



State of Wisconsin \ PUBLIC SERVICE COMMISSION

August 17, 1978

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FILE NO. 05-EP-1



To The Party Addressed:

In the Matter Of:

Advance Plans for Construction of Facilities
as Filed with the Commission for Review and
Approval Pursuant to Section 196.491, Wis. Stats.

We enclose certified copy of Findings of Fact, Conclusion of
Law and Order issued in the above-entitled matter.

Very truly yours,

Lewis T. Mittness
Lewis T. Mittness
Executive Secretary

LMH
Encl.

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DATE MAILED

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BEFORE THE
PUBLIC SERVICE COMMISSION OF WISCONSIN

Advance Plans for Construction of Facilities
as Filed with the Commission for Review and
Approval Pursuant to Section 196.491, Wis. Stats.

FINDINGS OF FACT, CONCLUSION OF LAW
AND ORDER

This order is the first promulgated by this commission
pursuant to the Power Plant Siting Law, Chapter 68 Laws of 1975.

The law and the implementing regulations of the commission
require each electric utility to file with the commission an
Advance Plan which includes, among other things, the utility's
forecast of energy and peak demand requirements over the next
20 years, plans for the construction of proposed generating
facilities over the next 15 years, plans for the construction
of proposed transmission facilities over the next 10 years, and
an analysis of alternatives to the proposed generation and
transmission facilities.

The law permits the filing of joint plans by two or more
utilities. The electric utilities in Wisconsin formed two groups
for the submission of joint Advance Plans in 1976. One group,
known herein as the Wisconsin-Upper-Michigan System ("WUMS"),
includes the following utilities serving the eastern two-thirds
of Wisconsin: Madison Gas and Electric Company, Wisconsin Electric
Power Company, Wisconsin Power and Light Company and Wisconsin
Public Service Corporation. The other group, designated for the
purposes of this proceeding as the Western Wisconsin Utilities
("WWU"), includes: Cooperative Power Association (a Minnesota
cooperative), Dairyland Power Cooperative, Lake Superior District
Power Company, Northern States Power Company (Minnesota), Northern
States Power Company (Wisconsin) and Superior Water, Light &
Power Company.

COMPARED WITH AND CERTIFIED BY ME
TO BE A FULL, TRUE, AND CORRECT COPY
OF THE ORIGINAL ON FILE IN MY OFFICE

05-22-36 1 1978

Louise T. Mitchell

Executive Secretary
Public Service Commission of Wisconsin

The Wisconsin Upper Michigan Systems (Wisconsin) (WUMS) group and the Western Wisconsin Utilities (WWU) group each submitted its first advance plan under s. 196.491(2), Wis. Stats., in July of 1976. An environmental assessment of the plans was issued by the staff of the commission in January 1977. Both plans were subsequently amended; WUMS submitted a revised plan (exhibit 12) in March 1977, and WWU submitted a revised plan (exhibit 125) in February 1978. The WUMS plan was further revised in oral testimony, and the staff evaluated the revised plans in testimony and exhibits.

Public legislative hearings on the plans and assessment were held in March and April, 1977, in La Crosse, Eau Claire, Hayward, Milwaukee, Oshkosh, Green Bay, Wausau and Wisconsin Rapids. In all, 78 days of both legislative and adjudicatory hearings were held, and the record consists of more than 13,000 pages of transcript and 190 exhibits. Major issues which emerged in the course of the proceeding included the status of future nuclear generating capacity in Wisconsin, the establishment of appropriate reserve levels for utility systems, and the role of strategies other than capacity additions for meeting needs for power.

Apart from the two utility groups, which participated in all phases of the proceeding, many members of the public appeared and commented. Active participants in the adjudicatory phase of the hearings included Safe Haven, Northern Thunder, Wisconsin's Environmental Decade, Citizens for a Better Environment, Friends of the Earth and the Sierra Club, representing various public interest points of view. A full list of appearances is attached as Appendix A.

The commission has wrestled at length with this unwieldy record and the briefs of the several parties and has carefully considered the policy issues involved. In recognition that this is the first plan, and that subsequent orders will be built upon its foundation, the commission has made the following findings of fact, conclusion of law and order.

Findings of Fact

THE COMMISSION FINDS:

1. The Western Wisconsin Utilities (WU) have proposed to construct one 1100-MW nuclear unit near Durand, Wisconsin, known as the Tyrone Energy Park to be completed in 1985.
2. The Wisconsin-Upper Michigan System utilities (WUMS) proposed the following generating capacity additions:

<u>Year of Construction Start</u>	<u>Year of Completion</u>	<u>MW</u>	<u>Type</u>	<u>General Location</u>
1976 Unit 1	1980	580	Coal-Steam	Pleasant Prairie Power Plant in Kenosha County
1976 Unit 2	1982	580	Coal-Steam	Pleasant Prairie Plant
1978	1979	213	Combustion Turbine	Germantown Plant in Washington County
1978	1982	300	Coal-Steam	Weston Unit 3 in Marathon County
1979	1983	400	Coal-Steam	Edgewater 5 in Sheboygan County
1980 Unit 1	1984	400	Coal-Steam	unsited at present
Unit 2	1985	400	Coal-Steam	unsited at present
1980 Unit 1	1987	900	Nuclear-Steam	Haven Nuclear Plant in Sheboygan County
		50	Combustion Turbine	
Unit 2	1989	900	Nuclear-Steam	Haven Nuclear Plant
1982	1986	300	Coal-Steam	unsited at present
1983	1984	50	Combustion Turbine	undetermined
1985	1986	50	Combustion Turbine	undetermined
1986	1990	300	Coal-Steam	Juneau-Adams County
1986 Unit 1	1992	900	Nuclear-Steam	undetermined
Unit 2	1994	900	Nuclear-Steam	undetermined
1987	1991	600	Coal-Steam	Ozaukee County
1989	1993	300	Coal-Steam	undetermined

This WUMS plan has been modified twice during the proceeding, and is likely to be further modified to accommodate changing forecasts. For instance, it now seems probable that the WUMS utilities may drop one of the 1984 or 1985 coal plants which were originally proposed for the Koskonong site and are presently unsited. Exhibit 12, submitted by WUMS in March 1977, gives these plants as sited at Koskonong.

3. Any analysis of the appropriateness of a system generation expansion plan depends on reasonably accurate forecasting of the demand for power on the system. A total of 19 separate forecasts using diverse methods has been submitted to the commission in this proceeding. There are at least two forecasts for each utility involved. Neither WUMS nor WWU submitted coincident forecasts of demand on the planning group system, nor was any statewide coincident forecast developed. For future advance plans, the commission will require both coincident forecasts for each planning group, and the group's planned response to demand growth which is either higher or lower than forecasted.

Rather than adopting any of the offered forecasts, the commission has chosen to accept a reasonable range of projected growth in demand and to direct the utilities as to how to adjust their planned reserve margin if growth approaches one end of the range or the other. This consideration of probable growth predictions in conjunction with system planning seems to the commission a reasonable way of dealing with the unavoidable uncertainties of long-term forecasting, the uncertainties of which were attested to by all parties who addressed forecasting issues.

Of the forecasts provided, the most recent predictions for WUMS, on an approximately coincident basis, ranged from a low of 3.2% average annual growth through 1988 to a high of 3.9%. The commission accepts this range as reasonable for planning purposes, and will permit the WUMS utilities to plan on 15% of coincident demand as a reserve margin if projected demand growth approximates 3.2% and a 14% reserve margin if growth approximates 3.9%. This policy corresponds to a range of total installed 1988 generating capacity from 9647 MW to 10,316 MW.

This range of capacity would require the authorization and construction of between approximately 1600 MW and 2300 MW of generating capacity not already constructed or authorized. These amounts contrast with 3130 MW most recently proposed in the advance plan. A revised schedule for specific plant capacity additions is not being specified herein.

Increased consumption of electric energy, especially during summer peak periods by residential, commercial and industrial customers, causes the projected need for these power plants even after reductions in projected peak demands are included for the effects of load management, time of use rates, interruptible rates, conservation, and efficiency improvements. The effect of these demand-reduction measures was estimated to range from 920 MW to 1023 MW. The power plants required due to projected increased consumption of electrical energy during peak periods are a major contributor to increases in electric rates.

Based on the information available at the present time, the commission would not be performing its function to insure a reasonably adequate supply of electric power if it did not allow the utilities to plan on the basis of the installation of this capacity.

At the same time the commission will continue to monitor very closely the response of the people of Wisconsin to the rate structure reforms already implemented or being developed, to the load management programs soon to be implemented, and to the energy situation in general. The commission will modify the utilities' construction programs if the public's reduction in load is greater than expected. Any further construction program reductions would be expected to slow the rate of increase in future electric rates from the rate which would otherwise occur.

Forecasts for WWU ranged from an annual average growth rate of 1% through 1988 to a rate of 4.7%. The commission does not find this range reasonable for planning purposes, but will allow the WWU to plan on an annual average growth rate range for western Wisconsin between 3 and 4%, and a 15% western Wisconsin coincident reserve margin. This rate was chosen because of peculiar circumstances surrounding the WWU plan. The only capacity addition the WWU propose in this planning period is Tyrone Energy Park Unit 1. The question of need for this plan will be thoroughly explored and determined in the certification proceeding, docket no. CA-5447. Consequently, the commission will allow the WWU to assume a 3-4% growth rate for planning purposes; this rate neither excludes nor compels the Tyrone project. The need for Tyrone will have to be demonstrated separately, on its own merits.

The individual utility forecasts offered in this proceeding by the utilities, staff, and others vary as to methods and assumptions employed. All of them depend on assumptions and judgments which materially affect the outcome, and most of these assumptions and judgments are open to legitimate question as to their appropriateness and validity.

A summary of the various forecasts follows:

Peak Demand Forecasts for the Wisconsin Utilities (MW)

	<u>WUMS</u>		<u>WWU-(Excluding SWL&P)</u>	
	<u>Utility</u>	<u>SPERCA*</u>	<u>Utility</u>	<u>SPERCA</u>
1978 summer	6147	5992	5575	5517
1978 winter	5637	5426	5120	4997
1982 summer	7191	6680	7026	6104
1982 winter	6634	5755	6198	5335
1985 summer	8103	7465	8133	6650
1985 winter	7645	6397	7113	5750
1988 summer	9049	8389	9378	7291
1988 winter	8758	7276	8081	6391

*Systems Planning, Environmental Review & Consumer Analysis Division of PSCW.

Forecast methods submitted in this proceeding are principally simple trending, Box-Jenkins intervention analysis (a more sophisticated kind of time-trending), end-use analysis, and econometric modeling. Each of these methods has its own strengths and weaknesses, and each is more likely to produce accurate forecasts under some conditions than under others. Consequently, the commission has determined that all are useful forecasting tools and may be used in future advance plans. None of them, however, is so distinctly superior to the others as to warrant requiring any utility to use it.

A description of the salient features of each of these methods follows:

Trend fitting models and univariate Box-Jenkins models are models which use only past data and/or time as input variables. The application of these models to forecast future levels of energy demand and peak load is based on the fundamental assumption that the future will be an extension of the past, and that there will be no significant structural changes in the system being forecast. It is necessary, therefore, to modify the forecast to reflect expected changes in, for example, fuel availability and price level because these factors might affect the future differently than they affected the historical period modeled.

Rapid and significant changes in the national and Wisconsin energy system which occurred following the oil embargo clearly indicate that the fundamental assumptions underlying the formulation of trend-fitting models are questionable.

Box-Jenkins intervention analysis is a sophisticated mathematical technique for incorporating significant changes in the historical period and predicting their effect on future trends. The method does not, however, assign a cause to the changes, and correlations between sharp changes in the trended data and social or economic events in the real world must be

drawn with great care, and with reference to data outside the model, such as various indices of industrial activity. It is also necessary to adjust the forecast for expected changes that have no historical counterpart. For instance, the effect of the expected introduction of significant amounts of load management on a system which had not had any load management prior to the time of the forecast would have to be predicted by an adjustment outside the mathematical model. This is true for any of the methods used in this proceeding.

End-use, or component, or system analysis models belong to the class of capital or appliance stock models. In this formulation electricity demand is derived first through the estimation of the existing stock of electricity consuming appliances and second through the prediction of the future growth in the level of appliance saturation.

In order to estimate future levels of electricity-consuming capital stock, one needs data on the past and current size of appliance stock and its vintage. In addition to adjusting the electricity-consuming stock, households and businesses, in the short run can adjust the utilization rate of the existing stock without altering its size. Knowledge of the past changes in the appliance stock size, as well as past changes in the level of stock utilization, is necessary to derive the forecast of future energy demand based on the end-use formulation.

The compilation of the requisite amount of data of consistent reliability is a continuing and major problem with end-use models. On the other hand, end-use modeling is the only forecasting method used in this proceeding which is based on disaggregate customer behavior in the affected service territory. It also utilizes sensitivity analysis, in which the forecaster can change his/her subjective view of the future with comparative ease.

Econometric models are based on multivariate regression analysis. Causal relationships are hypothesized between energy demand and those socio-economic and demographic factors which are responsible for energy use. These are then tested statistically and various parameters are estimated.

In an econometric model, demand for energy is assumed to depend on the overall level of economic activity and demographic factors. The model must be modified to incorporate policy decisions which are not incorporated in past data, such as rate reform, or it can include different scenarios for utilization of new energy forms or load management, if these variables can be incorporated into the variables which the model uses.

Econometric forecasts directly address the fact that demand for electricity is derived demand which depends, among other factors, on price of electricity, price of substitutes, and income. They do this by incorporating predictions of such factors as population and economic growth, saturation of appliances and price elasticity of electric demand. These forecasts depend on the accuracy of the predictions of the indicators they incorporate, and also on their appropriateness for the service territory in question.

Statistical models based upon trend analysis assume that the future will be like the past. The Box-Jenkins method used in this Advance Plan increases the statistical importance of the most recent past in these forecasts. Trend models do not specify a structural (causal) relationship between explanatory variables and dependent variables.

Econometric models formally specify such structural relationships. These models can be simultaneously estimated. Forecasts assume that the structural model will remain unchanged, but variations in the levels of the explanatory variables can be

considered in a simultaneous manner. This means that the future is assumed to be less dependent on the past than the statistical trend models.

End-use models are even less dependent on the past, since under these models the entire structural relationship can be varied, along with variations in the projected levels of the explanatory variables.

The reasonableness of alternative forecasting methods must be judged on the basis of each one's ability to produce accurate forecasts. There are advantages in having several forecasts for one utility using different methods. Data limitations and other constraints affect the feasibility of implementing some methods for some utilities.

The price and availability of electricity, as well as other energy, have been relatively stable until recently. Past usage therefore may not serve as a basis for estimating future usage without some consideration of changing price level, tariff structure, and availability of fuels. In this advance plan, the commission directed the utilities to consider several prospective changes. Specifically, the commission directed quantification of the effects on future load growth of (1) conservation, (2) conversion from natural gas, (3) load management, (4) rate structure reform, and (5) improvements in end-use efficiency.

In this proceeding, conservation has been defined for forecasting purposes as the reduction of load by voluntary methods. Various past responses to the oil embargo, the ensuing conservation movements, and, in general, all altruistic efforts at conservation are included in this definition.

The most likely forms of load management in the near term are residential water heater control and interruptible tariffs for large users. These strategies appear to be cost-justified at this time, and should be accounted for in forecasts. Other

applications--for example, control of residential and commercial air conditioning--may prove feasible and are being tested.

If gas and oil shortfalls are expected, an estimate must be made of the impact of those shortfalls on electricity demand. Forecasts of gas availability have changed dramatically during these proceedings. WEPCO and NSP have recently reduced demand forecasts due in part to the projected increase in the availability of natural gas. The potential impact of changing gas and oil availability on electricity demand suggests close, ongoing scrutiny of this factor.

Rate structure reform includes the impact of time-of-use pricing, interruptible and other load-management tariff forms. Because there is little history on which to build elasticity estimates for these rate forms, estimates of impact are generally judgmental until actual data from current experiments and implementation become available.

End-use efficiency improvement estimates quantify improvements in energy utilization, building codes, appliance performance standards and conservation policies. Pending legislation at both the state and federal levels will affect estimates of impacts for this category.

4. There has been in this record a large amount of debate on the most reasonable method of planning system reserves. The utility witnesses have recommended using a simple numerical reserve margin. The commission's System Planning staff has strongly recommended the use of probabilistic measures of system reliability. For the purpose of authorizing capacity additions for this first advance plan, and recognizing the forecast uncertainties which underlie the whole planning process at this time, the commission has decided to utilize numerical reserve margins for determining appropriate capacity additions.

However, the commission recognizes that it is charged with insuring reliable electric service, and that the degree of reliability of service is measured by the probability of being able to meet or not meet demands for service. Thus reliability of service is inherently a question of probability and probabilistic methods are necessary for measuring reliability. The underlying policy involved is that as relative growth rates increase and as the associated increased plant construction cause faster rate increases it is in the consumer's interest to accept a slightly less reliable system, rather than increased costs.

The commission is not convinced of the appropriateness of the high reserve margins recommended by Mid-America Interpool Network (MAIN) and Mid-Continent Area Reliability Coordination Agreement (MARCA) which, as voluntary reliability associations of utilities, have no direct responsibility to the Wisconsin consumer. Therefore, the utilities will be directed to provide the commission with cost-benefit analyses of different reserve levels in the next advance plan. Because the Tyrone application will probably be processed before review of the next advance plan has been completed, the WWU are directed herein to submit a similar analysis in the Tyrone proceeding.

If the WUMS and WWU in western Wisconsin project future demand growth rates toward the low end of the range found reasonable above, they may plan on the basis of a reserve margin of 15% of coincident demand. Faster rates of growth will be planned for on the basis of a smaller reserve margin as directed herein.

5. An issue was raised in this proceeding regarding the desirability of using small coal-fired generating units (100-400 MW) rather than units larger than 400 MW. The smaller units tend to be more reliable, but also are more costly per unit of capacity. An equally reliable system can be maintained with a slightly lower reserve level if smaller units are utilized,

due to their smaller size and increased reliability. The degree of reserve reduction made possible by the use of small generating units depends on the size mix of the existing system, the size of the system involved and the amount of additional generating capacity added in small-size units.

The potential advantage of lower reserve levels and the advantage of more readily matching generation additions to load growth patterns and local generation requirements must be balanced against the disadvantages of higher costs per unit of capacity, and of a requirement for the installation of more generating units. The commission found neither the arguments for the exclusive use of large units nor the arguments for the exclusive use of small units to be compelling on this record. The issue of the preferable unit size will be considered in individual certificate cases and in future advance plans.

6. WUMS and WWU each presented a plan which included additional nuclear generating capacity. Intervenor and utilities presented markedly different information concerning the addition of further nuclear capacity with respect to cost, safety, health effects, decommissioning costs, possible future unavailability of fuel, and the lack of available storage and permanent disposal for nuclear wastes. On the basis of this record, the commission declines to make a finding as to the safety or health effects of nuclear generation. These matters will be considered in the upcoming Tyrone and Haven applications. The record made in this docket regarding safety or health effects of nuclear generation shall be incorporated into those proceedings. The examiner, the staff and the parties shall be directed to make every effort not to duplicate what was incorporated from this docket, and to propose and consider only significant new information or significantly changed circumstances.

The commission determined that nuclear generation is likely to be more costly than coal (in terms of total fixed, fuel and operating costs) when considering present uncertainties in fuel, decommissioning, and waste disposal costs.

The commission's finding that coal-fired generation is likely to be more damaging to the environment than nuclear generation did not weigh heavily enough to change the commission's resolution of the "coal vs. nuclear" issue.

The questions of safe and available storage for nuclear wastes, methods and cost of decommissioning and availability, and cost of nuclear fuel in the long term are matters of significant concern. These uncertainties are serious enough to lead this commission to suspend the planning or application for new nuclear capacity other than Tyrone I and Haven I. These two plants are already into the certification process, and will be considered individually, each on its own merits in its own docket.

A discussion of the various aspects of the "coal vs. nuclear" controversy as it developed on this record follows.

There is a wide range of views in this record concerning the relative economics of nuclear and coal-fired generation. These views range from nuclear power's being much less costly than coal to coal's being much less costly than nuclear, and include the view that it is impossible to tell. The WWU found nuclear power to be always less costly than coal. The WUMS utilities and their consultants found nuclear generation less costly under certain assumptions and coal generation less costly under other assumptions. The commission staff found nuclear generation less costly under certain assumptions and coal generation less costly under other assumptions. Intervenors and their consultants uniformly found coal generation to be less costly than nuclear.

The commission finds on this record that coal-fired generation is likely to be less costly than nuclear generation, when considering the existing uncertainties as discussed herein regarding fuel supply, waste disposal, and decommissioning costs. A summary of the various coal vs. nuclear cost comparisons is attached as Appendix B to this order.

From this record, there is no environmentally benign way to generate bulk electricity. While effects from low level radiation and thermal degradation of water attendant on nuclear generation concern this commission, the commission considers that the air pollution, solid waste, and water quality problems caused by coal-fired generation are a more serious threat to a quality environment. Adverse health effects and biological damage may occur at levels of pollutants which are below existing standards.

The nuclear fuel issue of supply/demand imbalances is influenced by federal policies, which affect mining, milling, enrichment, reprocessing, the breeder, federal uranium requirements (military), growth in generating capacity, environmental constraints, and the availability of domestic and foreign uranium. Uncertainties exist in each factor; however, the record clearly indicates that the net effect could tend to increase the price of nuclear fuel.

The reliability of domestic uranium resource estimates is questionable. The reliability of these estimates decreases with increasing forward costs and with more speculative resource categories; the most reliable category (\$15 forward cost proven reserves) is estimated to an accuracy of ±20%.

The record indicates that the incremental lifetime uranium requirement for the Carter Administration's goal of 180,000 MW of nuclear power by 2000 would require producing

all domestic "proven reserves," "probable resources," and one half of the "possible resources" available at less than \$30 per pound U₃O₈ forward cost as currently estimated by the Department of Energy. It is imprudent to expect that large quantities of low-cost domestic uranium will continue to be discovered and developed. Shortfalls in the availability of domestic uranium for any reason would be expected to cause increased reliance on foreign uranium. Significant shifts to increased use of foreign supplies could also result in artificially high uranium prices or production limits set by actions of producing countries.

Uranium production (mining and milling) capability can also be limiting, at least in the short-term, because it is determined by the availability of manpower and equipment, environmental constraints, construction lead times, economic conditions, and total resource base.

Some utilities with nuclear plants built or planned are making efforts to resolve some of these fuel supply uncertainties by acquiring or attempting to acquire uranium reserves or rights to reserves to directly satisfy all or part of their long-range needs. The success of these efforts, however, is also uncertain and, to the extent buyers are competing for a fixed supply, could also tend to increase prices.

Although the sharp increase in uranium prices in recent years might offer an economic incentive for increased short-term production, the uncertainties of a practical long-range commitment to increased nuclear generation in this country might discourage investments in uranium exploration, due to the financial risks to the uranium producer during the long lead time required to bring a new mine from planning to actual production. Due to this time lag, it is not certain whether a dynamic balance will be attained between market prices and supply.

The commission concludes that the uncertainties at this time as to supply of nuclear fuel at a reasonable cost, together with other uncertainties named herein, are serious enough to militate against committing this state during this period of uncertainty to amounts of new nuclear capacity beyond that approved herein for planning purposes.

Facilities for disposal of radioactive spent nuclear fuel on a permanent basis are not available at this time. There is no reprocessing facility presently operating in this country, and the federal government, concerned about proliferation of nuclear weapons, has announced a policy of indefinitely deferring reprocessing until and unless the proliferation issue is resolved. Spent fuel from existing plants is presently kept in temporary storage pools, mostly on the site of the reactor which produced it.

Wisconsin utilities which operate nuclear plants have applied for permission to expand their on-site pools, but this is a temporary measure, not a solution to the permanent disposal problem. While the federal government is committed to and has embarked on a program for developing storage and permanent disposal facilities for nuclear wastes, there is no federal guarantee that permanent disposal for spent fuel will be available at any given future date, or that when it is made available, its cost will be reasonable.

The problems associated with permanent disposal of spent nuclear fuel are both technical and social. There is public and political opposition to nuclear waste disposal sites, and a lack of existing laws and regulations governing storage and disposal. Although federal government and other technical reports indicate that the technology for permanent disposal is or can be

developed, intervenors point to a lack of demonstrated waste disposal technology. Virtually all testimony concurred that federal policy regarding nuclear waste management has been indecisive, tardy, not responsive to the industry, and lacking in execution.

When existing plants were constructed, it was planned and predicted that spent nuclear fuel would be reprocessed, with resulting monetary value, for future use in the nuclear industry. As it became obvious in the mid 1970's that spent nuclear fuel would require storage for indefinite periods at significant costs, and would not be reprocessed to yield monetary salvage value the commission provided for inclusion of estimated future costs in the recorded costs of nuclear fuel during the burn-up period in the reactor. Accordingly, the amount included in operating expense for nuclear fuel during the period that such fuel is in the reactor generating energy includes the expanded costs for uranium, fabrication, processing and storage up to the time of placement in the reactor, and the potential cost for indefinite storage after the spent fuel is removed from the reactor.

Thus, in operation of the Point Beach plant fuel storage costs now include approximately 7.4¢ per million BTU for future estimated storage costs. Approximately \$29,000,000 has been provided up to this point in time for storage of expended fuel. The provision to date appears reasonable when compared with Department of Energy indications as to potential charges for permanent storage of such fuel.

Until the time that such funds for storage generated in rates for electric service are expended, the amount thereof is utilized as a reduction of net investment rate base. As a

result, the consumer is receiving a reduction in revenue requirement equal to the current economic cost of such capital, which is in the range of 15-17%.

Another uncertainty which cautions against further commitment to nuclear capacity is that relating to the method and cost of decommissioning plants at the ends of their useful lives. Federal policy as to this aspect of nuclear planning has been indecisive and inadequate. The technology for several methods of decommissioning exists and has been utilized for several smaller nuclear facilities.

The projected costs for the different methods of decommissioning vary considerably. In addition, potential problems of scale associated with the most comprehensive method of decommissioning (complete dismantlement, removal, and burial of all potentially radioactive plant components) adds additional uncertainty to the projected cost of decommissioning if that method should be required by future federal policy.

This commission, under statutory provisions, prescribes annual depreciation rates for various classes of public utility plant used by Wisconsin electric utilities in providing service. Annual depreciation rates are determined on the basis of estimated service lives, plus recognition for salvage value upon retirement of facilities and estimated cost of removal to be incurred upon retirement. Accordingly, it is necessary and proper that the commission, in prescribing annual depreciation rates for generating plants, including nuclear, give consideration to the cost of removing such facilities and potential salvage values when plants are no longer available for producing energy. Decommissioning costs for nuclear plants thus are recognized in the prescription of annual depreciation rates for the two nuclear facilities under

jurisdiction of this commission.

Although service lives, salvage, and cost of removal are based on informed judgment for practically all classes of depreciable property, the problem of estimated salvage and cost of removal for nuclear facilities is made more difficult by the lack of national policy as to an acceptable decommissioning method. At the present time prescribed depreciation rates, to be reexamined in the near future, for Kewaunee Plant include a cost of removal or decommissioning provision equal to approximately \$37 per kW of capacity. Currently, the commission is giving consideration to a recertification of annual depreciation rates for the Point Beach Plant which would include a provision for decommissioning costs within a range of \$45 to \$61 per kW of capacity.

On the basis of analysis, it appears that this commission is further advanced than any other State or Federal regulatory commission in the recognition of potential nuclear plant decommissioning costs for financial, accounting and rate-making purposes.

The regulatory aspects of cost of removal recognition for all classes of depreciable property are further complicated by the fact that both Federal and State income tax statutes presently provide that removal costs of depreciable plant are deductible for income tax purposes when actually expended rather than as provision in annual depreciation rates during the useful life of the property.

In recent months, a Wisconsin legislative council committee has considered the accounting and financial problems associated with decommissioning of nuclear power plants in Wisconsin. The

commission has furnished comprehensive data to support such legislative analysis and on various occasions has appeared before members of the group. Proposed legislative action may result from this committee.

In the face of these uncertainties, the commission finds that a commitment to new nuclear capacity beyond Haven I and Tyrone I would be imprudent. Haven and Tyrone have been in planning for some years, and Wisconsin utilities have made significant predecisional commitments to these projects. Because of the environmental advantages of nuclear power and the existing commitments, the commission will only consider Haven I and Tyrone I, each on its own merits in the certification proceedings.

However, on this record, it becomes apparent that Tyrone I will require a substantial showing of need to be found necessary and convenient to the Wisconsin public. The question of the local need for the proposed Tyrone plant in western Wisconsin depends on the growth rate of demand for electricity in that area. The commission believes that a reliable demand forecast for that area which projects a growth rate of more than 4% per year would tend to demonstrate sufficient need for this new capacity. A reliable forecast showing a growth rate of less than 3% per year would require a demonstration of substantial direct economic or environmental benefit to the Wisconsin consumer. A growth rate between 3 and 4% per year would require the demonstration of substantial direct economic or environmental benefit to the Wisconsin consumer from participating in a system which is shown to benefit from the project.

7. Co-generation has potential for increasing the efficiency of energy use in Wisconsin. The industrial co-generation of electric energy appears to provide more potential for improving energy efficiency than utility co-generation of steam. Process steam appears to be economical if sold on an interruptible basis. Economic usage of utility co-generation seem to depend on the simultaneous availability of a high load factor plant and a nearby high load factor, high volume user of low-temperature energy. The utilization of waste heat is another promising option.

8. Load management, whether it be of the time-of-use pricing variety or the regulating end-use variety, can serve as an alternative to capacity additions. It also may be used to conserve scarce fuels such as oil and gas, either by deferring electrical energy use from peak periods to off-peak periods or by directly substituting off-peak electricity for oil and gas in otherwise non-electrical uses. The commission is committed to the implementation of load management. It is proceeding on this basis in other dockets, and has, therefore, recited peak demand estimates in this proceeding.

9. The development of alternative sources of energy has potential for improving the Wisconsin energy situation. There is a wide range of views in this record concerning the economics of alternative sources of energy. However, given the lack of coal, oil, gas, or uranium in Wisconsin, it is important to continue to investigate other energy sources. Wisconsin does have sun, wind, municipal refuse, wood, and other bio-mass material. Use of these and other alternative sources for energy production, at both the utility and individual level, has a potential for helping to stabilize energy costs and reduce environmental degradation. It is appropriate for Wisconsin utilities to become more involved in the exploration and utilization of these alternative energy sources.

10. The programs offered in these advance plans to discourage inefficient and excessive use of electricity are limited in scope and direction. However, the commission takes note of some of the programs that are actually being pursued at this time. The commission is vigorously pursuing load management and time-of-use pricing. It will be analyzing the effects and implications of various types of institutional advertising in rate cases. It is also conducting a proceeding, 05-EI-1, which will analyze the effect of building codes, extension rules and other conservation measures on electric usage.

11. The research programs offered in these advance plans are limited in scope and direction. A major research effort of most of the utilities is their contributions to the Clinch River Breeder Reactor project. Given the reduced commitment to nuclear energy in this order, and the likely abandonment of the project, it is imprudent for Wisconsin utilities to make further contributions to it. The commission and utilities are at this time pursuing research programs, in addition to those offered in these plans, which are more appropriate. It is apparent that, since future Wisconsin electric generation will rely principally on coal, research efforts should be made toward burning coal in an environmentally acceptable manner. Programs designed to explore utilization of alternative energy sources and fuels, utilization of waste products and waste heat, and methods of controlling load are also appropriate and should be pursued. The commission recommends that funds planned to be used on breeder research be diverted to these and similar ends.

12. The WUMS transmission plan has been designed to support a generating system which includes generating plants at Lake Koshkonong. The present generating system plan does not include a plant at Lake Koshkonong. The transmission plan is also based on forecasts which have since been revised downward. These developments will be addressed in the applicable certification proceedings and future advance plans.

13. During the course of this proceeding it became apparent that some of the alternative generating and transmission plans proposed by the utilities were not actually feasible because of scheduling constraints. The requisite site analysis could not be done in time to put the proposed plant on line, or the appropriate licenses could not be obtained for transmission lines. The commission is very concerned that this situation should not recur in future plans and will direct the utilities to ensure that all alternative plans offered are equally feasible at the time of decision on the plans.

14. The foregoing Findings of Fact may appear to emphasize (and so it is intended) efforts to minimize unnecessary future load growth and thus reduce the amount of generating plant and transmission line construction necessary. The resulting benefits in terms of reduced environmental impact and lower rates (than otherwise) from such a course are rather obvious. The commission also remains mindful of its responsibility under the statutes of assuring that all Wisconsin customers (residential, farm, commercial and industrial) are provided adequate and reliable service for their present and projected needs. The advance plans as approved herein are consistent with the furnishing of reasonable and adequate service to the public.

Ultimate Findings of Fact

THE COMMISSION FINDS:

1. That the addition of capacity to result in a total system size ranging from 9,647 MW to 10,316 MW by 1988 is reasonable for the WUMS system. This range of capacity was determined by adding to the 1988 range of WUMS summer peak demand forecasts found reasonable (and listed on page 5) a 15% reserve level for the lower forecasted demand, and a 14% reserve level for the higher forecasted demand.

2. That no forecast offered for the WWU in this proceeding has been shown to be reasonably determinative for planning purposes, but that since only one plant is planned for the planning period by this group, the showing of need for the Tyrone plant may be litigated in the certification proceeding, docket no. CA-5447, under the general guidelines described in paragraph 2 of this order. The commission finds a total system growth rate of between 3 and 4% to be useful for planning purposes on the WWU system, while recognizing that individual substation growth rates as required for transmission planning may well be above or below this range. This range neither precludes nor mandates the Tyrone project.

3. That no forecasting method submitted to the commission in this proceeding is overwhelmingly superior to any other. The commission made use of diverse methods in deriving a forecast for WUMS, and thereby modified the proposed plan.

4. That a reserve margin of 15% of coincident WUMS group demand is reasonable for planning purposes if the demand growth rate projected approximates 3.2% per year, and a 14% reserve margin is reasonable if the growth rate approximates 3.9% per year.

5. That the present uncertainties in the nuclear fuel cycle regarding waste storage and disposal, uranium availability, reprocessing, and decommissioning costs make it contrary to the public interest for Wisconsin utilities to commit themselves at this time to a large program of future nuclear expansion. No new applications for nuclear generating plants, other than Tyrone I and Haven I, will be accepted until such uncertainties are resolved to the satisfaction of the commission.

6. That the programs offered in these advance plans to discourage inefficient and excessive use of electricity are not adequate, and further, do not reflect the actual programs being pursued by the utilities and the commission in other proceedings.

7. That the research programs offered in these advance plans are not adequate, and further, do not reflect the actual programs being pursued by the utilities and the commission in other proceedings. Specifically, it is not in the public interest for Wisconsin utilities to make further contributions to the Clinch River Breeder Reactor project in view of its likely abandonment and in view of the commission's findings on continued planning for nuclear generation, supra.

8. That alternative sources of energy are potentially valuable and that it is in the public interest for the utilities to become more involved in the development and implementation of such sources.

9. That this record is inadequate to determine whether planning for future planning periods should be done on a coordinated basis between the WUMS and WWU groups.

10. That a range of pollution control techniques for fossil-fired generating facilities should be considered in any proposal to construct such facilities, including best available control technology.

11. That the WUMS transmission plan will have to be revised due to the change in the site for the previously-proposed Koshkonong coal plant, and also due to forecast reductions since the plan was submitted.

12. That meaningful selection of site alternatives in these plans has not been possible due to licensing and construction time constraints, and that this restriction of the commission's options is inappropriate and must be avoided in the future.

13. That the plans as herein modified provide for a reasonably adequate supply of electric energy to meet the needs of the public during the planning period.

14. That a reasonable effort has been made to coordinate the advance plans with plans and policies of other agencies.

15. That the WUMS transmission plan is reasonable, with the exception of time changes in the transmission plan associated with forecast reductions since the submission of the original advance plan, and with the exception of changes associated with the relocation of the formerly proposed Koshkonong coal plant.

16. That the WWU transmission plan is reasonable, with the modification that the transmission alternative discussed in staff testimony shall be included as an alternative to be further investigated in the appropriate certificate proceedings.

17. That the WUMS generation expansion plan (exhibit 12), as modified to exclude nuclear capacity other than Haven I and to redesignate the previously proposed Koshkonong coal plant as unsited at present, and subject to the modifications in paragraphs 1 and 4 above, is in the public interest considering engineering, economic, health, safety, reliability, efficiency and environmental factors and alternative methods of generation or sources of supply.

18. That this record is not adequate to determine whether the WWU plan is or is not in the public interest considering engineering, economic, health, safety, reliability, efficiency and environmental factors and alternative methods of generation or sources of supply.

Conclusion of Law

THE COMMISSION CONCLUDES:

That it has jurisdiction pursuant to s. 196.491, Wis. Stats., and Chapter 68, Laws of 1975, to issue the following order; and that the following order should issue.

Order

THE COMMISSION THEREFORE ORDERS:

1. The WUMS utilities may continue to plan on adding generating units in such a way as to provide between 9,647 MW and 10,316 MW of capacity in 1988. In planning for this range of capacity additions, the WUMS utilities are to plan on a reserve margin equal to 15% of coincident demand for the planning group if the growth rate of demand projected approximates 3.2% per year, and a 14% margin if the growth rate approximates 3.9% per year. The utilities are, within this expansion range, directed to plan so as to maximize reliability and minimize cost.

2. The WWU are directed to bring in a showing in the Tyrone certification case, docket no. CA-6447, of either:
(1) reliable coincident demand projections which predict a growth rate in excess of 4% per year in western Wisconsin; or
(2) reliable coincident demand forecasts for western Wisconsin which predict a growth rate of less than 3% per year and also a convincing demonstration of direct substantial economic or environmental

benefit to the Wisconsin consumer from continued participation in the project; or (3) a reliable showing of a coincident demand growth rate in western Wisconsin between 3 and 4% per year and of substantial direct economic or environmental direct benefit to the Wisconsin consumer from participating in a system which is shown to benefit from the project. Without at least one of these three showings, the Tyrone application will be denied.

3. All utilities filing advance plans for the next planning period shall include a cost-benefit analysis for a range of system reliability levels. All utilities filing plans for the next planning period shall also include an analysis of the projected effect year by year of their proposed and alternative generation plans on average prices per kWh throughout the planning period.

4. The WWU shall present support (including a cost-benefit analysis) for their proposed reserve level or reliability level in the Tyrone proceeding. The analysis shall include:

a. Consideration of the ability of seasonal power exchanges between winter- and summer-peaking utilities.

b. Justification for a 15% noncoincident reserve margin (which roughly equates to approximately a 20% reserve margin above 1985 coincident system demands) as proposed when WUMS and MAIN have maintained adequate reliability using approximately a 15% reserve margin above coincident demands.

c. A quantification of any increase in oil consumption which may be caused by a reduction in reserve policy to approximately 15% above coincident WWU demands.

5. No nuclear generation shall be planned or applied for with the exception of Haven Unit I and Tyrone Unit I until reasonable progress--satisfactory to the commission--has been made in resolving waste disposal, fuel supply, and decommissioning issues. Any utility which desires in the future to incorporate in its advance plan nuclear plants beyond the two mentioned above shall submit to the commission a petition documenting those changes from the present situation which demonstrate such progress. After appropriate investigation, the commission will rule on the petition based on its view of the then-current situation.

6. All utilities shall proceed with the implementation of feasible load-management strategies as soon as possible.

7. All utilities shall promote the utilization of alternative sources of energy by the consumer by proposing rate structures in future rate cases and other appropriate means. The utilities shall investigate and adopt reasonable alternative generation strategies.

8. No Wisconsin utility shall provide research funds to the Clinch River Breeder Reactor project. Funds proposed in the 1976 plans to be so allocated shall be reapplied to research on coal-fired generation by environmentally acceptable means, such as, but not limited to, fluidized bed combustion, techniques for cleaning coal before combustion, and utilization of scrubber wastes. No funds for the Clinch River Breeder Reactor project shall be included as a recoverable item in future rate cases.

9. In proposals for the construction of fossil plants, all utilities shall provide a cost analysis of technology required to meet applicable pollution control standards, a cost analysis of technology required to arrive at control of pollution equivalent to the state of the art, and a cost analysis of an option between these extremes which the utility judges to be most cost-justified. The above information shall be provided regarding air pollutants, waste disposal, noise emissions and waste-water treatment facilities.

10. All utilities shall file in their next advance plan an analysis of the costs and benefits of coordinated planning for future generation additions between WUMS and WU. This analysis shall include the costs and benefits assuming no additional transmission ties, and also the cost and benefits assuming the transmission system is reinforced as necessary to maximize planned reserve sharing capability in the future.

11. Each planning group which offers a combined plan in future planning proceedings shall develop a coincident forecast for the group, and shall submit alternative plans which specify which capacity additions will be deferred or omitted if actual growth in demand is less than that forecasted, and contingency plans which specify the options available if actual growth in demand is greater than that forecasted.

12. The utilities shall develop and submit sufficient site data, pursuant to ss. PSC 111.24 and 111.26, Wis. Adm. Code, early enough so that, at the time of commission decision on the advance plan submittal, all alternatives are equally feasible with regard to facility design and construction lead times.

This order represents the first direct involvement of the public and their appointed representatives in long range planning of electric generation and distribution facilities. Our decision is a consensus. Our decision addresses most of the concerns expressed by the public and other interested parties. While we went further than some may have expected, others will think we have gone not nearly far enough. Since it is the first such plan for Wisconsin we felt we must be cautious. This conclusion was reinforced by the fact that the second advance planning process begins in a short six months. The utilities and public have a right to know why I supported our conclusions, and what this means for the future. Therefore, I will attach my thoughts in this concurring opinion.

Forecasting

Only about five years ago, when I was still intervening before this Commission on rate design, I can recall staff and intervenors alike calling for the development of an independent forecasting capability. During that period electricity consumption was growing at about seven percent per year and electric utility generation and transmission capacity doubled every decade. Forecasts were nothing more than "self-fulfilling prophecies." Plants were built, promotional advertising and pricing were practiced and load management was ignored or abandoned. This vicious cycle meant that electricity consumption kept pace with plant expansion so that forecasting seemed unnecessary. In any case it was strongly argued that forecasting was a utility management decision.

The philosophy of the early seventies is gone. The Commission, Legislature, intervenors and even the utilities have rejected it. I see this first advance plan, with its forecasted growth rates of about one-half the earlier trends, as only the first step in the process. Now that we have the capability of an independent staff forecast, which in this case was compared to each utility's forecast, I believe we should take the evolutionary process even further in future advance plans.

Three changes seem appropriate:

- * In the next advance plan, I believe the staff should forecast using each of three methods (econometric, engineering and Box-Jenkins). Utility analysts and intervenors should have access to staff working papers, data and assumptions. Differences related to the underlying assumptions should be the basis of the hearings.

Differences on methodology and data should be placed in the hearing file as technical information. If staff capability in the three forecasting areas mentioned is weak, the next advance plan could substitute utility experts under this same format. This first plan should make it clear that disagreements over forecasts do not make a useful record. It is Commission judgment, using a record based upon what we believe to be an art, rather than a science, that is determinative. Forecasting percent rates of growth should not, therefore, take up similar hearing time nor be as hotly disputed as in the recent record of this proceeding.

- * Forecasting and system planning must be considered interdependently. In this first plan we permitted the eastern utilities to submit independent forecasts. However, coordinated system planning and construction are practiced by the eastern utilities to keep costs down. Since

the supply side is considered as a single system, future forecasting demand must be made for the combined eastern utility system.

* Load management, reduced reserve requirements and time of use pricing are means being pursued to hold down costs and reduce environmental impacts. In this first plan these matters were considered. But their direct meaning for forecasting was treated too superficially. Future advance plans must therefore incorporate these policy matters more completely in the forecasting exercise.

Reserve Margin

The record in this proceeding addressed various issues related to reserve margins and system reliability. Among issues considered were simple percent reserves, loss of load probability, small versus large plants, fuel diversity, interstate reliability council requirements. In the end the Commission reached three conclusions.

* For approving advance plan forecasts simple percent reserves were more useful than these other issues.

* The other policy questions that were mentioned above should continue to be addressed in future advance plans and used for establishing system reliability. The most useful form of these considerations would be as specific policy questions.

(For example, should Wisconsin utilities consider the concerns of neighboring states and reliability councils when determining capacity requirements?)

* Carrying reserves is like buying insurance. But just as generation and transmission is growing more expensive, so is reliability insurance. I believe that if higher rates of growth

are observed in the future we must reduce our insurance costs by reducing reserves. This order begins that process for the eastern utilities, but the concept must be more completely understood and pursued in the next advance plan.

Generation

The simplest conclusion I reached in the advance plan was coal fired electric generation was economically superior to nuclear when the costs of waste storage, decommissioning and the uncertainty of fuel availability are considered.

Coal is also a problem if we rely on it for electricity in its conventional form. The environmental health effects of coal are quite serious. My second conclusion was that coal fired electric generation is environmentally inferior to nuclear.

Our environmental staff and the environmental intervenors concentrated so much of their energy on the nuclear versus coal issue that there was a serious deficiency in the treatment given the pollution effects of conventional coal fired electricity generation. I had hoped that the utilities might take up the cause playing coal's environmental problems off against nuclear's economic ones. While there was some reference that nuclear was environmentally preferred, it was too shallow and general to be useful.

It is my intention to address the full consideration of coal and its environmental health issues in the next advance plan. I believe the Department of Natural Resources, our own staff, utilities and intervenors alike should take up this consideration in AP II with the same intensity that the nuclear debate received in AP I.

What tilted my decision to join my colleagues in banning new nuclear applications in Wisconsin until the federal government resolves nuclear fuel availability, waste disposal and decommissioning is two and a half decades of broken federal promises and a desire to avoid economic catastrophe if the federal government continues to promote nuclear with unnecessary siting laws, unrealistically strong endorsements and its own incredible inaction. I am pleased that Wisconsin now joins California, Iowa and Maine in laying the nuclear burden upon Washington, where it has belonged for almost three decades.

As for the specific nuclear plants for which applications have been filed, I retain full discretion to decide on the merits of each in their individual certificate of authority cases. The public deserves to know that I believe the need-related burden of proof, which we have placed on the proponents of Tyrone, is nearly insurmountable. However, with tens of millions invested, I am willing to give the western utilities the chance of convincing me and making their case that this plant is in the public interest of Wisconsin.

With respect to Haven, since it will now be restricted to one unit, the utilities themselves may request a change. Absent that, Haven, in my opinion, has several major regulatory steps to overcome. I have voted to keep it alive as an option for two reasons. First, money was spent in good faith by the utilities under a set of rules which this advance plan has now changed for new nuclear applications and plans. Second, as stated, I believe that coal fired plants have significant environmental impacts. I could not go any further in the case of Haven I at this time. For Wisconsin, even with increased

conservation and increased use of renewable energy systems, power plants must still be added and nuclear and coal are the only economically viable options. Under these conditions, there will be more opportunities ahead to consider these issues, and I shall take them. Also to be considered in determining the ultimate need for Haven I is the expected reduced eastern utility forecasts and the proposed construction of the coal fired Weston III, Edgewater V and Pleasant Prairie II.

System Planning

A. On the "small versus large" coal plant issue I was not convinced that the case for rejection at this time of either base or intermediate load coal from either an economic or environmental perspective was made. This does not mean that I reject the analysis. Far from it. I now believe we have a basis to question plant size as proposed by utilities, and they in turn now know what tests of acceptance their proposals must pass.

B. Load management and time of use pricing are economically and environmentally cost effective. This Commission leads the nation in vigorously pursuing both. However, I do not believe that the advance plan is the time to over-promise or over-claim progress. We have to do more and we will do more. We will make this progress in individual rate cases. Future advance plans should do more to relate load management and time of use pricing to forecasts, and to compare the costs of these tools to the cost of new generation and transmission.

For this advance plan I believe we should reject saying too much about load management and time of use pricing and instead take up the matters currently before us with vigor and

enthusiasm. One of our state's leading intervenors has recently received a grant to bring load management more vigorously to the Commission's attention. I supported that grant and relish the thought of an informed debate on this subject.

While not related to load management and time of use pricing, several other issues that were raised in the advance plan should get similar separate rate case treatment:

- * Institutional advertising
- * Provisions for nuclear waste disposal from existing plants
- * Accounting for decommissioning costs of existing nuclear plants.

The first principle of utility accounting should be that beneficiaries of service should pay those costs related to that service. Therefore, storage and decommissioning costs should be paid by current ratepayers. We do, unlike most states, collect such costs in current rate cases in Wisconsin. The dollars collected are used to reduce rate base and will thus be available in the future. The Internal Revenue Service has indicated it believes such assessments should be taxed as income. We shall continue to lobby in Washington to change the IRS. Based upon the evidence in the advance plan it appears current decommissioning cost estimates are too low and should be increased. Future rate and depreciation cases are the best places to make these adjustments. I plan to support them at that time.

C. Electricity has not received the same consideration as natural gas in Wisconsin with respect to building codes, types of heating sources, extension rules, etc. These matters are to be addressed in a separate proceeding (05-21-1), and therefore will not be considered in this first advance plan.

D. Some of the less informed political activists in this country are incredibly misinformed concerning the promotion of renewable energy systems such as solar, heat storage and wind generators. They are opposed to any utility involvement in these "pure" energy systems by the "big, dirty, ugly utilities." In my opinion, excluding utility involvement means that homeowners and industries that choose solar or wind must be prepared to pay for both systems as though they were independent.

Involving the utilities in solar and wind financing, promotional tariffs, load management using remote control, and similar efforts, will mean that these new forms will have a chance to penetrate the market. Keeping utilities out will keep solar and wind systems from achieving their full potential. I do not believe we must "monopolize" the sun or the wind to make such systems viable. Instead, I believe that the private sector should compete with utility systems in the same way they did in the past on electric and gas appliances, and as they will in the future for telephone wiring and primary instruments (i.e., a telephone). However, keeping electric, and when available, gas utilities from promoting and selling solar, wind, heat storage and insulation packages is bad energy, environmental and economic policy.

In subsequent rate cases I intend to pursue this issue for specific utilities. In the meantime, I shall lobby both the current Presidential administration and the U.S. Congress to keep them from excluding utilities from the renewable energy future.

E. The Clinch River Breeder reactor was never a good project. It was not justified on economic grounds, and it was

a technology that would increase the specter of nuclear weapons proliferation. The President has opposed that project, and he now seems to have been given by Congress the power to end it. Under such circumstances I do not believe Wisconsin utilities should put any additional ratepayer money into that project.

F. With my above stated concerns with respect to the health related aspects of coal fired electricity generation, I support the use of the best available pollution control technology. The Department of Natural Resources has agreed to give us a report on the environmental effects of both the minimum permit requirements, as well as more stringent systems up to the best available control technology. This is a practical way to share responsibility between the PSC and DNR and to gain the most from our limited staffs. My own personal vote is for the B.A.C.T. in all cases, regardless of cost, unless there are offsetting environmental damages associated with such systems as contrasted with minimum permit requirements. Specific cases will soon let us know whether this cooperative agreement can work.

Conclusion

I never thought much of the art of planning. I still don't. But other than the name, the advance plan is a useful policy review. I believe it has brought the public into a domain that for too long was exclusively that of utility management. At that same time it has clarified for utility management the beliefs, biases and future intentions of the Commission.

I believe all interested parties have gained from this experience. I hope that our second advance plan, beginning in early 1979, will continue the evolutionary process and that public input to such far-reaching matters can be increased even further.

Charles J. Cicchetti

Charles J. Cicchetti
Chairman

APPENDIX A

Appearances:

State of Wisconsin Department of Business Development
 Wisconsin State AFL-CIO
 Wisconsin Upper Michigan Systems (WUMS)
 Wisconsin Power & Light Co.
 Wisconsin Electric Power Co.
 Western Wisconsin Utilities
 Dairyland Power Cooperative
 Wisconsin's Environmental Decade, Inc.
 Citizens for a Better Environment
 Friends of the Earth, Inc.
 Wisconsin Farm Bureau Federation
 Kieran Powers
 Darwin Schendel
 Howard Eastoupil
 Edward Ausderau
 Alex Nelfestun
 John Walek
 Jim Scholtz
 Lavern Cass
 Earl Jaeger
 Quinn Johnson
 Robert Bonnewell
 Alan Kopan
 Robert Dalaney
 Boyd Stymiest
 West Central Wisconsin Regional Planning Commission
 James K. Richardson
 Victor J. Andrew
 Wayne Gossman
 Will Fantle
 Meta Gannon
 John Brent
 Robert Ross
 Roy Dahl
 James Mason
 Jim Weingart
 Robert J. McAlelwain
 Duane Crank
 Larry Weber
 R. T. Evans
 James C. Michal
 Harold Johnson
 Gordon Olson
 Richard Creaser
 Ellen Asaneqko
 Dick Marx
 Donald Somsen
 Jack Lee
 Ron Pember
 Victor Peterson
 Charles Veient
 Norm Busse
 Harold Kringla
 Chuck Aubert
 Elmer Nelson
 Herb Schmidt

Appearances (continued)

Tom Laddy
 Edward Elliott
 William Maki
 Wendelin Schaefer
 Jean Reid
 James Schaefer
 Nicholas Ricci
 Edward Klossig
 Marguerite Tirk
 Jean Schmitt
 Lee Schmitt
 JoAnn Lortz
 Mrs. Judy Miller
 Don Belleau
 Carol Wieland
 Lee Schwalenberg
 Kathleen M. Schuette
 Sonia Schmitt
 Carl Hujat
 James M. Olsen
 William Buedingen
 William Dohr
 Town of Rudolph
 William W. Tolley
 Michael Hittner
 Terry Testolin
 Mrs. Cornelia Groshek
 Mrs. Shirley Siefert
 William Hoekstra
 Judith Fisher
 Louise McDougall
 V. B. Willott
 Terry Norris
 Tom Ruesch
 Max O. Andrae
 Robert F. Dickinson
 Bill Hosig
 Carl Guelcher
 Arlen Wanta
 Maureen Schlosser
 Henry Arnold
 Norma Hogan
 Pat Hamm
 Naomi Jacobson
 Christy Smith-Nanus
 Kathi Schulze
 George Dixon
 Beverly Fischer
 Marlene Schirt
 Gordon Shipman
 Silvia Becker
 Maxine Burress
 Mr. Burress
 Helan Molepske
 Robert Ramlow
 Gertrude Dixon
 John Smith
 Glen Molepske
 Jeanette Hoffman
 Kirk Bochner

Appearances (continued):

Tom Booher
Todd Louis
Ms. Wochinski
Ken Hoffman
Mrs. Martin Wochinski
Sarah Jenkins
Wisconsin Public Power, Inc.
Dennis Dums
Safe Haven, Lts.
Sierra Club
Two Rivers Water & Light Dept.
Office of State Planning & Energy
Nancy Salini
Carol Wisland
Francis Koerber
Thomas Galazek
Northern Thunder

Of the commission staff:

Steven M. Schur
Barbara J. Willard
Chief Counsel

Virgil N. Endres
Clarence F. Riederer
Lanny L. Smith
Engineering Division

Jerry E. Mendi
Dave Schoengold
Floyd Nelson
Dana Sears
Dick Eberle
Gabe S. Stern
A. Ravindran
Systems Planning, Environmental Review, Consumer Analysis

Pursuant to the decision of the Wisconsin Supreme Court
in Wisconsin's Environmental Decade vs. Public Service
Commission, Case 76-768, decided June 30, 1978, the following
are designated as principal parties in docket no. 05-EP-1.

Wisconsin Upper Michigan Systems, by,
Foley & Lardner, Attorneys

Western Wisconsin Utilities, by,
Shaw, Pittman, Potts & Trowbridge

Dairyland Power Cooperative, by,
William D. Harvey, Attorney

Wisconsin Electric Power Company, by,
James Sakrajsheck

Wisconsin Power & Light Company, by,
Eugene O. Gehl, Attorney

Northern States Power Company, by,
F. J. Kripps

Wisconsin's Environmental Decade, Inc., by,
Peter Anderson

Friends of the Earth, Inc., by,
Robert H. Owen, Attorney

Citizens for a Better Environment, by,
David Merritt

Safe Haven, Ltd., by,
Jame Schaefer

Northern Thunder, by,
Richard Ehrig, Attorney

Sierra Club, by,
Thomas Donovan, Attorney

LAND, by,
Naomi Jacobson

Town of Rudolph, by,
Walter G. Wefel, Jr.

Department of Business Development, by,
David H. Swanson

State Office of Energy & Planning, by,
Teresa Danovich

Sarah Jenkins
Madison, WI 53706

Thomas Galaxen
Turtle Lake, WI 54889

Appendix B

Summary of Specific Coal vs. Nuclear
Comparisons Found In This Record

Dr. Irving Bupp

Conclusion: All input variables are too uncertain to enable anyone to determine whether coal or nuclear is cheaper. (Tr. 7482-7483)

WUNS - Eugene R. Mathews

Conclusion: If the proposed Haven nuclear plants can maintain a 75% capacity factor, a nuclear expansion plan is \$217,000,000 cheaper than a coal only expansion plan with scrubbers (present worth to 1976). If the proposed Haven nuclear plants can only maintain a 60% capacity factor, a coal only expansion plan with scrubbers is \$64,000,000 cheaper than a nuclear expansion plan (present worth to 1976). (Tr. 1261-1263, 2781)

Assumptions:

Nuclear fuel cost = 60c/MBtu ('76) (Tr. 1278, 1290)
Coal cost = \$1.18/MBtu ('76) (Ex. 12; 3.12)
Discount factor = 11% (Tr. 1259)
Escalation rates = 6% (Tr. 1259)
Nuclear plant capital cost = \$560/kW ('76) (Ex. 12)
Coal plant capital cost = about \$350/kW ('76) (varies with size) (Ex. 12)
Fixed charge rate (coal) = 16.5% (Tr. 1260)
Fixed charge rate (nuclear) = 16% (Tr. 1260)

Sargent and Lundy

Conclusion: The total cost of two 900 MW nuclear plants equals the total cost of three 600 MW coal plants without scrubbers. (Tr. 1307)

Assumptions:

Coal cost = \$1.22/MBtu ('76) (Ex. 52; 3)
Nuclear fuel cost = 68c/MBtu ('76) (estimated from various parameters) (Ex. 52)
Capacity factors = 70% (Ex. 52; 5)
Discount rate = 12% (Ex. 52; 4)
Coal plant capital cost = \$822/kW ('87) (Ex. 52; B-2)
Nuclear plant capital cost (including first cost) = \$1150/kW ('87) (Ex. 52; B-2)
Escalation rate = 6% (Ex. 52; 10, 15, 16, 17, 18, 19, 22, 24)
Full CWIP allowed (Ex. 52; 4)

David Comey

Conclusion: Expected 1984 costs are as follows: (Ex. 54; 32-34)

Nuclear plant (PWR) - 5.21c/kWh
Western coal plant with scrubbers - 4.55c/kWh
Eastern coal plant without scrubbers - 4.13c/kWh
Eastern coal plant with scrubbers - 5.19c/kWh

Assumptions:

Nuclear plant capital cost = \$1020/kW ('84) (Tr. 3352)
Coal plant capital cost with scrubbers = \$839/kW ('84) (Tr. 3352)
Coal plant capital cost without scrubbers = \$729/kW ('84) (Tr. 3352)
Fixed charge rate = 16% (Tr. 3351)
Nuclear plant capacity factor = 47.6% (Tr. 3352)
Coal plant capacity factor (no scrubbers) = 72.8% (Tr. 3352)
Coal plant capacity factor (with scrubbers) = 64.6% (Tr. 3352)

Lewis Perl - NERA

Conclusions: Expected costs levelized to 1987 (Tr. 6592)

Nuclear plant (900 MW) - 6.2c/kWh
Coal plant with scrubbers (600 MW) - 8.4c/kWh
Coal plant without scrubbers (600 MW) - 6.9c/kWh
Coal plant with scrubbers (300 MW) - 8.7c/kWh
Coal plant without scrubbers (300 MW) - 7.5c/kWh

Assumptions:

Coal plant capital cost without scrubbers (600 MW) = \$980/kW ('88) (Ex. 96; 23)
Coal plant capital cost with scrubbers (600 MW) = \$1124/kW ('88) (Ex. 96; 23)
Coal plant capital cost without scrubbers (300 MW) = \$1124/kW ('88) (Ex. 96; 23)
Coal plant capital cost with scrubbers (300 MW) = \$1238/kW ('88) (Ex. 96; 23)
Nuclear plant capital cost = \$1415/kW ('88) (Ex. 96; 23)
Nuclear fuel cost = 93c/MBtu ('89) (Tr. 6713)
Coal cost (high sulfur) = 84c/MBtu ('75) (Tr. 6598)
Coal cost (low sulfur) = \$1.69/MBtu ('75) (Tr. 6598)
Capacity factors = 65% (Tr. 6602)
Discount rate = 11% (Tr. 6603)
Fixed charge rate (coal) = 16.46% (Tr. 6603)
Fixed charge rate (nuclear) = 15.97% (Tr. 6603)
Escalation rate (1976-1988) = 5% (Tr. 6604)
Escalation rate (post-1988) = 4.5% (Tr. 6604)

Ronald Knecht - Sierra Club

Conclusions: Expected costs levelized to 1985 for investor-owned utilities (Ex. 175; RLK-19)

Nuclear plant - 9.8c/kWh
Coal plant (large) - 8.9c/kWh
Coal plant (small) - 8.2c/kWh

Assumptions:

Nuclear plant capital cost = \$1424/kW ('85) (Ex. 174; 18)
Coal plant capital cost (small) = \$1285/kW ('85) (Ex. 174; 18)
Coal plant capital cost (large) = \$1111/kW ('85) (Ex. 174; 18)
Nuclear fuel cost = 8.65 mills/kWh ('76) (Ex. 175; RLK-16 (7))

Nuclear fuel escalation rate = 7% (Ex. 175; 25)
Coal cost = \$1.08/MBtu ('76) (Ex. 175; RLK-18)
Coal escalation rate = 6% (Ex. 175; 2930)
Nuclear plant capacity factor = 60% (Ex. 175; 30)
Coal plant capacity factor (small) = 70% (Ex. 175; 30)
Coal plant capacity factor (large) = 60% (Ex. 175; 30)
Discount rate = 10% (Ex. 175; 26)
Fixed charge rate (coal) = 18% (Ex. 175; 32)
Fixed charge rate (nuclear) = 17.5% (Ex. 175; 32)

Western Wisconsin Utilities - James Forest

Conclusions: An expansion plan including the proposed Tyrone nuclear plant is \$261,000,000 cheaper than a plan including no new nuclear plants (present worth to 1983). (Ex. 126; 3-188)

Assumptions:

Nuclear plant capital cost = \$621/kW ('76), \$945/kW ('85) (Ex. 126; 3-33)
Coal plant capital cost = \$400-\$550/kW ('76) (depending on size and year) (Ex. 126; 3-63 to 3-68)
Nuclear fuel cost = 49c/MBtu ('76) (Ex. 145)
Coal cost = \$1.04/MBtu (except at Sherburne site = 77c/MBtu) (Ex. 126; 3-111)
Capacity factors = approximately 75% (average) (Ex. 126; 3-176)
Escalation rate (non-fuel) = 7% (Ex. 126; 3-15, 3-42, 3-46)
Discount rate (NSP) = 10% (Ex. 126; 3-190)
Discount rate (Co-ops) = 9% (Ex. 126; 3-190)
Fixed charge rate (NSP, nuclear) = 13.15% (Ex. 126; 3-189)
Fixed charge rate (NSP, coal) = 13.02% (Ex. 126; 3-189)
Fixed charge rate (Co-ops, nuclear) = 11.24% (Ex. 126; 3-189)
Fixed charge rate (Co-ops, coal) = 10.32% (Ex. 126; 3-189)
Coal escalation rate = 5-10% on various components (Ex. 126; 3-111)
Nuclear fuel escalation rate = 7.4% ('76-'92); 6% ('92-) (Ex. 145)

Virgil Endres - PSC Engineering Division

Conclusions: A number of different cases were considered utilizing various capacity factors for the new coal or nuclear plants (60% and 70%), and various escalation rate scenarios (6% and 8%). For the case which assumed a 6% escalation rate and 60% capacity factor, coal and nuclear costs were approximately equal. For other cases (higher capacity factors and escalation rates), coal was more expensive than nuclear. (Ex. 168, Tr. 13012)

Assumptions: (Ex. 168)

Nuclear plant capital cost (900 MW) = \$600/kW ('76)
Coal plant capital cost (600 MW) = \$480/kW ('76)
Fixed charge rate = 15.5%
Coal cost = \$1.20/MBtu
Nuclear fuel cost = 72c/MBtu (Tr. 13012)
Discount rate = 11%

David Schoengold - PSC SPERCA Division

WUMS Analysis

Conclusions: Two alternative expansion plans were compared to the WUMS proposed plan. Both alternatives had no new nuclear plants. With no scrubbers on the new coal plants, one plan (A) was \$28,000,000 cheaper than the WUMS plan, while the other plan (B) was equal in cost (present worth to 1981). Scrubbers added \$139,000,000 to A and \$202,000,000 to B. (Ex. 44, Tr. 11347)

Assumptions:

Capital costs = those given by WUMS utilities in Exhibit 12.
(Tr. 1769)
Scrubber costs = those given in the WEPSCO - Gilbert
Commonwealth study (Tr. 11346)
Nuclear fuel costs = 40.4c/MBtu ('76) (Tr. 1769)
Coal cost = \$1.18/MBtu ('76) (Tr. 1769)
Escalation rate = 6% (Tr. 1769)
Discount rate = 11% (Tr. 1745)
Fixed charge rate = 16.5% (Tr. 1746)
Nuclear plant capacity factors = 75% through 1990, then
falling at 2% per year for 14 years (ending at 37%)
(Tr. 1775, 1803, 5183)

Western Wisconsin Utilities Analysis

Conclusions: Two alternative expansion plans were compared to the WWU proposed plan. Both alternatives had no new nuclear plants, and the new coal plants all had scrubbers. Two nuclear plant capacity factor scenarios were considered. Each had capacity factors of approximately 75% through 1990. After 1990, one scenario projected a levelized capacity factor of 60%, while the other scenario projected a levelized capacity factor of 50%. Under the higher capacity factor scenario, alternative 1 was \$12,000,000 more expensive than the WWU proposal, while alternative 2 was \$59,000,000 more expensive (present worth to 1981). Under the lower capacity factor scenario, alternative 1 was \$57,000,000 cheaper, and alternative 2 was \$30,000,000 cheaper. (Ex. 151)

Assumptions:

Capital costs = those given by WWU utilities for large plants and WUNS utilities for small plants (Tr. 11064)
Nuclear fuel cost = 60c/MBtu ('76) (Tr. 11064)
Coal cost = \$1.04/MBtu ('76) (77c/MBtu at Sherburne site) (Tr. 11064, Ex. 126)
Escalation rate = 0%
Discount rate = 10% (Tr. 11186)
Fixed charge rate = 11-13% (company dependent) (Tr. 11063, Ex. 126)

Peter Anderson - Wisconsin's Environmental Decade

(This analysis is not in evidence but was submitted as a brief)

Conclusion: The levelized cost of a large nuclear plant in 1988 is 22.83¢/kWh. The levelized cost of a smaller coal plant in 1988 is 22.43¢/kWh.

Assumptions:

Nuclear fuel cost = 37¢/MBtu ('76)
Coal cost = 103.75¢/MBtu ('76)
Discount factor = 13%
Escalation-rates (fuel) = 7%
Nuclear plant capital cost = \$385/kW ('76)
Coal plant capital cost = \$346/kW ('76) (This figure does not include scrubbers which are accounted for in the escalation rate)

Escalation rates (capital) = 13%
Fixed charge rate (coal) = 20.3%
Fixed charge rate (nuclear) = 21.3%
Capacity factor (nuclear) = 55%
Capacity factor (coal) = 65%
O & M cost (coal) = 0.3522¢/kWh ('78)
O & M cost (nuclear) = 0.1112¢/kWh ('76)
Escalation rate (O & M) = 6%