrepreneurial activity between rate cases.

The problem created by customer energy efficiency programs is that utilities are asked to do something that is not in their stockholders' interests. One would expect hesitancy, reluctance, and a general lack of enthusiasm for such activities and that is exactly what has been found among utilities. Rather than promoting the efficient use of energy, utilities have tended to aggressively promote the expanded use of electricity through a variety of programs. That is the incentive structure we would have in place without the LRAM. Adopting a regulatory mechanism that eliminates that disincentive to pursue cost-effective supply resources that benefit customers only removes one particular perverse disincentive.

The reference point in analyzing this disincentive is not the revenues upon which rates were set in the general rate case. Revenues almost always rise above that as a result of customer and load growth. The reference point is what the revenues would have been if the utility had not engaged in cost-effective customer efficiency investments. Effective customer energy efficiency programs do reduce utility revenues and profits relative to what they otherwise would have been if the utility did not have those customer efficiency programs. There is no getting around that fact.

The Commission has ordered NWE to treat cost effective customer efficiency programs in the same way it would any other resource that can help meet customers' loads. When the utility purchases conventional energy supply resources, its ability to recover T&D costs is not diminished in any way. That is not true when customer electric efficiency expenditures are used to help meet customers' loads. If the utility is being asked to treat demand-side and supply side resources in the same way, the incentive structure they face has to be symmetrical too.

Q. How large is this potential lost revenue problem for NWE?

A. For the residential class the average T&D charge per kwh was 3.4 cents in NWE's calculation of lost revenues for 2011-12.[2] The electric supply cost rate

[2] Recon-SBW-EXHIGIT_(WMT-3) Electric DSM Lost Revenues UPDATED final orig.xls, tab 7.Calc Lost Revenues, B158-9.

was 3.85 cents per kwh. With the Colstrip 4 and Dave Gates fixed costs added in, the electric supply rate was 6.0 cents per kwh. As a result, when consumption is reduced due to customer energy efficiency programs, the quantitative impact is similar to the utility not getting paid for a certain amount of the energy it purchased and supplied to a customer. For the commercial and industrial customers the T&D revenues are not quite as large, 2.2 cents per kwh, but still quite significant compared to the electric supply costs either with or without the fixed costs of owned-generation.

Q. How large are the actual lost revenues that NWE seeks to recover under the LRAM?

A. That depends on how many years there are between rate cases. During each rate case, the rates are adjusted to NWE's actual T&D and fixed generator costs and the actual level of electricity sales. As a result the LRAM adjustment is reset to zero and then begins building again as new investments in customer electric efficiency are made.

For the 2012-2013 tracker year NWE estimates lost revenues of $4.9 million associated with under-collected T&D revenues and another $3.5 million in under-collected fixed costs associated with Colstrip 4 and Dave Gates Station. For that tracker year NWE estimates total electric supply revenues will be $358 million. The lost revenues for the 2012-2013 tracker year represent about 2.3 percent of those energy supply costs.[3]

Q. How does the LRAM eliminate this disincentive to a utility for running customer electric efficiency programs?

A. It does not remove all of the disincentives because it applies only to energy efficiency measures directly put in place in customers' homes and businesses by utility programs. Efforts by NWE to generally raise awareness of the benefits of customer conservation efforts or efforts in support of building efficiency codes or appliance efficiency codes, etc. have no impact on the LRAM even though such efforts could play a more significant role in encouraging

[3] Prefiled Direct Testimony of Cheryl A. Hansen, p. 14 at 15; Supplemental Testimony of William M. Thomas, Ex_(WMT-5).

customer energy efficiency. Nor does the LRAM remove the disincentive the utility has to propose a more economically efficient rate structure such as inclining block rates.

The LRAM works by adjusting electric supply rates between rate cases through the tracker mechanism to reflect the projected decline in sales and fixed cost revenue collection associated with the direct utility investments in cost effective customer electric efficiency made during that time period. The cumulative energy savings and lost revenues from NWE efficiency programs put in place since the last rate case are also included. The lost revenues are treated the same way as other electric supply costs currently are in the tracker cases. Initially, the projected revenue losses would be used to set rates. The projections would be based on planned customer electric efficiency investments. The following year, those revenue losses would be "trued up" based on the customer electric efficiency measures actually installed. Every five years, an outside review of NWE's customer energy efficiency programs, such as SBW's in this case, is carried out to confirm or adjust the estimated energy savings associated with NWE electric efficiency programs, and those results are used to adjust the lost revenues collected by the utility over that five year period. When a general rate case takes place, the LRAM is reset at zero in each future tracker year hearing, the lost revenues from new electric efficiency investments are again calculated and accumulated until there is a general rate case.

Q. What are the strengths and weaknesses of the LRAM as a way to remove the disincentive to customer energy efficiency investments by the utility?

A. Some have argued that an LRAM is easier to understand than more comprehensive adjustments to eliminate the "throughput incentive" altogether by breaking the link between the volume of utility energy sales and the utility's revenues. The energy savings associated with the electric efficiency measure are simply multiplied by the utility's fixed costs per kwh that were embedded in the rates at the time of the last rate case. That is the lost revenue.

Leaving aside the fact that the link between sales and fixed cost recovery is not entirely broken so a disincentive for utility support and engagement on efficiency continues to exist, there are two potential weaknesses of LRAM approach. First, it could be argued that this arrangement provides a new perverse incentive. The best customer electric efficiency program for the utility under this arrangement would be a customer electric efficiency program that does not work at all. In that situation there would be no decline in consumption but the utility would get additional revenue. The more ineffective the customer electric efficiency programs were, the greater would be the benefit to the utility. The second weakness, closely related to the first, is that rates would be set on projected results with no true up based on actual results. Good regulation rarely approves of that type of arrangement.

Q. Can those potential problems with the LRAM be avoided?

A. Yes. The design of the LRAM agreed to by both NWE and the Commission avoids these problems. Both NWE and the Commission have insisted on regular critical evaluations of customer electric efficiency programs by an independent party that documents the actual impacts of the customer electric efficiency programs on electrical usage. These regular evaluations can be used to periodically true up the lost revenue adjustment based on the actual impact that the customer electric efficiency measures had on electrical usage. That is the purpose of NWE witness Thomas reconciling the LRAM adjustments in the five past tracker years with SBW's estimates of actual energy savings associated with NWE's customer electric efficiency programs. The records associated with the five past years of lost revenue adjustments indicate the assumed electric energy savings associated with each program each year. That can be compared to SBW's results and appropriate adjustments in the allowed lost revenues can be made both retroactively and prospectively. This arrangement solves both of the potential problems mentioned above. If the utility programs systematically did not work as planned, NWE's rates would be appropriately adjusted downward to get back the revenues (with interest) that were not actually lost in the previous periods. Revenue recovery would be tied to actual, not assumed, performance of the customer electric efficiency measures.

Q. Are there other ways to eliminate the “throughput incentive” that discourages utility investment in customer electric efficiency measures?

A. Yes. One would be to have general rate cases each year so that rates are adjusted annually to collect the authorized fixed costs. That, of course, is partially what tracker cases such as this and the inclusion of the LRAM seek to do. That, however, could be administratively costly for the Commission and other parties. In addition, it removes the positive incentives associated with regulatory lag.

Q. Are there other adjustment mechanisms that have been widely used to eliminate the “throughput incentive”?

A. Yes. As mentioned above, the LRAM only applies to specific customer electric efficiency programs that install particular technologies. The utility’s revenues are not protected from non-utility energy efficiency programs or changes in building efficiency or appliance efficiency programs. On the other hand, the utility can still enjoy the “windfall” associated with customer adoption of new energy using appliances. The “throughput incentive” continues to operate in other areas.

One way to eliminate that incentive for consumption and disincentive for energy efficiency is to “decouple” utility revenues from the volume of energy sold. In that setting the utility would be neutral with respect to increases or decreases in energy sales. The Montana Commission, with the support of the utility, twice adopted such a broader decoupling mechanism. Decoupling mechanisms have also been adopted in California, Washington, and Idaho, among many other states. In Montana the two experiences with decoupling were short lived for reasons not related to the potential for this mechanism to more closely align utility incentives with public policy.

Q. Have other proposals been made by utilities as to how to eliminate the “throughput incentive”?

Yes, NWE and, before it, the Montana Power Company (and other utilities around the nation) have pointed out that this problem can be solved by collecting the fixed T&D (and, potentially, *all* utility fixed costs) in a monthly, per customer, fixed charge. That way, fluctuations in usage would not affect collection of those fixed costs. Changes in the number of customers could affect the recovery of these costs, but the number of customers usually does not fluctuate widely from month to month or, even, from year to year.

If all fixed T&D and owned-fixed-generation costs were collected in monthly per customer charges rather than in usage charges, then declines in usage due to utility customer electric efficiency programs would not affect recovery of those costs and a lost revenue adjustment mechanism would not be needed. Utilities have actually labeled this as an alternative decoupling mechanism.

Q. Are you recommending high monthly fixed charges as a solution to the lost revenue problem?

A. Certainly not! I have strongly opposed such a rate design every time NWE consultants or Montana Power proposed it. The Montana Commission has also consistently rejected that type of rate design.

In the current context of encouraging utility and customer efficiency programs, the primary objection to high per customer fixed charges is that it reduces the reward or payoff to customers who reduce consumption. With a fixed revenue requirement in place, significantly raising the number of dollars collected in monthly fixed charges significantly reduces the number of dollars collected in usage charges. As usage charges fall, the number of dollars saved by adopting electrical efficiency measures is reduced. The incentive for efficient use of electricity and adoption of efficiency measures is reduced.

When the incremental costs of new electric supply are expected to be higher in the future than they were in the past, lowering the charges associated with the usage of electricity sends the wrong signal to customers. It suggests that electricity is getting cheaper when in fact it is becoming more expensive. When the environmental costs associated with electric generation are taken into account, the misleading character of reduced usage charges is even clearer.

There are other problems with high fixed per customer monthly charges that are unrelated to the incentives to use electricity efficiently. Such a charge particularly burdens small users who face a high monthly bill regardless of how much electricity they consume. Larger volume users, on the other hand, would face reduced bills. Although some parties in utility regulatory hearings often deny it, electricity consumption, like the consumption of most normal goods, rises with income. Lower income households, in general, use less energy because they live in smaller homes and own fewer energy consuming appliances. Higher income households, on the other hand, tend to live in larger homes and have a much more extensive stock of energy intensive appliances. Because of this, high monthly per customer charges tend to be regressive, burdening lower income households more than higher income households. That too is a relevant consideration in rate design.

8. SBW's Analysis of the NWE Customer Electric Efficiency Programs

Q. Can you define what the terms "freeridership" and "spillover" mean in the context of the SBW evaluation of NWE's customer electric efficiency programs?

A. SBW provided the following definitions (p. 859)

- "Free ridership: Energy savings likely to have occurred in the program's absence." The energy savings from a program would be reduced to account for this.
- "Spillover: Energy savings induced by, but not subsidized by, the utility's programs." The energy savings associated with the utility's programs would be increased to account for this.

Q. In your discussion above, you have often referred to the SBW evaluation of NWE's customer electric efficiency programs. You have cited the SBW results as indicating that NWE's efficiency programs have generated significant net benefits. But is it not true that that SBW ignored "free rider" and other problems that reduce the actual performance of energy efficiency measures below their engineering-based potential?

A. That is <u>not</u> true. SBW made significant downward adjustments from the theoretical expectations of the efficiency measures in arriving at its estimates of the actual energy savings that resulted from the various customer electric efficiency programs. That can be seen in the SBW Impact Result Tables.[4] For instance, across all five years, the electric savings from customer electric efficiency programs that were part of the electric supply portfolio were reduced by 10 percent. The adjustments ranged from reductions of 55 percent to increases of 21 percent as a result of SBW's program-by-program evaluation. For the multi-purpose USB programs, the electric savings were reduced 35 percent with a range from a 55 percent reduction to a 42 percent increase in measured savings.

In addition, SBW estimated both freeridership and spillover rates for the programs where they could carry out surveys of enough program participants to make the results statistically reliable . SBW's estimated free ridership rates are shown in Table 659 and its estimates of spillover values are found in Table 661. SBW points out that its estimates of freeridership rates were similar to the estimates in other studies but that there were few studies of spillover rates to use for comparison. (p. 859)

Q. But those same SBW Impact Result Tables have zeros in the columns that are labeled "Free Ridership Rate" and "Spillover Rate." Does not that indicate that SBW ignored these impacts on NWE's programs?

A. No, it does not.

SBW provides a twenty-page discussion of the accuracy of its own estimates of the free ridership and spillover rates as well as the conclusions other professional in the field have reached on the reliability of such estimates (pp. 859-881). SBW's conclusion was <u>not</u> that free ridership and spillover should be ignored but that taken together they tend to offset each other so that the sum of the two is close to zero. Put slightly differently, considering the accuracy of the measurement of these impacts, the range of reasonable values for the sum of these two impacts includes zero and a value other than zero cannot be assigned to that sum with any reasonable level of confidence.

Q. Why is it difficult to come up with a valid measure of freeridership and spillover effects?

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[4] NWE response to PSC-033d, February 2013, under the tab Portfolio Impact ####, where the #### represents each of the years studied or all of the five years combined.

A Consider the question we are trying to answer when measuring freeridership: What would a program participant have done with respect to installing particular energy efficiency measures if the utility program had not existed? The idea is that the energy savings that would have taken place anyway should not be attributed to the utility's particular program that supported the installation of that measure.

We seek to answer that question by interviewing a sample of utility program participants and asking them what they imagine they would have done if they had not received a subsidy, rebate, or free installation from the utility. This interviewing is done six months to several years after the efficiency measure was installed and the home or business has enjoyed its effects. In that setting we ask the participant to think back to before the measure was installed and imagine not having participated in the program and how they would have behaved. We are asking the participants to predict retrospectively what they would have done in the absence of the utility program.

The question is how valid and accurate the response to such a question is likely to be? Given that there is clear evidence that when program participants are called they cannot accurately report whether they participated in a utility energy efficiency program or whether they actually purchased an energy efficient appliance, the validity and accuracy of answers to counter-factual questions certainly is doubtful.

This is *not* to say that there is no such thing as freeridership in utility efficiency programs. There clearly is. Someone who is planning to install a particular energy saving technology may well approach the utility about a subsidy even though that person intends to proceed with or without the subsidy. The question is not whether freeriders exist but the *size* of that impact in the context of other adjustments such as spillover effects.

Q. Is the measurement of spillover effects any easier?

A. No, it is considerably more difficult.

Spillover is the impact of utility programs in influencing non-participants to install energy efficiency measures without any support from the utility. The approach to measuring it is again self-reporting, this time by non-participants. Since we are trying to evaluate individual utility programs the question we have to ask non-participants to answer is whether their decision to install a *particular* efficiency measure was affected by the *particular* utility program promoting the same action?

The longer a utility has run a diverse set of customer energy efficiency programs, the greater the likelihood is that customers will become aware of the fact that energy can be saved in a broad variety of different ways at significant savings to the household. One result of years of utility promotion of energy efficiency is that the population becomes more sensitive to the energy savings opportunities that confront them within their homes and businesses.

But the question that is asked of the non-participants is not whether a particular utility's efficiency programs or any utility's efficiency programs made them aware of energy efficiency potentials. Instead we seek to tie a *particular* measure to a *particular* utility promotional program. It is rare that anyone seeks to measure the overall effect of all utility energy efficiency programs over many years on the willingness of customers to finance and install energy efficiency measures by themselves without reliance on utility subsidies.

Q. Your description of the problems associated with measuring the spillover impacts of utility energy efficiency programs seems to mix up freeridership and spillover effects. Is that correct?

A. Yes. Utility energy efficiency programs over the years inform the population about a broad range of energy efficiency measures that they could install to reduce their energy use and save money overall. Those programs not only recruit participants at the time but also educate a much broader range of non-participants who may act on their own at some point in the future to install one or more of the measures the utility is promoting.

But participants in the utility's energy efficiency programs have also been educated about the benefits of energy efficiency measures. When after they have taken advantage of one of those programs, they are asked whether they would have installed that measure even if that measure had not been subsidized by the utility, they may well answer “yes” and be classified as a freerider whose energy savings should not be counted.

The problem is that spillover and freeriding are certainly linked. When we are measuring freeridership we may be measuring spillover effects but putting a negative sign on them. As a result, the two effects, one positive (spillover) and one negative (freeridership) tend to cancel out. What the net effect of the two together is is a matter of having valid and accurate measures of each one, but their interaction prevents that. In that complex setting, SBW’s professional judgment and that of other energy analysts was that the sum of the two effects cannot be shown to be different from zero.

9. Qualifications of Thomas Michael Power

Q. What is your current professional association?

A. I am a Research Professor and Professor Emeritus in the Economics Department at The University of Montana in Missoula, Montana. I am also a Principal in Power Consulting, Inc., an independent economic consulting firm.

Q. Please describe your formal education and training.

A. I received my Bachelor's Degree in Physics from Lehigh University in Bethlehem, Pennsylvania. I graduated with honors and Phi Beta Kappa. I was elected a Woodrow Wilson Fellow in national competition and attended Princeton University where I received my Masters and Doctoral Degrees in Economics.

I taught math and physics at Lehigh University and have taught economics at Princeton University, Lehigh University, and the University of Montana. I have been on the faculty of the University of Montana since 1968. I served as Chairman of the Economics Department from 1978 to 2007. In August 2007 I retired from University teaching and administration. My specialties are regional economics and resource economics.

Q. Have you testified as an expert witness before utility regulatory commissions before?

A. Yes. Since 1974 I have appeared many times before numerous federal, state, and municipal regulatory commissions.

I have testified before the Federal Energy Regulatory Commission, the Northwest Regional Power Planning Council, and the Bonneville Power Administration as well as before various congressional committees.

I have also testified before the utility regulatory commissions in the following states: Arizona, Colorado, Florida, Idaho, Indiana, Illinois, Kansas, Montana, Nebraska, Nevada, Oklahoma, Oregon, Texas, Utah, and Washington.

In addition, I have testified in utility cases before the City Councils of Seattle, Austin, and Spokane. I have also testified before the Snohomish County, Washington, Public Utility Board and the Springfield, Oregon, Public Utility Board. I have testified in State District Courts in Idaho, North Dakota, Oregon, and Montana and in Federal Court in Montana.

I have testified before the Montana Board of Natural Resources and the Washington Department of Ecology, and the Washington Energy Facility Site Evaluation Council on the siting of energy facilities.

I have served as lecturer at National Association of Utility Regulatory Commissioners' Technical Conferences and at annual conferences of the Mid-America Regulatory Commissioners and the Western Utility Regulatory Commissioners.

Since 1988 I served on the Montana Power Company Conservation and Least Cost Planning Advisory and Universal Benefits Advisory Committee until the Montana Power Company left the utility business. Since NorthWestern Energy Company took over the Montana Power distribution system, I have served on its Technical Advisory Committee and Universal Benefits Advisory Committee as well as its Natural Gas Technical Advisory Committee. For several years I also served on the Montana Regulatory Reform Working Group. In the past I have served on the Montana Governor's Citizens Advisory Council on Energy. More recently I served on the Governor's Energy Security Task Force.

Q. Have you done other studies dealing with energy economics?

A. Yes. In 1975, I received an NSF/RANN grant to assemble a team of economists, geologists, and energy technologists to study coal development in the Northern Great Plains. That study led to a series of almost a dozen reports, the final summary being published as ***Projections of Northern Great Plains Coal Mining and Energy Conversion Development 1975-2000 A.D.*** Several of the other papers dealing with defining coal markets and energy projection techniques have also been published.

Between 1976 and 1985 I conducted studies of the economics of alternative energy systems, transmission reliability, the applicability of the PURPA rate making standards to hydroelectric system "going thermal", utility avoided costs, optimal operation of storage hydroelectric facilities, development of electric utilities on Indian reservations, and the impact of energy facility development on local economic development. In 1995 ***Public Utilities Fortnightly*** published my article on "Making Sense of Peak Load Cost Allocations."

Q. Can you give examples of other studies have you done in the field of resource economics?

A. In 2007 Stanford University Press published a book I edited and contributed to entitled ***Accounting for Mother Nature: Changing Demands for Her Bounty*** (with Terry Anderson and Laura Huggins). In 2001 Island Press published ***Post-Cowboy Economics: Pay and Prosperity in the New American West***, which I co-authored with Richard Barrett. In 1996 two other books of mine were published. Island Press published ***Lost Landscapes and Failed Economies: The Search for a Value of Place***. M.E. Sharpe published ***Environmental Protection and Economic Well-Being: The Economic Pursuit of Quality.*** The latter book is the rewritten and updated Second Edition of ***The Economic Pursuit of Quality***, which was published by M.E. Sharpe, New York in 1988. In 1980 Westview Press published my first book, ***The Economic Value of the Quality of Life.***

I have also contributed two dozen chapters to various other books. Among the many articles and reports I have published are: "Public Timber

Supply, Market Adjustments, and Local Economies: Economic Assumptions of the Northwest Forest Plan," (***Conservation Biology***, 20(2):341-350, 2006), "The Economics of River and Wetland Restoration in the Vermillion River Basin," ***Great Plains Natural Resources Journal,***4(2), Spring, 1999, "The Wealth of Nature," ***Issues in Science and Technology***, National Academy of Sciences, Spring, 1996, "Economic Well-being and Environmental Protection in the Pacific Northwest," ***Illahee: Journal for the Northwest Environment*****,** 11(3 & 4), Fall-Winter, 1995, and "Urban Disamenities" ***Journal of Urban Economics***, June, 1981.

I have published papers on almost a dozen federal irrigation projects in the western states in addition to papers dealing with the value of in-stream flows for wildlife and recreational uses. I have testified before the State Board of Minerals and the Environment and the Oahe Conservancy Board in South Dakota as well as the Alberta Energy Resources Conservation Board and Natural Resource Conservation Board on topics related to resource development. I have also testified several times before various Canadian Federal Environmental Review Boards.

Q. Does that conclude your testimony?

A. Yes, it does.