Service Date: September 21, 1983

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

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In the Matter of the Montana Public Service Commission's Investigation of Montana-Dakota Utilities Company's Electric Rate Structure.	))))	UTILITY DIVISION DOCKET NO. 83.1.3 ORDER NO. 5010

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BACKGROUND

1. On October 20,1981, the Commission issued Order No. 4799c in Docket No. 81.1.2. This was the most recent general electric rate case filed by Montana-Dakota Utilities (MDU). The Company's existing electric rate structure resulted from testimony and exhibits filed in Docket No. 81.1.2.

2. Due to the substantial public interest in the impact of the resulting residential voltage level rate design, the Commission initiated the instant proceeding. The primary focus of this proceeding, however, is the impact of the resulting residential voltage level rate design on customers with electric space and hot water heating equipment, but without natural gas as a fuel substitute, e.g., the communities of Plentywood and Scobey.

3. In the instant proceeding the Commission shall reconsider the wisdom of the existing residential voltage level rate design. In addition, the Commission shall set forth the economic criteria for solar hot water heater resource acquisitions by the utility.

Residential Voltage Level Rate Design

4. In Docket No. 81.1 .2 the residential voltage level revenue responsibility of $6.6 million was established (see Order No. 4799c, Finding No. 56). This revenue responsibility equals about 78.3 percent of the residential voltage level marginal cost revenue responsibility.

5. The above revenue requirement is the binding constraint when designing residential rates: that is, rates must be designed so that $6.6 million in revenues are generated. To this end, the Commission balanced the objective of economic efficiency with concerns for fairness. The result was a two-step inverted block rate design featuring the following element:

Existing Rates

Energy:	
First 300 kwh/mo	5.56e/kwh
Over 300 kwh/mo	6.90¢/kwh
Minimum Bill	$2. 90/mo

6. The above initial block rate for 300 kwh/mo was designed to accommodate "essential" electric services where there exists no practical fuel substitute, e.g., lighting and refrigeration. The tailblock rate of 6.9¢/kwh was designed to reflect the incremental cost of power to this customer class. The minimum bill provision reflects the perception that each customer has an obligation to pay for billing and meter related costs. This rate design, however, melds billing and metering related costs with the energy and capacity costs.

7. The Commission examined the existing rate design, in lieu of a number of alternatives, and finds merit in a rate design that features a service charge in lieu of a minimum bill. The Commission finds that a $2. 0 per month service charge shall be tariffed. It should be noted that this $2. 0 charge is significantly lower than the $8. 96 Marginal cost Customer charge resulting from MDU's testimony in Docket No. 81. 1.2; the $2.0 charge is also one-half the customer charge rate proposed by the Montana Consumer Counsel in the same docket (see Finding Nos. 47 and 59 respectively of Order No. 4799c). The following illustrates the new residential voltage level rate elements:

New Rates

Energy:	
First 300 kwh/mo	5.17¢/kwh
Over 300 kwh/mo	6.41¢/kwh
Service Charge	$2.00/mo

8. The above energy rates are simply the existing scaled back so that the combined elements -- energy and service charge -- still generate $6.6 million in revenues (the actual energy rates may deviate slightly from the above rates).

9. The Commission notes that, to the extent the new tail-block rate of 6.-41¢/kwh approximates the marginal cost per kwh in MDU's next electric rate proceeding, that the initial block

(first 300 kwh) and the service charge will likely be increased to meet the residential voltage level revenue requirement.

10. The effect of the above rate design change varies with the level of monthly consumption. An electric space heating customer with monthly consumption between 5000 and 10000 kwh will experience an approximate 6.5 percent reduction in the monthly bill. At a level of consumption of 700 kwh per month the reduction is about 2.6 percent. Consumers with less than 500 kwh consumption per month will experience a slight increase in their monthly bills.

11. It is worth noting that the Commission's analysis of alternative rate structures was quite revealing. Regardless of what rate design structure is focused on, a residential customer with 10000 kwh of consumption per month -- not untypical of some customers with electric space heat -- is going to experience a large bill; of the ten alternative rate designs the Commission analyzed, no bill would have gone below $550. 0 per month. Furthermore, the Commission would note that, in Order kilo. 4799c the initial block rate for the first 300 kwh was to provide for the essential needs of "...all residential customers, irrespective of age or income level." That is, the Commission did not adopt a "lifeline" like rate structure that benefits only a portion of the residential voltage level customer class. Finally, the Commission would emphasize that the new residential rate design preserves the fundamentals of ratemaking philosophy: the new rate design reflects the objective of economic theory (the tail-block rate approaches long-run marginal costs) and the concern for fairness (the nominal service charge of $2.00 moderates actual cost estimates identified by both the Company and the Consumer Counsel).

Long-Run Resource Acquisitions: Energy Conservation and Solar

12. The Commission finds that the cause of high electric bills for certain residential customers is not the existing rate design. As indicated above, a residential customer with electric space heating and/or water heating is going to experience a large monthly bill regardless of the rate design. The Commission finds that two solutions to this problem include increased energy conservation and use of solar energy. These solutions provide an opportunity to mitigate the impact of the economically based rate design. In addition, these solutions do not deviate from a resource acquisition policy of acquiring only cost-effective resources.

13. The Commission has consistently endorsed cost-effective conservation programs as a means of holding down a utility's revenue requirement and consequently customers' rates. To the

extent there exists economic potential for residential energy conservation in MDU's Montana electric jurisdiction, the Commission finds that the utility should expand its conservation efforts.

14. The Commission finds, however, that the utility should not constrain its resource acquisitions to energy conservation but should include cost-effective solar hot water heating investments. To this end, the Company shall perform the below described analysis for a pilot solar hot water heating program (for the communities of Plentywood and Scobey).

15. The Commission finds that such a pilot program does not conflict with the Company's existing zero-interest loan programs: the utility should only include cost-effective resources in lts resource plans. According to the Company, however, there exists negligible energy conservation potential in the communities of Plentywood and Scobey. It Is uncertain to the Commission, however, that there does not exist cost-effective solar hot water heating potential in the above communities. While the Company's analysis in this regard is laudable (late filed Exhibit No. 3), the Commission finds an in-house study for a single collector design to be unnecessarily limiting. Different collectors will no doubt have different performance (engineering-efficiency) ratings.

Microeconomic Analysis[1]

16. The Commission seeks information on whether it is economically efficient to install solar hot water heaters in place of acquiring new thermal resources to satisfy a portion of the

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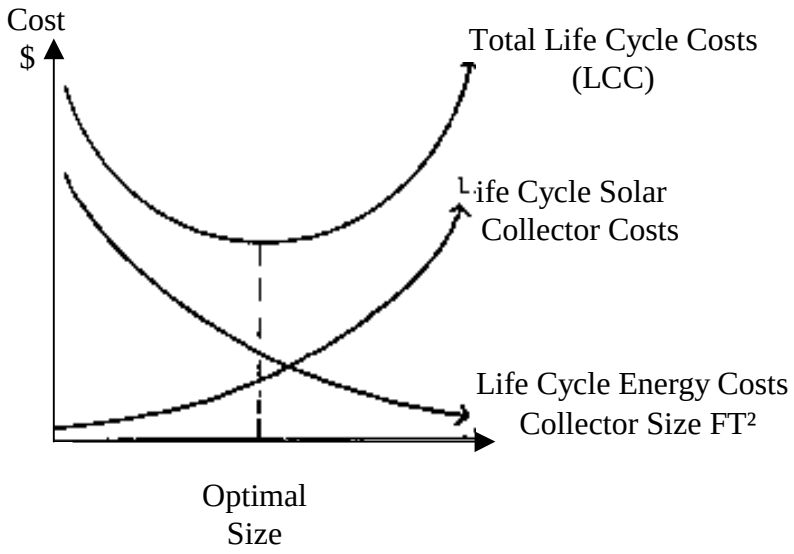
[1] Two useful references for this analysis include: J. Douglas Balcomb et al., Passive Solar Design Handbook, Volume Two of Two Volumes: Passive Solar Design Analysis, Prepared by the Los Alamos Scientific Laboratory for the U.S. Department of Energy. DOE/CS-0127/2. January, 1980. Also see Rosalie T. Ruegg and G. Thomas Sav, The Microeconomics of Solar Energy in a publication by Dr. Jan F. Kreider and Dr. Frank Kreith, Solar Energy Handbook. 1981. McGraw-Hill Book Company.

Company's future power needs. If it is: economically efficient, then the Company should install cost-effective solar hot water heaters. The communities (within the city limits) of Plentywood and Scobey shall serve as the pilot projects. for this purpose.

17. In general, the information required for this analysis falls into two categories. First, engineering data on collector performance will be required; that is, how efficient is a particular collector in converting diffuse incident solar radiation into useful hot water? Also, what fraction of a residential customer's total hot water heat load can be provided by various sized collectors? Secondly, economic data on collector costs -- initial and operating -- is required for a particular manufacturer's collector. There also exists a requirement of an analysis of optimal sizing relative to load. Ultimately, one desires to compare the total life cycle costs of a solar hot water heater system with electric back up, for an optimally sized collector, to the total life cycle costs of just the conventional hot water heating system. The following figure illustrates this concept:



18. The upward sloping line, from the origin, indicates the rising total life costs of the solar collector -- initial and annual recurring -- as the collector size increases. The. downward sloping line reflects declining total life cycle energy. costs, for just the conventional hot water heater, as collector size increases. The U-shaped life-cycle curve is the summation of the above two cost curves, and is necessarily a function of the hot water load; that is, the optimal size of a solar collector

will vary with the size and efficiency of the existing hot water system which in turn depends in part on the size of the household. To avoid either a shortage or excess capacity of solar collector area the actual area should be optimally sized and not simply assumed .

19. The Company is directed to develop the life-cycle cost (LCC) model depicted in the above graph. A general algebraic equation for the LCC model is:

(1) LCC = P - S + M + E where,

P = the initial solar collector purchase and installation cost;

S = salvage value at the end of the solar collector life,

M =- recurring maintenance and repair costs for the solar collector and electric back up system;

E = energy costs for operating the electric back up system at the optimal solar collector size;

LCC = the total present value (constant $;) of the values for variables P, S, M and E.

20. In estimating equation [1] above the Company should exhaust all cost components, including: taxes (federal, state, property and credits), insurance, capital and installation, O&M and fuel.

21. The following should be noted regarding the LCC model. The variables M and E will escalate over time. In addition, because the future value of variables M and E must be present valued, a discount rate is required; The Company is directed to use its incremental cost of capital for this purpose. All cash flows must be in constant dollars and the discount rate in real terms respectively.

22. The LCC model developed by MDU shall allow for variations in input parameters, that, for example, derive from variations in collector costs, performance ratings and estimated lives.

23. The Company must base its decision to finance the customer purchase of a solar hot water collector on the following analysis:

[2] $LCC_1 \begin{matrix} > \\ \sim \\ < \end{matrix} LCC_2$

where,

LCC_1 = the life cycle cost of operating the electric hot water heating system without any solar backup

LCC_2 = is as estimated from equation [1] above.

Note that, in equation [2] above, the current Commission tariffed avoided cost rate shall be the basis of power costs in computing LCC1 and LCC2. (Future values of avoided cost rates shall be obtained from escalating variables e, f, h and k of the Commission's existing long-term avoided cost energy component. [See Appendix B of Order No. 4865.] Escalation rates shall in turn be the Company's best current estimates.) If LCC2 is less than LCC1, it is evident that the solar heating system with electric back up is the least cost alternative.

24. It is the Commission's intent that each and every residential dwelling with electric hot water systems, in the two communities, be retrofitted with a solar hot water system if cost-effective and, of course, subject to the customer's willingness to participate. The above LCC model must be structured to accommodate the varying characteristics of each customer's dwelling (See Finding No. 22 above). The choice of solar collector manufacturer/installer shall remain with the customer; the Commission, however, contemplates utility assistance in this decision i.e., the provision of technical information .

25. The Commission contemplates initial utility financing of the solar hot water systems. Customers shall in turn be required to pay back the utility capital investment, with no interest. It is left to the utility to determine which of the following two options shall be the basis for utility cost recovery: 1) rate base treatment or 2) identical treatment as occurs under the Company's existing zero interest loan program; the objective in this decision, however, should be to minimize ratepayer costs. The buy back period will vary with each customer and should be based on the anticipated savings to the customer i.e., a payback basis. With either financing option the Commission is concerned with the artificial constraint of a ceiling on loans made to customers: the amount of a loan should clearly vary with the size of a household. The Commission intends to leave to MDU the setting of a ceiling on the loan amount. The Commission advises MDU that it will carefully scrutinize any ceiling established.

26. To avoid duplication of effort, the Commission encourages MDU to consult with the following organizations/agencies in this endeavor. 1) The Montana Department of Natural Resources and Conservation (DNRC). The Planning and Analysis Bureau of DNRC has developed a performance and economic model for analyzing solar hot water heating; 2) Fowlkes Engineering

(Bozeman, Montana), with the support of DNRC, has compiled solar data for the state of Montana. Two other organizations are possible sources of solar collector data: 1) American Refrigeration Institute (Arlington, Virginia) and 2) Solar Rating Certification Corporation (Washington, D.C.). Finally, the Mechanical Engineering Department at Montana State University (Bozeman, Montana) has established a test facility for purposes of analyzing the performance of various types of solar collectors. For a lengthy list of solar hot water collector manufactures, collector costs etc., see the August, 1983 issue of Solar Age (pp. 32-35).

CONCLUSIONS OF LAW

1. Montana-Dakota Utilities Company is a "public utility." 69-3-101, MCA

2. The Commission has the statutory authority to supervise, regulate and control public utilities. 69-3-102, MCA

3. Utilities are required by statute to render "reasonably adequate service and facilities" at "reasonable" and "just" rates. 69-3-201, MCA

4. The rate level and rate structure approved herein are just, reasonable, and not unjustly discriminatory. 69-3-330, MCA

ORDER

IT IS HEREBY ORDERED that:

1. MDU shall submit tariffs and supporting workpapers implementing a $2. 00 service charge and rates in conformance with Finding of Fact Nos. 7 and 8.

2. MDU shall develop the LCC model and perform the analysis described in Finding of Fact Nos. 16 through 25. In addition, the Company shall develop payback and cost recovery methods in compliance with Finding No. 25. Results of these studies shall be reported to the Commission within 90 days of service of this Order. The report shall include all input assumptions used in the LCC model.

3. Upon reporting to the Commission, MDU shall proceed to install solar hot water heating equipment in residences meeting the criteria set forth in Finding of Fact Nos. 22 and 23, and in conformance with the standards described in this Order. The Company shall file quarterly progress reports with the Commission.

4. MDU is directed to include a bill insert, describing the pilot hot water program, in each monthly bill to customers in Plentywood and Scobey.

Done and Dated this 19th day of September, 1983 by a vote of 5-0.

BY ORDER OF THE MONTANA PUBLIC SERVICE COMMISSION.

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THOMAS J. SCHNEIDER, Chairman

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JOHN B. DRISCOLL, Commissioner

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HOWARD L. ELLIS, Commissioner

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CLYDE JARVIS, Commissioner

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DANNY OBERG, Commissioner

ATTEST:

Madeline L. Cottrill
Secretary

(SEAL)

NOTE: Any interested party may request the Commission to reconsider this decision. A motion to reconsider must be filed within ten days. See 38.2.4806, ARM.