DOCKET NOS. UE-920433, UE-920499, UE-921262
EXHIBIT NO. T-___(DWS-1)
Witness: Donald W. Schoenbeck
Date: February 24, 1993

BEFORE THE WASHINGTON UTILITIES & TRANSPORTATION COMMISSION

PETITION OF PUGET SOUND POWER & LIGHT COMPANY FOR AN ORDER REGARDING THE ACCOUNTING TREATMENT FOR POSTRETIREMENT EXCHANGE BENEFITS	Docket No. UE-920433
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, vs. PUGET SOUND POWER & LIGHT COMPANY, Respondent,	DOCKET NO. UE-920499
WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION, Complainant, vs. PUGET SOUND POWER & LIGHT COMPANY, Respondent,	DOCKET NO. UE-921262

PREPARED DIRECT TESTIMONY

OF

DONALD W. SCHOENBECK

ON BEHALF OF THE

WASHINGTON INDUSTRIAL COMMITTEE
FOR FAIR UTILITY RATES

February 24, 1993

WASHINGTON UTILITIES AND TRANSPORTATION COMMISSION
No. UE-920433; -920499; -921262 Ex. T-73✓

Before the Washington Utilities and Transportation Commission
Docket Nos. UE-920433, UE-920499, UE-921262

Testimony of Donald W. Schoenbeck

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. Donald W. Schoenbeck, 825 N.E. Multnomah, Portland, Oregon.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. This is summarized in Appendix A to my testimony.

Q. ON WHOSE BEHALF ARE YOU APPEARING IN THIS PROCEEDING?

A. I am appearing on behalf of the Washington Industrial Committee for Fair Utility Rates (WICFUR), a coalition of large industrial customers served by Washington electric utilities, including Puget Sound Power & Light Company (Puget or Company).

<u>SUMMARY</u>

Q. PLEASE SUMMARIZE YOUR TESTIMONY INCLUDING YOUR SPECIFIC RECOMMENDATIONS.

A. My testimony addresses certain cost-of-service and rate design defects contained within Puget's filing. The cost-of-service issues addressed include the appropriate classification and allocation of production, transmission and distribution costs. I also discuss the design of Puget's interruptible rates and recommend modifications to more appropriately reflect the cost of this service.

The recommendations contained in my testimony are:

1. Puget's peak credit calculation understates the cost of providing capacity and the peak credit calculation does not consider the amount of generation required from the resources. Correcting for these errors results in classifying 31% of production costs to demand and 69% to energy.

2. While Puget has made numerous normalization adjustments to the test period results of operation, Puget does not include these same adjustments in the cost-of-service study allocation factors. As a consequence, Puget's cost-of-service study does not properly assign cost responsibility.

3. Puget's proposal to allocate system demand-related costs using class contributions to the highest 200 hourly loads is inconsistent with the planning criteria employed by Puget in acquiring resources and in establishing revenue requirement. To properly assign cost responsibility to the classes that have caused the cost to be incurred, Puget's planning criteria should be used in the cost-of-service study for allocating demand-related costs.

4. To ensure that there are no "winners" or "losers" as a result of acquiring demand-side resources, the acquisition of conservation must be treated precisely the same as a generating resource. This must be done by including the conservation savings (both demand and energy) in the assignment factors for allocating costs.

5. Puget's subfunctionalization of transmission costs into generation-related and non-generation-related segments, with the latter considered entirely demand-related, should be approved by the Commission.

6. Puget's distribution system costs--beyond simply the service drop and meter--are affected by the number of customers. Accordingly, distribution costs should be classified into demand and customer components.

7. Incorporating these recommendations into a cost-of-service analysis, as shown by the following table, indicates that only the Residential and Resale classes have a revenue to cost ratio ("parity ratio") less than 100%, showing insufficient revenue recovery from these classes. All other classes are paying more than their fair share of revenue.

Comparison of Class
Cost-of-Service Studies
Ratio of Revenue to Cost Responsibility

Voltage Class	Puget COSS	WICFUR-Excluding Min. Dist. Sys.	WICFUR-Including Min. Dist. Sys.
Residential	97%	87%	84%
Secondary: Small	109%	123%	122%
Medium	115%	130%	146%
Large	113%	130%	145%
Primary	91%	108%	118%
High Voltage	86%	105%	105%
Lighting	134%	144%	146%
Resale	75%	92%	99%

8. WICFUR concurs with Puget's proposal to move all classes gradually toward cost-of-service. However, this gradual movement must be based upon the studies presented in this testimony which correct the errors and oversights contained in Puget's study. The following table compares the class percentage increases resulting from WICFUR's recommendation (using Puget's full rate request) and Puget's proposal:

Rate Spread Comparison
Percentage Increases

Voltage Class	Puget Proposal	WICFUR Recommendation	Difference
Residential	12.7%	17.7%	5.0%
Secondary: Small	8.4%	4.1%	(4.3)%
Medium	6.6%	2.6%	(4.0)%
Large	7.3%	3.1%	(4.2)%
Primary	15.3%	8.4%	(6.9)%
High Voltage	17.4%	8.9%	(8.5)%
Lighting	1.8%	(0.3)%	(2.1)%
Resale	25.1%	14.8%	(10.3)%
Total	11.5%	11.5%	0.0%

9. WICFUR supports many of the rate design modifications contained within the Company proposal, including the proposed voluntary experimental tariffs. However, the long-term interruptible reservation credit proposed by the Company is inadequate. To more properly reflect the cost (and need) of providing this service, the credit should be increased to $3.00 per kilowatt month.

PEAK CREDIT CLASSIFICATION

Q. HOW HAS THE COMPANY CLASSIFIED GENERATION COSTS BETWEEN DEMAND AND ENERGY COMPONENTS?

A. Puget has employed the peak credit method to classify production-related costs. This method analyzes the current cost of two different resources in order to ascertain the cost of supplying capacity (peak demand) and energy. The two resources are a "peaking" resource, representing the cost of supplying capacity, and a "baseload" resource, which can be utilized to provide both capacity and energy. The portion of the cost of the baseload resource that exceeds the peaking resource is considered energy-related, while the remainder is considered capacity or demand-related. Once this cost relationship is known, it is then used to classify the Company's existing generating costs into demand and energy components.

Q. WHAT RESOURCES HAS THE COMPANY SELECTED FOR USE IN THE PEAK CREDIT CLASSIFICATION DETERMINATION?

A. Two very similar resources were used by Puget: (1) a simple cycle combustion turbine (CT); and (2) a combined cycle combustion turbine (CCCT).

Q. DO YOU AGREE WITH PUGET'S SELECTION OF THESE RESOURCES FOR THE CALCULATION?

A. Yes. The fundamental choice in selecting a CT or a CCCT is the degree to which the resource will be utilized. If the resource will be used infrequently, the lower capital cost and higher fuel cost CT is the logical choice. On the other hand, if the resource is expected to be operated for many hours, the fuel savings from operating a CCCT will more than offset the higher capital cost of installing a heat recovery system to run in a combined cycle mode. Consequently, the direct tradeoff between these nearly identical technological resources--a larger capital investment in order to realize fuel savings--is the exact relationship the peak credit calculation is trying to capture: the cost of capacity and the cost of energy.

Q. WHAT CAPACITY/ENERGY SPLIT IS PUGET PROPOSING TO USE FOR CLASSIFYING PRODUCTION-RELATED COSTS?

A. As a result of the Company's peak credit calculation, Puget is proposing that 16% of the production-related costs be classified to demand and the remaining 84% classified to energy.

Q. DO YOU AGREE WITH THE MANNER IN WHICH PUGET HAS PERFORMED THE PEAK CREDIT CALCULATION?

A. No. There are three aspects of Puget's determination which are in error. First, Puget has arbitrarily used only one-half of the capital and fixed operations and maintenance cost of the CT as the proxy for the cost of providing capacity. The proper method for calculating the peak credit requires recognition of the full cost of building the CT in determining the cost of capacity.

The second error in Puget's peak credit analysis has to do with the assumed utilization of the baseload resource. While providing no explanation, Puget has assumed the CCCT would run 80% of the time to provide both capacity and energy. For the CT, Puget has assumed it would be necessary to operate 200 hours to provide peak capacity, apparently for consistency with the number of hours Puget has chosen for allocating demand-related costs.

The third error is Puget's failure to credit the CCCT fuel costs to the CT in order to appropriately recognize the energy-related component of running the CT.

Q. REGARDING THE FIRST ERROR, PLEASE EXPLAIN WHY THE ENTIRE COST OF THE CT SHOULD BE USED IN DETERMINING THE COST OF CAPACITY IN THE PEAK CREDIT CALCULATION?

A. The only apparent basis for Puget's decision to use less than the full cost of the CT, a significant deviation from the peak credit method, appears to be the simplistic reasoning that the CT can be used for other purposes besides providing just capacity, an assertion that can be said of <u>any</u> resource. Once a resource is completed and available, it can be operated for many purposes and it will always be simultaneously providing both capacity and energy. The foundation of the peak credit theory, however, is to separate these joint uses by determining the cost of supplying pure peak capacity. As recognized by Puget in its <u>Integrated Resource Plan 1992-1993</u>, simple cycle combustion turbines are the lowest cost alternative for providing capacity:

> In the past, Puget Power has constructed simple cycle combustion turbines to meet peaking requirements and this option appears to still be the lowest cost for new utility-developed capacity. (Appendix E, page E-10)

Long-term peak capacity cannot be provided at only one-half the cost of a CT. This fact is recognized by Puget in its avoided cost calculations. In calculating its avoided cost, Puget included the total cost of operating the CT in determining the capacity-related component. This same concept must be consistently employed in determining the capacity/energy split for use in Puget's class cost-of-service study. The total cost of building the CT must be employed in the peak credit calculation.

Q. REGARDING THE SECOND ERROR, HOW SHOULD THE UTILIZATION OF THE CCCT BE DETERMINED?

A. The hours the CCCT is assumed to run should be analyzed in either one of two ways. The most straight forward approach, and the method employed by other utilities including the Bonneville Power Administration (BPA or Bonneville), determines the utilization based on the native system load characteristics (load factor) that the utility must serve. In the case of Puget, this is about 54%--almost the exact figure employed by BPA. The alternative method is to assume the resource is operated to the maximum practical extent--80% in this case--but the generation in excess of native system needs is sold on the surplus or nonfirm market and the resulting revenue is used to offset the resource cost. Neither of these methods was employed by Puget.

Q. WHICH OF THE TWO APPROACHES DO YOU RECOMMEND THE COMMISSION ADOPT FOR DETERMINING THE CCCT UTILIZATION?

A. To avoid the additional controversy which would arise over determining the surplus sale revenue credit, I recommend the system load factor approach be employed to determine the CCCT utilization.

Q. HOW SHOULD THE UTILIZATION OF THE PEAKING RESOURCE BE DETERMINED?

A. In the peak credit determination, the peaking resource is assumed to operate at a minimal level in order to provide peak capacity. Based on Puget's planning documents, peaking resources are planned to run only 200 hours to provide capacity. Given Puget's sharp, short system peak, this is an appropriate utilization level for the peak credit calculation.

Q. DO YOU AGREE WITH THE COMPANY'S APPARENT BELIEF THAT THERE MUST BE CONSISTENCY BETWEEN THE HOURS EMPLOYED FOR THE OPERATION OF THE PEAKING RESOURCE IN CLASSIFYING PRODUCTION COST AND THE ALLOCATION OF THESE COSTS?

A. No. Determining the appropriate number of hours to employ in the allocation of demand costs is not directly related to the assumption regarding the utilization of the peaking resource in the peak credit determination. A utility must have sufficient resources to meet the peak demand of its customers which in turn must be reflected in the development of the appropriate coincident demand allocation factor. The theoretical peak credit classification calculation, on the other hand, derives the appropriate cost of providing capacity without energy ("naked capacity") from the cost of resources simultaneously providing both capacity and energy. Accordingly, the operation of the resource should be limited, but it need not be precisely the same as the number of hours used in developing the coincident demand allocation factor.

The hours of operation may be necessary when analyzing the mix of resources if one were classifying costs under a different method, such as the base-intermediate-peak approach. The peak credit classification method however is a uniform classification method in that it does not distinguish between the various types of resources or take into account the hours each resource will operate.

Examples of utilities that use different hours in these two distinct matters are Pacific Power & Light Company (PP&L) and BPA. Bonneville allocates costs based on the twelve monthly coincident peaks but employs a 1% utilization factor for the peaking resource. Similarly, when PP&L used a CT in its peak credit calculation, it assumed a 1% or 3% capacity factor and allocated demand costs based on only the three highest system hours.

Q. REGARDING THE THIRD ERROR IN PUGET'S PEAK CREDIT CALCULATION, HOW SHOULD THE COMPANY'S FAILURE TO ADEQUATELY DETERMINE THE FUEL COST OF RUNNING THE CT BE CORRECTED?

A. As explained above, in quantifying the cost of the peaking resource, the Company did not credit the fuel cost of running the CT with the corresponding running cost of operating the CCCT. In other words, the only capacity-related fuel component of the CT is the cost premium above the fuel cost of operating the CCCT. This error is corrected by appropriately crediting the CT cost with the CCCT fuel costs.

Q. WHAT DEMAND/ENERGY SPLIT RESULTS FROM INCORPORATING YOUR CORRECTIONS INTO THE PEAK CREDIT CALCULATION?

A. These recommendations result in classifying 31% of the production-related costs to demand and the remaining 69% to energy. This is very close to the same relationship as set forth in Puget's avoided cost payment schedule. For comparison purposes, employing Puget's avoided cost schedule results in a classification of 29% of the production-related costs to demand and the remaining 71% to energy, values very close to WICFUR's 31%/69% recommendation.

NORMALIZATION OF ALLOCATION FACTORS

Q. HAS THE COMPANY PROPOSED ADJUSTMENTS TO THE ACTUAL TEST PERIOD RESULTS OF OPERATION?

A. Yes. Puget has proposed numerous pro forma and normalization adjustments in order for the test period to be representative of the costs that would be expected to occur during the time the proposed rates would be in effect. These adjustments include a substantial restatement of power-related expenses and a weather normalization adjustment since the Company experienced a very mild winter peak season in the test year.

Q. WERE THE ACTUAL RESULTS OF OPERATIONS OR PROPOSED COST LEVELS EMPLOYED BY THE COMPANY IN THE CLASS COST-OF-SERVICE STUDY?

A. For cost allocation purposes, the Company has utilized the adjusted or normalized results of operation.

Q. HAS THE COMPANY ADJUSTED THE COST ALLOCATION FACTORS TO BE CONSISTENT WITH THE NORMALIZED EXPENSE LEVELS?

A. No. For cost allocation purposes, the Company has used the actual or unadjusted peak demand and energy sales for the test period. Accordingly, the Company has made a fundamental error by not normalizing the cost allocation factors to be consistent with the revenue requirement Puget is seeking and the class cost-of-service analysis it has performed.

The inequity resulting from this mis-match can be illustrated by examining the Company's historical and normalized energy generation requirements. In determining power supply costs and expected revenues, Puget has used a temperature adjusted load of 19,621 gWh, 476 gWh above the actual test period amount. For determining class cost responsibility, however, Puget has assigned costs based on the actual class loads of only 19,145 gWh. The following table indicates the shift in cost responsibility as a result of this error.

Table 1

Energy Allocation Factor Comparison
Actual v. Normalized

Class	Actual Energy (gWh)	Actual Allocation Factor (%)	Normalized Energy (gWh)	Normalized Allocation Factor (%)	Difference (%)
Residential	8,941	46.7%	9,417	48.0%	1.3%
General Service: Secondary	5,695	29.8	5,695	29.0	(0.8)
Primary	1,521	7.9	1,521	7.7	(0.2)
High Voltage	2,798	14.6	2,798	14.3	(0.3)
Lighting	64	0.3	64	0.3	0.0
Firm Resale	126	0.7	126	0.7	0.0
Total:	19,145	100.0%	19,621	100.0%	0.0%

As indicated by the table, by failing to assign costs based on the same usage employed for revenue requirements purposes, the residential class is not assigned its full cost responsibility, while all other classes are assigned more than their fair share of costs.

Q. DOES SUCH A MODEST DIFFERENCE IN ALLOCATION FACTORS HAVE A SIGNIFICANT IMPACT IN DETERMINING COST RESPONSIBILITY?

A. Yes. Under Puget's peak credit proposal, 84% of all production-related costs are considered energy-related. The production related expense accounts total almost $500.0 million; therefore, the modest change in the energy allocation factor shifts well over $5.0 million in cost responsibility away from the residential class.

Q. DOES THIS SAME MIS-MATCH BETWEEN ACTUAL AND NORMALIZED RESULTS EXIST IN THE DEMAND ALLOCATION FACTORS EMPLOYED BY PUGET IN THE COST-OF-SERVICE STUDY?

A. Yes. The mis-match in the cost-of-service study between Puget's use of demand allocation factors based on unadjusted results of operation and its use of corrected normalized factors for other purposes in the study is even more dramatic for two reasons: (1) Puget is proposing to change the manner in which it has allocated production-related demand costs; and (2) no peak-like weather conditions were experienced during the test period.

Q. HOW HAS PUGET ALLOCATED PRODUCTION-RELATED DEMAND COSTS TO THE VARIOUS CLASSES IN PRIOR PROCEEDINGS?

A. In the Company's most recent proceedings, these costs have been allocated based on the class contributions to the

Company's twelve (12) highest peak hours that occurred during the test period.

Q. IS THE COMPANY USING THE TWELVE HIGHEST HOURS IN THIS PROCEEDING?

A. No. In this case the Company has deviated substantially from its past practice by proposing to use the class contributions to the 200 highest recorded coincident peak hours.

Q. IS THIS AN APPROPRIATE ALLOCATION METHOD FOR A UTILITY SUCH AS PUGET WITH ITS SYSTEM PEAK REQUIREMENTS?

A. No. As set forth in the testimony and exhibits of Company witness J. Richard Lauckhart, Puget's revenue requirement is premised on acquiring sufficient additional capacity to serve the projected net system peak of 4,942 for 1992/1993 and 5,111 MW for 1993/1994. This includes the estimated cost of a-yet-to-be-acquired capacity resource of 400 MW. Under Puget's proposed capacity allocation method however, the average of the actual highest 200 system hours that occurred during the test period is only 3,608 MW or just 70-73% of the projected peak used for planning and revenue requirement purposes. In fact the <u>highest</u> actual load for the test period was only 3,830 MW, over 1,000 MW <u>below</u> the planning forecast. The enormous disparity--1,300-1,500 MW--between the resource need derived from Puget's planning criteria and Puget's coincident demand allocation factor is clear evidence of the inappropriateness of Puget's selection of 200 hours for assigning capacity-related production costs.

Q. HOW DID THE WEATHER THAT WAS EXPERIENCED DURING THE TEST PERIOD AFFECT PUGET'S PEAK DEMAND?

A. During the 1991/1992 winter, the three lowest recorded daily temperatures were 25 degrees Fahrenheit, 26 degrees Fahrenheit and 30 degrees Fahrenheit. The following tables indicate the temperature distribution for the top 200 hourly loads for 1991/1992, the month and number of days when the peaks occurred, and the average daily temperatures.

Table 2

Frequency Distribution of the 200 Hourly Temperatures 1991/1992

Temperature Range - DF	Hourly Observations
0.0 - 10.0	0
10.1 - 15.0	0
15.1 - 20.0	0
20.1 - 25.0	12
25.1 - 30.0	43
30.1 - 35.0	78
35.1 - 40.0	49
40.1 - 45.0	18
Total:	200

Table 3

Distribution of 1991/1992 Hours
Time of Occurrence

Month	Days	Hours
October	3	13
November	4	7
December	13	80
January	15	69
February	10	28
March	3	3
Total:	48	200

Table 4

Distribution of Average
Daily Temperatures
1991/1992

Average Temp.- DF	No. of Days
33 - 35	2
36 - 38	7
39 - 41	12
42 - 44	14
45 - 47	9
48 - 49	4
Total:	48

The mildness of the 1991/1992 winter is shown by the tables. No peak-like hourly temperatures are shown on Table 2. The large number of days over which the 200 hours occurred and the broad range of months is also an indication that no concentrated period of extreme temperatures occurred. Of particular significance is Table 4, presenting the average daily temperatures of the 48 days. Only 12 of the 48 days had average temperatures less than 40 degrees Fahrenheit, and four days had average temperatures of 48-49 degrees Fahrenheit. Given this temperature data, it is easy to understand why the actual 1991/1992 system peak of 3,830 MW was almost 800 MW below the 4,615 MW peak experienced during the 1990/1991 winter, even though Puget had about 25,000 fewer customers in the 1990/1991 winter than in the 1991/1992 winter.

Q. HAVE YOU COMPARED THE ACTUAL SYSTEM PEAK LOADS FOR 1991/1992 WITH THOSE EXPERIENCED DURING 1990/1991?

A. Yes. The following three tables present a limited comparison of the peak loads experienced by the Company over these periods. Table 5 presents the load distribution for the actual 200 peak hours for 1991/1992--the peak demand allocation period proposed by Puget in this proceeding. Note that over half of the hours were at a load level that was at least 1,200 MW below the 1990/1991 peak. Table 6 presents the hours from the 1990/1991 peak period of December 19-29 that were above the 1991/1992 peak. During this limited period, there were 68 hours where the peak demand was higher than the peak hour experienced during 1991/1992. Finally, Table 7 compares the average peak for 1991/1992 with 1990/1991 for various groups of hours. In all cases, the 1990/1991 peak is at least 600 MW above the comparable 1991/1992 value. This evidence shows that the proposed demand allocation factors developed by Puget are inappropriate for assigning demand-related cost responsibility.

Table 5

Distribution of 1991/1992
Hourly Loads
(MW)

Peak Load (MW)	**No. of Hours**
3,800 - 3,900	2
3,700 - 3,800	5
3,600 - 3,700	12
3,500 - 3,600	10
3,400 - 3,500	43
3,300 - 3,400	61
3,200 - 3,300	67
Total:	200

Table 6

Distribution of Hours Above 1991/1992 Peak From December, 1990

Peak Load - MW	No. of Hours
4,700 - 4,600	2
4,600 - 4,500	1
4,500 - 4,400	1
4,400 - 4,300	5
4,300 - 4,200	10
4,200 - 4,100	13
4,100 - 4,000	12
4,000 - 3,900	18
3,900 - 3,831	6
Total:	68

Table 7

Comparison of Select Hours

No. of Hours	1991/1992 Average - MW	1990/1991 Average - MW	Difference MW
1	3,830	4,615	785
10	3,752	4,424	672
25	3,662	4,293	631
50	3,569	4,173	604

Q. HOW SHOULD THE DEMAND-RELATED COSTS BE ALLOCATED TO THE VARIOUS CUSTOMER CLASSES?

A. The only way to accurately assign the demand or capacity-related costs to the customers responsible for these same costs is to have the cost allocation method mirror the planning criteria used to establish the capacity requirements. Puget's capacity forecast (and consequently capacity need) is founded on the 1990/1991 actual peak load of 4,615 MW reached at a temperature of 12.5 degrees Fahrenheit. This planning standard is substantially different from arbitrarily averaging the highest 200 hours of recorded peaks during the test year irrespective of weather conditions.

To reflect the planning criteria in the coincident demand allocation factor, WICFUR recommends that the class contributions to the daily peaks within 95% of the test period peak be employed for cost allocation purposes. By so doing, the cost allocation more closely approximates the sharp short system peak used for determining capacity needs. Further, to the extent peak-like weather is not experienced during the test period, a normalization adjustment must be made consistent with the revenue requirement determination for Puget's weather sensitive residential class.

Q. PLEASE INDICATE THE RESULTS OF IMPLEMENTING THIS RECOMMENDATION FOR THE COINCIDENT DEMAND ALLOCATION FACTOR.

A. Based on the recorded daily peak loads experienced during the test period, only two days had peaks within 95% of the January 7, 1992, peak: December 16, 1991, and December 17, 1991. Accordingly, the class contributions for these three hours should be used for assigning peak cost responsibility. In addition, the low temperatures that were experienced on these days were 25, 30 and 29 degrees Fahrenheit. Since peak weather was not experienced during the test period, a normalization adjustment to the class contributions is necessary. Applying Puget's peak load to temperature relationship of 40 MW per degree Fahrenheit, results in a peak normalization adjustment of 620 MW. The following table compares the coincident allocation factors as proposed by Puget along with WICFUR's recommendation. Under this recommended normalization approach, peak responsibility costs are matched to the peak planning criteria employed in the acquisition of resources by the Company.

Table 8

Coincident Demand Allocation Factor Comparison
Actual v. Normalized

Class	Puget 200 Hours (MW)	200 Hour Allocation Factor (%)	3 Day Normalized Demand (MW)	Normalized Allocation Factor (%)	Difference (%)
Residential	2,081	57.7%	3,094	64.0%	6.3%
General Service: Secondary	904	25.1	1,030	21.3	(3.8)
Primary	255	7.1	322	6.7	(0.4)
High Voltage	344	9.5	359	7.4	(2.1)
Lighting	8	0.2	10	0.2	0.0
Firm Resale	16	0.4	17	0.4	0.0
Total:	3,608	100.0%	4,832	100.0%	--

Q. **SHOULD A SIMILAR NORMALIZATION ADJUSTMENT BE MADE TO THE NONCOINCIDENT DEMAND ALLOCATION FACTOR?**

A. Yes. Under the normalization approach outlined above, it is appropriate to adjust the weather sensitive class noncoincident contribution as well. Since the peak design criteria was applied in order to determine the coincident demand contribution, it is reasonable to assume that the resulting contribution to the coincident peak will also be the class's noncoincident demand. Accordingly, Puget's proposed noncoincident demand for the residential class of 2,743 MW should be replaced with the value from the above table of 3,094 MW.

CONSERVATION PRICING/ALLOCATION FACTOR DEVELOPMENT

Q. THE COLLABORATIVE RATE DESIGN GROUP AGREED THAT CONSERVATION COSTS SHOULD BE TREATED IN A CONSISTENT MANNER WITH GENERATION OR SUPPLY-SIDE RESOURCES. HAS PUGET FULFILLED THIS REQUIREMENT?

A. No. Puget has not treated the acquisition of conservation resources in the same manner as supply-side resources, and has, thereby, unfairly created "winners" and "losers" in the assignment of cost responsibility to the various customer classes. The inequitable manner in which Puget has treated conservation investment is addressed in a article written by Myron B. Katz, former Oregon Public Utilities Commissioner, in the October, 1989 issue of The Electricity Journal. (A copy of this article has been included in Appendix B to this testimony.) To illustrate the conflict between acquiring conservation or a generating resource, the author presents the following example.

Table 9
Conservation Pricing Examples

	Today	Tomorrow		
		Generation Strategy	Conservation Strategies	
			I	II
1. Initial Annual Load (kWh 000s)	1,000,000	1,000,000	1,000,000	1,000,000
2. 10% Load Growth	---	100,000	100,000	100,000
3. Total Annual Energy Services	1,000,000	1,100,000	1,100,000	1,100,000
4. Embedded or Resource Cost (Cents/kWh)	5.0	6.0	3.0	3.0
5. Annual Revenue Requirement ($000,000)	$50.0	$56.0	$53.0	$53.0
6. Average Rate (Cents/kWh)	5.0	5.09	5.30	4.82
Derivation: Row 5 divided by row:	3	3	1	3

In the illustration, the utility is faced with the dilemma of acquiring either additional generating resources at a cost of 6.0 cents/kWh, or conservation resources at a cost of 3.0 cents/kWh. As discussed by the author, "winners" and "losers" are created under Conservation Strategy I. The "losers" are those customers who shouldered the entire cost responsibility of the conservation measures even though their consumption did not change (or they were unable to participate in the programs). Even though the conservation resource cost only 3.0 cents/kWh, their average rate increased from 5.0 cents/kWh to 5.3 cents/kWh. The clear "winners" are those customers who received the benefit of the conservation programs at no cost. Further, in actuality, not only do the "losers" pick up the tab for the entire conservation program, these same customers must pay the other margin-related costs (lost revenue) that had (or would have) been paid by the "winners." Finally, the author notes that the "losers" would have in fact been better off if the utility had pursued the more costly generating resource alternative, since in this case the resulting rate would have been less than under Conservation Strategy I.

The author correctly concludes that the only equitable pricing or allocation method is Conservation Strategy II, where conservation is treated exactly like any other resource:

> Conservation Strategy II, on the other hand, treats conservation exactly as any other resource. Those who consume energy services, whether conventional kWh or conservation kWh, pay for energy services in proportion to their consumption. The utility, whose investments make it possible, charges for conservation kWh saved as well as for conventional kWh consumed.

Not surprisingly, Alfred E. Kahn reached this same conclusion in an article published in The Electricity Journal in June, 1991, entitled "An Economically Rational Approach to Least Cost Planning:"

> If the utility company finances efficient investments in conservation, and the beneficiaries pay for the kilowatt-hours saved at the same retail price they would otherwise have paid for the kilowatt-hours taken (as Cicchetti and Hogan have recommended), average customer costs of achieving a given level of service will decline, and there will be no burden on non-participating customers--i.e., there will be no losers.

A copy of Dr. Kahn's article has been included in Appendix B to this testimony.

Unfortunately, Puget has treated conservation costs for rate making purposes in precisely the same inequitable manner as Conservation Strategy I set forth in the analysis by Mr. Katz. Consequently, Puget has created a class of "losers" who are forced to shoulder the burden of Puget's conservation investment and a class of "winners" who received the benefit of the conservation investment (reduced power bills) at no cost.

Q. HOW CAN THIS INEQUITY BE CORRECTED?

A. The most equitable solution is to institute an energy service charge whereby those customers receiving the conservation measures or expenditures would be required to reimburse the utility at a rate equivalent to the otherwise applicable charge that would have been paid for the kilowatt-hours. Since this can not be instituted "after the fact," the next best alternative is to include the conserved energy and demand in the development of all cost allocation factors used within the cost-of-service study. By so doing, the costs of the program are treated exactly like a generating resource and the inequity presented by Conservation Strategy I--Puget's proposed method--is substantially corrected.

Q. HOW CAN THIS RECOMMENDATION BE IMPLEMENTED?

A. The following peak demand and energy conservation savings provided by Puget in response to WICFUR Data Request #1510, should be apportioned across the appropriate rate schedules for inclusion in the allocation factors.

Table 10
Conservation Savings

Class	Peak Adjustment (MW)	Energy Adjustment (AMW)
Residential	346.7	84.6
Commercial	44.9	33.5
Industrial	10.3	10.3
Total:	401.9	128.4

This table further illustrates the cost assignment inequity caused under Puget's "Conservation Strategy I" assignment method. Under the existing allocation method, less than 50% of Puget's $164.3 million conservation investment is assigned to the residential class even though this class has been the direct beneficiary of the vast majority of the program.

The following tables set forth the final recommended coincident demand and energy allocation factors incorporating WICFUR's recommendations for normalizing the allocation factors for consistency with the revenue requirement and the recommended treatment of the conserved kilowatts and kilowatt-hours.

Table 11

Coincident Demand Allocation Factor Comparison
Puget Proposal v. WICFUR Recommendations

Class	Puget 200 Hours (MW)	200 Hour Allocation Factor (%)	Conserved and Normalized Demand (MW)	Conserved and Normalized Allocation Factor (%)	Difference (%)
Residential	2,081	57.7%	3,441	65.8%	8.1%
General Service: Secondary	904	25.1	1,075	20.5	(4.6)
Primary	255	7.1	326	6.2	(0.9)
High Voltage	344	9.5	364	7.0	(2.5)
Lighting	8	0.2	10	0.2	0.0
Firm Resale	16	0.4	17	0.3	(0.1)
Total:	3,608	100.0%	~~4,832~~ 5,233	100.0%	--

alh

Table 12

Energy Allocation Factor Comparison
Puget Proposal v. WICFUR Recommendations

Class	Actual Energy (gWh)	Actual Allocation Factor (%)	Conserved and Normalized Energy (gWh)	Conserved and Normalized Allocation Factor (%)	Difference (%)
Residential	8,941	46.7%	10,159	49.0%	2.3%
General Service: Secondary	5,695	29.8	5,990	28.9	(0.9)
Primary	1,521	7.9	1,551	7.5	(0.4)
High Voltage	2,798	14.6	2,856	13.7	(0.9)
Lighting	64	0.3	64	0.3	0.0
Firm Resale	126	0.7	126	0.6	(0.1)
Total:	19,145	100.0%	20,746	100.0%	--

CLASSIFICATION AND ALLOCATION OF TRANSMISSION COSTS

Q. DO YOU AGREE WITH THE MANNER IN WHICH THE COMPANY HAS CLASSIFIED AND ALLOCATED TRANSMISSION COSTS?

A. Yes. The Company has segmented the transmission plant into two categories: (1) generation-related (30%); and (2) non-generation-related (70%). The generation segment was classified in the same manner as production-related investment, using the peak credit approach. The non-generation portion was classified 100% to demand, in recognition of its use, and allocated based on the coincident demand allocation factor. These two subfunctions capture the two major uses of Puget's transmission system: to integrate the generating resources into the load area and to provide a sufficient network of capacity to maintain a reliable system even under unexpected or forced outage situations.

CLASSIFICATION OF DISTRIBUTION COSTS

Q. HOW HAS THE COMPANY CLASSIFIED DISTRIBUTION COSTS IN THIS PROCEEDING?

A. The Company has acquiesced to the urgings of Commission Staff and Public Counsel to abandon any form of a minimum grid or access charge concept for classifying distribution costs. Under these methods, some portion of the distribution costs are considered to be necessary for the service to be available for the customer's use and therefore classified as being customer-related. The remaining costs are then classified to demand and assigned using a noncoincident allocation factor. In this proceeding, however, the Company has used a limited basic customer method whereby only the costs of services and meters are classified as being customer-related (16%). All other costs--about 84%--are classified to demand.

Q. IS THE BASIC CUSTOMER METHOD APPROPRIATE FOR USE IN CLASSIFYING PUGET'S DISTRIBUTION COSTS?

A. No. On this issue WICFUR supports the testimony submitted by Mr. Saleba on this issue. However, I will provide the following limited comments. As indicated in sensitivity studies performed by the Company on this issue, the shift in cost responsibility is too dramatic to justify abandoning the theoretically correct approach in order to placate the Staff and Public Counsel. Contrary to Puget's allegation, there is no "consensus" on the issue. Consensus will never be reached on this issue just as is the case with all other major cost allocation issues where substantial shifts in cost responsibility creates "winners" and "losers".

During the Rate Design Collaborative meetings, the Company indicated it had commenced work on updating and refining the assignment of distribution-related costs to the customer classes. Unfortunately, it appears the Company ceased this effort.

The assumption that only services and meters are customer-related, an assumption the Company now only tentatively embraces, ignores the fact that a more extensive distribution system is required to physically attach and maintain service to a multitude of small customers as compared to larger customers of the same total requirements. This is precisely why a proper cost-of-service study should recognize that a customer or access component of the distribution system goes far beyond the meter and service drop.

As stated in my previous testimony before this Commission, the claim that there is no customer component to the distribution system rests on the following insupportable arguments: (1) additional customers can be added without incurring additional investment; (2) the issue is really one of customer density; and (3) the costs are unallocable "joint" costs that cannot be separated into demand and customer components.

None of these reasons justifies the argument for rejecting the "customer component" or "access" concept. Additional investment is needed to serve Puget's ever-expanding customer base. Adding one or two customers may not make a noticeable difference. But Puget adds 25,000 customers per year which makes a significant difference.

Customer density does indeed impact customer costs. However, unless it can be shown that it varies significantly between customer classes, it has no relevance in classifying distribution costs. If all customer classes have essentially the same density characteristics, recognizing the customer component of the distribution system reflects reality, without penalizing any customer class.

The "joint" cost argument applies with equal logic to many of the distinctions made in any cost study; but such distinctions must still be made. As I noted previously, generation costs are always separated into demand and energy components. While there are conceptual problems in disaggregating theoretically inseparable functions, such as generation costs, it is better to be approximately right than to ignore undeniable facts solely to maintain theoretical purity. It always has been, and it continues to be, appropriate to classify some portion of the distribution investment as being customer-related.

COST-OF-SERVICE RESULTS AND RATE SPREAD RECOMMENDATION

Q. HAVE YOU QUANTIFIED CLASS COST RESPONSIBILITY BASED ON YOUR COST-OF-SERVICE RECOMMENDATIONS?

A. Yes. The results of two cost-of-service studies have been included in Appendix C to this testimony. The first cost study incorporates the following three recommendations:

1. Puget's credit classification demand/energy split is changed from 16%/84% to 31%/69%,
2. The demand and energy allocation factors are normalized to be consistent with Puget's revenue requirement normalization adjustments, and
3. The demand and energy allocation factors are also adjusted for the conservation savings Puget has achieved.

The second cost-of-service study contains these same three modifications and the additional recommendation of classifying distribution costs between demand and customer components using the same method as was done by the Company in prior proceedings.

Q. PLEASE SUMMARIZE THE RESULTS OF THESE COST-OF-SERVICE STUDIES.

A. To facilitate the comparison of the two WICFUR studies with the study submitted by Puget, the following table presents the ratio of class revenue to cost responsibility. If the class "parity ratio" is less than 100%, the revenues collected from the class are inadequate to compensate the Company for the cost incurred in providing service to the class. On the other hand, a parity ratio greater than 100% indicates the class is contributing more than its fair share of revenues to cost responsibility.

Table 13

Comparison of Class Cost-of-Service Studies Ratio of Revenue to Cost Responsibility

Voltage Class	Puget COSS	WICFUR-Excluding Min. Dist. Sys.	WICFUR-Including Min. Dist. Sys.
Residential	97%	87%	84%
Secondary: Small	109%	123%	122%
Medium	115%	130%	146%
Large	113%	130%	145%
Primary	91%	108%	118%
High Voltage	86%	105%	105%
Lighting	134%	144%	146%
Resale	75%	92%	99%

As indicated by the table, correcting for the inappropriate classification and allocation techniques contained in Puget's study results in a substantial difference in class cost responsibility. Under Puget's study the Residential, Primary, High Voltage and Resale classes all have parity ratios less than 100%. However, under the WICFUR studies only the Residential and Resale class revenues are insufficient to cover Puget's cost of providing service.

Q. DO YOU SUPPORT THE COMPANY'S PROPOSAL TO GRADUALLY MOVE CLASS REVENUE RESPONSIBILITY TOWARDS THE RESULTS INDICATED BY COST-OF-SERVICE STUDIES?

A. Yes. WICFUR supports in concept Puget's effort to move all class rates closer to a parity ratio of 100% in a gradual manner. Further, Puget's proposal of going one-third of the way at this time is appropriate. However WICFUR cannot support using Puget's flawed cost-of-service study as the yard stick for determining class cost responsibility. In determining the distribution of the rate increase resulting from these consolidated proceedings, the cost-of-service results indicated by WICFUR's study excluding the minimum distribution system, should be employed. Based on Puget's full increase request, the following table illustrates percentage increases resulting from moving one-third of the way toward parity. For comparison purposes, Puget's proposed rate spread is also present.

Table 14

Rate Spread Comparison
Percentage Increases

Voltage Class	Puget Proposal	WICFUR Recommendation	Difference
Residential	12.7%	17.7%	5.0%
Secondary: Small	8.4%	4.1%	(4.3)%
Medium	6.6%	2.6%	(4.0)%
Large	7.3%	3.1%	(4.2)%
Primary	15.3%	8.4%	(6.9)%
High Voltage	17.4%	8.9%	(8.5)%
Lighting	1.8%	(0.3)%	(2.1)%
Resale	25.1%	14.8%	(10.3)%
Total	11.5%	11.5%	0.0%

Q. WHY DID YOU NOT DETERMINE THE RATE SPREAD RECOMMENDATION USING THE WICFUR COST-OF-SERVICE STUDY THAT CLASSIFIED DISTRIBUTION COSTS USING A MINIMUM DISTRIBUTION SYSTEM APPROACH?

A. Absent other considerations, this study would have been used as the basis for WICFUR's rate spread recommendation since it includes a more appropriate method for assigning distribution-related cost responsibility. However, the use of this study would have resulted in too great an increase (more than about 1.5 times the system average) for the Residential class. As it turns out, the WICFUR study excluding the minimum distribution system, allows for substantial movement toward rate parity without causing any single customer class to receive an increase much beyond 1.5 times the system average, a reasonable ceiling level.

<u>RATE DESIGN MATTERS</u>

Q. DO YOU SUPPORT THE COMPANY'S EFFORTS TO RE-DESIGN THE INDUSTRIAL RATE SCHEDULES AND OFFER ADDITIONAL EXPERIMENTAL TARIFFS?

A. Yes. WICFUR supports the general movement toward cost based rate designs, including seasonally differentiating demand charges and reflecting greater seasonality in the energy charges. Additionally, the proposals to offer new interruptible and optional tariffs (Schedules: 38, 39, 30 and 48) on a limited or experimental basis is appropriate until several years of experience is gained under these rate structures. There is one aspect of the interruptible tariffs, however, that will likely result in limited if any acceptance of these tariffs.

Q. WHAT DO YOU PERCEIVE AS A SHORTCOMING IN THE INTERRUPTIBLE TARIFF SCHEDULES?

A. For customers to volunteer for these schedules, the benefit--a reduced or lower rate--must compensate the customer for the costs associated with the service interruptions. At the same time, the Company can not provide an interruptible credit greater than the alternate cost of providing the capacity in the most economical manner possible. The balance struck between the customer's and the Company's needs will determine the success or failure of the interruptible schedules.

Unfortunately, the long-term interruptible reservation credit being offered by the Company ($1.25 per kilowatt per month of interruptible demand) is only about 20% of the long-term fixed cost portion of providing firm capacity (about $15.00/kW-year v. $72/kW-year). Consequently, it is likely to be inadequate to attract any significant interruptible load, an unfortunate situation since the Company needs to acquire an additional 400 MW of capacity.

Q. WHAT WOULD BE AN APPROPRIATE INTERRUPTIBLE RESERVATION CREDIT FOR A LONG-TERM COMMITMENT?

A. The utility and its other customers will benefit to the extent the interruptible rights can be acquired at a price less than the available alternatives. Under the Company's proposed new interruptible tariff design, the customers are paid a reservation charge plus an energy credit applied to the interrupted load. Accordingly, the reservation credit should reflect the fixed costs of resources standing by to provide capacity. Based on WICFUR's peak credit determination, Puget's long-term fixed levelized cost of providing capacity is $72/kW-year. Therefore, WICFUR recommends that at least one-half of this value--$36/kW-year or $3.00/kW-month be offered under the new tariffs. Further, the Company should inform the customers under existing Schedules 43 and 46 of the opportunity to transfer to the eligible new schedule.

Q. THANK YOU. I HAVE NO MORE QUESTIONS AT THIS TIME.

APPENDIX A

APPENDIX A

**Qualifications and Background
of
Donald W. Schoenbeck**

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. Donald W. Schoenbeck, 825 N.E. Multnomah Street, Portland, Oregon 97232.

Q. PLEASE STATE YOUR OCCUPATION.

A. I am a consultant in the field of public utility regulation and I am a member of Regulatory & Cogeneration Services, Inc. (RCS).

Q. PLEASE SUMMARIZE YOUR EDUCATIONAL BACKGROUND AND EXPERIENCE.

A. I have a Bachelor of Science Degree in Electrical Engineering from the University of Kansas and a Master of Science Degree in Engineering Management from the University of Missouri.

From June of 1972 until June of 1980, I was employed by Union Electric Company in the Transmission and Distribution, Rates, and Corporate Planning functions. In the Transmission and Distribution function, I had various areas of responsibility, including load management, budget proposals and special studies. While in the Rates function, I worked on rate design studies, filings and exhibits for several regulatory jurisdictions. In Corporate Planning, I was responsible for the development and maintenance of computer models used to simulate the Company's financial and economic operations.

In June of 1980, I joined the national consulting firm of Drazen-Brubaker & Associates, Inc. Since that time, I have participated in the analysis of various utilities for power cost forecasts, avoided cost pricing, contract negotiations for gas and electric services, siting and licensing proceedings, and rate case purposes including revenue requirement determination, class cost-of-service and rate design.

RCS provides consulting services in the field of public utility regulation to many clients, including large industrial and institutional customers. We also assist in the negotiation of contracts for utility services for large users. In general, we are engaged in regulatory consulting, rate work, feasibility, economic and cost-of-service studies, design of rates for utility service and contract negotiations.

Q. IN WHICH JURISDICTIONS HAVE YOU TESTIFIED AS AN EXPERT WITNESS REGARDING UTILITY COST AND RATE MATTERS?

A. I have testified as an expert witness in rate proceedings before commissions in the States of Alaska, Arizona, California, Delaware, Illinois, Montana, North Carolina, Ohio, Oregon, Washington, Wisconsin and Wyoming. In addition, I have presented testimony before the Bonneville Power Administration, the Federal Energy Regulatory Commission, publicly-owned utility boards and in court proceedings in the States of Washington and Oregon.

APPENDIX B

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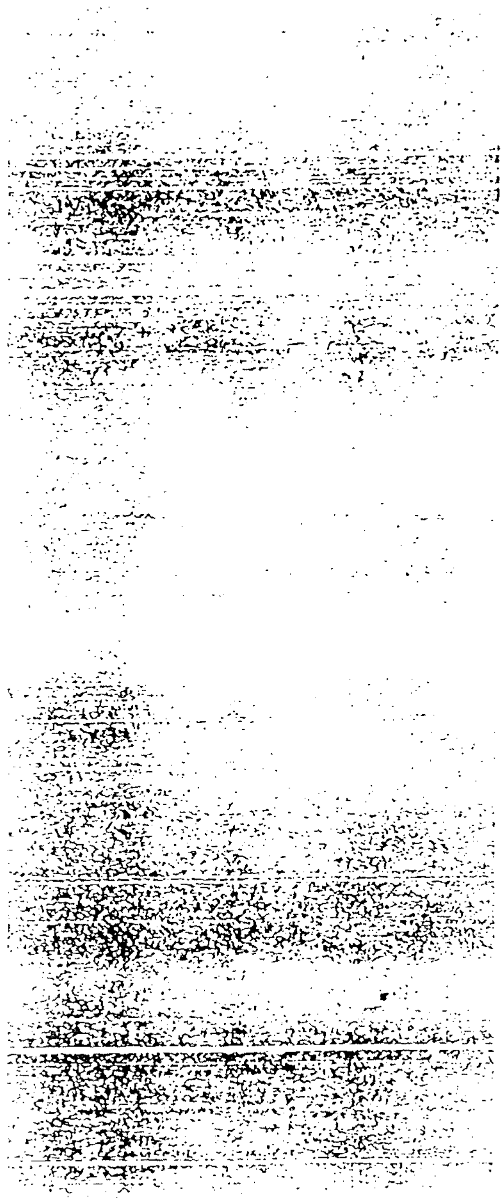
the Electricity JOURNAL

Energy Efficiency: 1989
Part II



Utility Conservation Incentives: Everyone Wins

By allowing utilities to charge consumers for energy conservation services in the same way they are charged for energy supply, regulators can help serve both efficiency and equity.

Myron B. Katz

***Mike Katz** has served as a Public Utility Commissioner in Oregon since 1988. Prior to that he served the Department of Energy's Bonneville Power Administration for over 25 years as senior economist and, later, Assistant to the Administrator. While with DOE, he served in special capacity as Editor-in-Chief of DOE's 1979-80 National Power Grid Study and as Director of the Northwest Energy Policy Project. He holds an undergraduate degree from the University of Wisconsin and has done graduate studies at the Universities of Northwestern, Chicago, Washington and Oregon. The views expressed here are his own and not those of the Oregon PUC.*

Some things are remarkably self-evident. For example, investor-owned electric utilities rely more or less exclusively on the sale of energy for revenues and hence for profits. Utility profits are diminished by actions that reduce sales or increase expenses. It has not gone unnoticed that most conservation programs do both simultaneously.

This article is a contribution to the current debate on the proper treatment of conservation as an energy resource. Among recent participants in that debate are the Northwest Power Planning Council, Professor Paul L. Joskow of MIT, former Maine Public Utilities Commissioner David Moskovitz, Amory Lovins of the Rocky Mountain Institute, Eric Hirst of Oak Ridge National Laboratory, Ralph Cavanagh of the Natural Resources Defense Council, and Professors William Hogan and Charles Cicchetti of Harvard's Energy and Environmental Policy Center. Versions of their contributions have appeared in *The Electricity Journal* of August/September 1988 and March 1989.

The Problem

A utility can ordinarily meet load growth in one of two ways—conservation or generation. Both cost money. Investment in generation, even if more costly than conservation, is ordinarily "rate based," i.e., allowed to earn a return on investment. Moreover, when sold, the kWh product of that investment produces revenues.

Conservation, on the other hand, is often denied the opportunity to earn a return on investment.[1] Moreover, conservation reduces revenue-producing sales of kWh. The more successful the conservation, the greater the reduction in kWh sales. Until a utility's next regulatory rate case, conservation cuts into profits by increasing costs and reducing revenues. In the long run, assuming demand is inelastic, rates must be increased to compensate not only for increased expenses but for decreased revenues as well. This is true even if the marginal cost of a kWh saved by conservation is less than average system or embedded cost. Not so for generation. If the marginal cost of generation is less than average embedded cost, the addition of generation would push rates down, not up.

Bright utility managers who want to get ahead will notice that utility profits are coupled to the sales of kWh. Under the circumstances, they will be inclined to pursue programs that (1) increase revenues, (2) keep expenses down, and (3) increase investments on which a return can be earned. Generation fits that bill better than conservation.

There is nothing sinister or venal about this. It is what happens when one keeps shareholders in mind. When driven by profit-maximizing proclivities, a utility's first preference is to avoid spending any money on conservation. But if forced to spend on conservation, its second preference might well be to spend on conservation that doesn't work. In that way, at least, revenues are not seriously diminished.

The Solution

How can electric utilities be given a proper incentive to acquire least-cost conservation resources to meet load growth? How can utility profits be uncoupled from exclusive reliance on conventional kWh sales? The conceptually correct answer is to treat conservation *exactly* as any other resource. To do that utilities must charge for unconventional kWh saved by virtue of conservation measures installed by utilities in customers' premises the same as they charge for conventional kWh that are fed through meters. In other words, utilities should be in the business of selling energy services.[2]

Table 1 depicts, from a "global" perspective, two alternative ways to meet a 10 percent utility load growth: additional generation or conservation. It assumes that conservation is cheaper than new generation and, for purposes of illustration, cheaper than embedded average system cost, too. Within the conservation strategy there are two alternative substrategies: one in which the utility invests in con-

When driven by profit-maximizing proclivities, a utility's first preference is to avoid spending any money on conservation.

servation but gives it away to consumers free, collecting the costs in rates to all consumers; the other in which the utility invests in conservation and charges for it as for other electricity.

Observations About Table 1

Both Conservation Strategies I and II result in minimum total bills ($53 million annual revenue requirement) to serve tomorrow's load. Why? Because in this illustration, the extra cost of serving additional load by conservation averages only 3 cents per kWh, below embedded average cost of 5 cents per kWh. The extra cost of additional generation, on the other hand, is 6 cents per kWh. Hence, from society's perspective conservation is incontestably superior to generation for meeting additional load.

However, in Strategy I conservation is not treated the same as other resources. There conservation kWh are not paid for by the principal beneficiaries. They are paid for instead by the consumers of conventional kWh who not only pay for electricity flowing through their own meters (as they should) but also for other people's energy services achieved by conservation savings.

The few big winners are those who obtain free conservation and decreased bills.

Table 1 shows that Strategy I results in the highest rates (5.3 cents per kWh) for consumers of conventional kWh even though conservation is the least-cost alternative. The many losers are those who consume conventional kWh, whose consumption remains unchanged, whose rates will go up from 5 cents per kWh to 5.3 cents per kWh and whose bills will increase commensurately. The few big winners are those who obtain free conservation and as a result,

TABLE 1: Conservation Pricing Examples—Macro Perspective
(Utility System and Ratepayers)

	Today	Tomorrow		
		Generation Strategy	Conservation Strategy	
			I	II
1. Initial Annual Load (kWh 000s)	1,000,000	1,000,000	1,000,000	1,000,000
2. 10% Load Growth (kWh 000s)	—	100,000	100,000	100,000
3. Total Annual Energy Services (kWh 000s)	1,000,000	1,100,000	1,100,000	1,100,000
4. Annual Revenue Requirement ($ million = total bills)	50.0[1]	56.0[2]	53.0[3]	53.0[3]
5. Average Rate (cents/kWh)	5.00	5.09	5.30	4.82
Derivation: Row 4 divided by row	3	3	1	3

[1] Embedded cost of existing system is 5.0 cents per kWh
[2] Additional generation costs 6.0 cents per kWh
[3] Additional conservation averages 3.0 cents per kWh

Note: Conservation Strategy I imposes tomorrow's total system costs on the consumers of 1 billion conventional kWh. Conservation is given away free.

Conservation Strategy II imposes tomorrow's total system costs on the consumers of both 1 billion conventional kWh and 100 million conservation kWh. Consumers are charged for conservation as for any other energy resource.

substantially decreased bills.

Conservation Strategy II, on the other hand, treats conservation exactly as any other energy resource. Those who consume energy services, whether conventional kWh or conservation kWh, pay for energy services in proportion to their consumption. The utility, whose investments make it possible, charges for conservation kWh saved as well as for conventional kWh consumed.

Because in this illustration it is also the least-cost resource, utility investment in conservation under Strategy II results in the lowest rates for all consumers of kWh, conventional and conservation alike. There are no losers. Both efficiency and equity are realized. Total bills are minimized. Society achieves the least-cost utility system. Customers are treated fairly. The utility is able to earn revenues from all its resources, not just generating resources. Importantly, the utility has an incentive to invest in (and earn a profit from) conservation as it has had all along to invest in conventional generating resources. Strategy II successfully uncouples utility sales and profits from exclusive reliance on conventional loads. Table 2 depicts from a single household's perspective, the same two alternatives for meeting tomorrow's load growth—generation or conservation—and shows how typical electrically heated households fare under each strategy and substrategy.

Observations About Table 2

Table 2, below, incorporates the proposition demonstrated in Table 1 that to meet 10 percent utility system load growth under a Generation Strategy, rates have to be increased from 5 cents to 5.09 cents per kWh. An unweatherized house consuming 12,000 kWh a year would see its annual bill increase from $600 to $610.80.

If, instead, the utility adopts a Conservation Strategy and if such a house is selected for participation in the utility's weatherization program, its total consumption of *energy services* from the utility remains at 12,000 kWh per year but its conventional electricity load would drop by 2,000 kWh a year.

Conservation Strategy I

Let us first consider Conservation Strategy I where weatherization is given away to users without charge. The utility's rates would have to increase 6 percent, from 5 cents to 5.3 cents per kWh, which means that most of the burden must be borne by other nonparticipating ratepayers.

Participating House

For the initially unweatherized participating house, the 6 percent rate increase is more than offset by a 16.7 percent reduction in conventional kWh consumption, from 12,000 to 10,000 kWh per year. Since Strategy I charges only for conventional kWh consumed, the household's annual bill will drop by 11.7 percent, from $600 to $530.

In terms of comprehensive energy services, however, there is no change. A weatherized house consuming 10,000 kWh annually of

The many losers are those who consume conventional kWh and whose bills will increase commensurately.

conventional electricity fed through the meter plus 2,000 kWh of conservation savings is assumed to yield the same (some say superior) comfort and convenience as an unweatherized house consuming 12,000 kWh per year of conventional electricity.

Nonparticipating House

What happens to households that do not participate? Under Conservation Strategy I, everyone's electricity rates would be increased by 6 percent, from 5 cents to 5.3 cents per kWh. Without consuming a single kiloWatt-hour more, each unweatherized house not selected for participation would find its annual bill increasing from $600 to $636. Is it not peculiar that that is considerably *more* than their bills would go up if the higher cost Generation Strategy had been adopted instead? Clearly, all these ratepayers, and they represent the majority, would be better off with the utility acquiring additional expensive generation (which will cost each of them $610.80 a year) than cheaper conservation (cost-

Under Strategy II, there are no losers. Both efficiency and equity are realized. Total bills are minimized. Society achieves the least-cost utility system.

TABLE 2: Conservation Pricing Examples—Micro Perspectives
(Typical Electrically Heated Households)

	Today	Tomorrow: Generation Strategy	Tomorrow: Conservation Strategy I	Tomorrow: Conservation Strategy II
PARTICIPATING HOUSE (Initially Unweatherized)				
1. Annual conventional load (kWh)	12,000	12,000	10,000	10,000
2. Annual conservation saving (kWh)	—	—	2,000	2,000
3. Total Annual Energy Services (kWh)	12,000	12,000	12,000	12,000
4. Average Rate (cents/kWh) (Table 1)	5.00	5.09	5.30	4.82
5. Annual Bill (dollars)	600.00	610.80	530.00	578.40
Derivation: Row 4 times row	3	3	1	3
NONPARTICIPATING HOUSE (Without Weatherization)				
1. Annual conventional load (kWh)	12,000	12,000	12,000	12,000
2. Annual conservation saving (kWh)	—	—	—	—
3. Total Annual Energy Services (kWh)	12,000	12,000	12,000	12,000
4. Average Rate (cents/kWh) (Table 1)	5.00	5.09	5.30	4.82
5. Annual Bill (dollars)	600.00	610.80	636.00	578.40
Derivation: Row 4 times row	3	3	1	3
NONPARTICIPATING HOUSE (Previously Weatherized)				
1. Annual conventional load (kWh)	10,000	10,000	10,000	10,000
2. Annual conservation saving (kWh)	2,000	2,000	2,000	2,000
3. Total Annual Energy Services (kWh)	12,000	12,000	12,000	12,000
4. Average Rate (cents/kWh) (Table 1)	5.00	5.09	5.30	4.82
5. Annual Bill (dollars)	500.00	509.00	530.00	482.00
Derivation: Row 4 times row	1	1	1	1

Getting the consumer equities right doesn't have to depend on a spin of the wheel.

ing each of them $636 a year). They might be expected to howl.

On the other hand, those who, because of civic virtue, social conscience, environmental sensitivity, or other noble reason had already weatherized their homes at their own expense would be out of luck. Consuming only 10,000 kWh of conventional electricity per year, each previously weatherized house under Conservation Strategy I would have its annual bill increase from $500 to $530. This is not because such households are contributing to load growth (on the contrary, their consumption has previously been reduced), but because they had the misfortune of proceeding to do on their own what they and everyone else should have been doing in the first place.

These virtuous households would also be better off with a Generation Strategy ($509 annual bill) than with Conservation Strategy I ($530 annual bill). They should howl, too.

Neglectful homeowners who stalled and did not weatherize and as a result are selected for participation under Strategy I find their annual electric bills dropping from $600 to $530. Conscientious homeowners who previously weatherized on their own and pay for it themselves find their annual electric bills increasing from $500 to $530. Conservation Strategy I, which gives conservation away, rewards vice and penalizes virtue. It is an incentive system stood on its head.

Conservation Strategy I, which gives conveervation away, rewards vice and penalizes virtue. Nonparticipating ratepayers might be expected to howl.

Conservation Strategy II

Now let us turn to Conservation Strategy II. Only Strategy II is a win-win-win proposition. There are no losers. Conservation is treated as any other resource. Because in this illustration conservation costs less than average system cost of existing generation, in the face of 10 percent utility load growth accommodated by conservation savings, everyone's rates for electricity (conventional kWh and conservation savings alike) decline by 3.2 percent, from 5 cents to 4.82 cents per kWh.[3] Those who use energy services pay for energy services.

Under Strategy II, the annual bills for those unweatherized homes selected for participation in the utility's weatherization program would go down from $600 to $578. Those homes would continue to consume 12,000 kWh a year of energy services: 10,000 kWh of conventional electricity and 2,000 kWh conservation savings. Unweatherized homes that do not participate find that their bills go down a like amount because they receive the same service (12,000 kWh per year) but with a lower average rate.

Finally, for those admirable people who previously weatherized their own homes at their own expense, annual electricity bills will also go down still further, from $500 to $482. Justice at last.

Enabling utilities to extract profits from investments in conservation as from investments in generation provides the proper incentive for utilities to proceed toward genuine least-cost resource acquisitions.

General Observations

Conservation Strategy II solves several problems simultaneously. Under that strategy, utilities would no longer rely exclusively on conventional kWh sales for revenues. Charging for all energy services and enabling utilities to extract profits from investments in conservation as from investments in generation provide the proper incentive for utilities to proceed toward genuine least-cost resource acquisitions whether they be demand-side conservation or supply-side generation.

Here are some important policy principles. Utility investments in low-cost conservation resources should not be "expensed" in the year they are made. As in Oregon, they should be (1) added to utility plant-in-service rate base, (2) amortized over their useful lives, and (3) allowed a reasonable rate of return. The overriding guiding principle is straightforward: treat conservation and other demand-side management techniques exactly the same as other resources are treated.[4]

An important characteristic of both Conservation Strategies I and II is that they overcome the disinclination of many homeowners to make investments on their own that have long payback periods. It is frequently noted that most consumers have a notoriously high personal discount rate. Unless a payback period is less than one or two years, they prefer spending to investing. In both Conservation Strategies I and II, the utility, not the consumer, is expected to make the full investment in weatherization as it does in generation resources. But only with Strategy II can a utility expect to earn revenues (and profits) from investment in conservation as it does from generating resource investments.

Implementation

How can a utility recover its investment in weatherization? Theoretically, under Conservation Strategy II the utility should charge for conservation savings at the same rate as for conventional electricity—namely, average system cost—where cost includes amortization expenses of utility conservation investment. Because there is no meter to measure conservation savings month by month, it may be difficult to estimate that form of energy services consumption accurately.

A reasonable surrogate would be to set up a separate amortization schedule to recover the appropriate portion of a utility's weatherization investment in each house. The payments due could be included on the household's monthly utility bill. The interest rate to be charged could correspond to the utility's authorized rate of return.

If conservation can be acquired for 3 cents per kWh, as is assumed in Tables 1 and 2, the "surrogate" amortization payments would amount to only 3 cents per kWh saved, less than the rate charged for conventional kWh. The customer's total bill would have added to it the monthly amortization payment to recover the cost of conservation and subtracted from it an even greater amount by virtue of consuming less conventional kWh. In this case, however, the benefits of low-cost conservation would not be shared with other ratepayers. If that is what it takes to make the strategy work, it should be done. At least other customers will be spared the high rates associated with a higher-cost generation strategy or, what is so perverse, the even higher rates of a lower-cost conservation strategy in which conservation is subsidized. Second best which leaves everyone as well off or better off is preferable to first best which may not work in practice.

What portion of a utility's conservation investment in a customer's premises should be recovered directly from that customer? All of it, up to the point where the cost of conservation is no more than the utility's embedded average system cost per kWh. If, however, cost-effective conservation exceeds the utility's average system cost (unlike the illustration in Tables 1 and 2), it should still be acquired when needed to meet load. Being cost effective means it is cheaper than any alternative. But when acquired it will drag average system cost up, naturally. A customer in whose premises a conservation measure is installed by a utility should not be charged more for a conservation kWh saved than the

Most consumers have a notoriously high personal discount rate. Hence, in both Conservation Strategies I and II, the utility, not the consumer, is expected to make the full investment in weatherization.

The "demand side payment" debates have unleashed a torrent of words, but concepts adopted have to work in the real world.

Ratepayers could be provided incentives to participate through lower rates. A decision to participate or not should leave other ratepayers indifferent.

average utility system cost per kWh for that particular class of customer. Any conservation costs in excess of average system cost should be spread over the entire rate base, exactly as is done with investment in generation, the cost of which exceeds embedded average system cost. Such costs in excess of system average should be recovered from all customers based on each customer's consumption of energy services (including, of course, conservation kWh).

In any event, as illustrated in Table 2, the participating homeowner's utility bill for energy services combining charges for both conventional kWh and conservation savings kWh will be lower than it would otherwise be were the utility to embark on a Generation Strategy to meet future load. So would the bills of all other customers. Utilities would be in the business of marketing not just conventional kWh but a broader range of energy services, and least-cost ones at that.

What about the unweatherized home whose owner does not wish to participate in a utility weatherization program? Homeowners whose unweatherized houses are identified for participation should have the choice of participating or not. Involuntary participation should not be imposed upon reluctant homeowners. But by refusing to participate, the homeowner whose conventional electricity consumption remains at 12,000 kWh per year imposes higher (generation) costs on society. It is only reasonable and fair that society should be recompensed. How?

Here is one possibility. If some households decline to participate (and thus force the utility toward the higher cost Generation Strategy), they should remain on the standard tariff schedule associated with the Generation Strategy, while all other customers enjoy a lower tariff associated with Conservation Strategy II. A decision by a designated homeowner to participate or not should leave other ratepayers indifferent.

One final observation. There is nothing extreme about charging direct beneficiaries for conservation savings. Model Conservation Standards (MCS), the energy-saving building codes about which conservationists are often and justifiably enthusiastic, are intended to do precisely that.

When government adopts and enforces MCS building codes, construction costs for new housing, reflected in homeowners' monthly mortgage payments, are increased. The same is true, of course, for all building codes.

The advantage of MCS to the participating homeowner and to ratepayers generally is that their combined mortgage payments and electricity bills are lower than without MCS. That is because MCS should be both cost effective for the utility and economically feasible for consumers.

Similarly, the advantage of Conservation Strategy II is that all participating ratepayers' bills (which reflect combined weatherization amortization payments and conventional electricity usage payments) are lower than they would otherwise be with a

Generation Strategy, and the equity issue is solved: those who use energy services pay for energy services—in proportion to their use.

Conclusion

It may be difficult to achieve simultaneously economic efficiency and perfect equity. But that does not grant license to endorse either inefficiency or inequity, or to tolerate an arrangement that can be improved upon. We should do the best we can.

Treating utility investment in conservation just as a generating resource is treated is an approach which (1) provides utilities with appropriate incentives to invest in cost-effective conservation, (2) achieves least-cost system objectives, (3) is theoretically sound, and (4) is fair to all ratepayers. It should be tried. ■

Footnotes:

1. Practices differ among the states. The current procedure in Oregon is to capitalize most weatherization expenditures which are then allowed to earn a return as a rate-base item and are amortized over a reasonable period of time.

2. The concept of charging for conservation kWh saved in the same fashion as for conventional kWh consumed was advanced in a paper by this author titled "Brief Essays in Clear Thinking: No. 7" distributed to the Northwest Power Planning Council in 1985.

3. Even if the marginal cost of conservation were higher than embedded average cost, bills would go up less than they otherwise would as long as the cost of new conservation is less than the marginal cost of additional generation.

4. Some commentators suggest that utility rate-basing of conservation expenditures, while superior to the simple "expensing" of such costs in the year incurred, does not alone provide adequate incentives for utilities to invest in cost-effective conservation. To overcome that lack of incentive, some jurisdictions allow a higher rate of return on conservation investments than on traditional utility investments. Washington state, for example, allows 2 percent above the normally authorized rate of return for conservation investments.

However, without the additional element of changing direct beneficiaries for the energy services derived from conservation measures installed by a utility, as advocated here, not only is equity denied but electric utilities are competitively disadvantaged. As this article explains, when conservation is given away free, rates for conventional kWh must be increased to compensate for increased conservation expenses and, *ceteris paribus*, reduced electricity sales.

In Oregon as in other areas, electricity faces fierce competition from other fuels in certain important applications such as space heating. If rates for conventional kWh must be raised because of successful conservation measures, electric utilities can expect to see more space heating diverted to natural gas suppliers than otherwise. In periods of surplus or when the marginal cost of conservation is below average system cost, that loss of business means each remaining core customer will be obliged to pick up a larger share of the utility's fixed costs. The temptation to use the dreaded words "death spiral" to describe what might ensue becomes hard to resist.

An Economically Rational Approach to Least-Cost Planning

Least-cost planning proponents and skeptics alike must come to terms with two questions: how much potential for efficient conservation is out there, and how much direct responsibility should utilities have for demand-side management and environmental protection?

Alfred E. Kahn

Alfred Kahn *is Robert Julius Thorne Professor of Political Economy, Emeritus, at Cornell University and special consultant to National Economic Research Associates. His textbook,* The Economics of Regulation, *is one of the seminal works of utility economics. Dr. Kahn was chairman of the New York Public Service Commission from 1974-77.* *Dr. Kahn wishes to acknowledge Joel Brainard, Bruce Netschert, Dennis Rapp, and his colleagues at NERA for their helpful comments. This article was developed from a paper Dr. Kahn presented at a recent workshop on incentive regulation sponsored by New York state energy agencies and utilities and the U.S. Department of Energy.*

The title of this paper may suggest that there are major issues of principle between economists and advocates of least-cost planning. Actually I see none, at least not overtly: an economist can hardly quarrel with the goal of "least-cost planning."

Instead, the differences between the most ardent proponents and the economist-skeptics are primarily empirical and institutional.

The empirical issues have to do with the extent of the opportunities for efficient conservation that are at present not being exploited, and, similarly, on the size (or present value) of the as yet uninternalized environmental costs associated with the supply of electric power.

The institutional questions relate to the proper choice of instrumentalities for assessing those unexploited opportunities and external costs, and for remedying the market imperfections and failures they reflect — specifically, to whether the proper remedy lies in the kinds of least-cost planning that regulators in state after state are now requiring, with their increasing emphasis on direct utility company responsibility for demand-side management (DSM) and environmental protection.[1]

I propose to offer an exposition of the applicable economic principles and an economist's view of the alternative institutional mechanisms available for applying them — that is, for assessing the needs and opportunities and for remedying the deficiencies of our present or historic policies. In between, I will offer a cursory view of the factual evidence.

I. Some Elementary Economic Propositions for Utility Planning

A. The Supply Side

1. Electric utility companies should operate their generating plants and plan for the expansion of generating capacity in such a way as to minimize the costs to them and their customers, in present value terms, of whatever level of power is to be supplied.

2. Society should, by taking into account externalities (both costs and benefits), ensure that what is minimized is net total or social, rather than merely private, costs.

B. The Demand Side

1. Society should by some means determine the optimum level of output—that is, the level at which incremental benefits cease to exceed incremental cost. This means, in the present context, that demand-limiting alternatives must be weighed against output-expanding ones. If society can provide a given amount of space conditioning at lower incremental cost with more efficient air conditioners or more insulation, along with correspondingly fewer kWhs, than with less efficient air conditioners or insulation and more kWhs, efficiency requires the former be chosen over the latter. By the same token, the opposite outcome should dictate the opposite choice.

2. In weighing the economic merits of demand-reducing against supply-expanding options, all costs of each option must be taken into account, including costs of demand reduction incurred by consumers, and any related incremental inconvenience or loss of benefit.

Reduction of a consumer's total or average electricity bill alone is not necessarily an accurate sign of whether investments in conservation have or have not been efficient.

3. In auctioning systems, therefore, demand-limiting bids cannot be directly compared with supply-expanding ones. To pay consumers or outside suppliers of conservation services whatever they bid per kilowatt-hour of promised savings so long as those bids fall short of the marginal cost of expanding supply will involve paying them doubly, once in the direct payment by the utility, second in bill savings, and will therefore encourage inefficient demand-limitation. If, for example, price and marginal cost are both 7 ¢/kWh and a contractor proposing to install insulation successfully bids 6 ¢/kWh saved, the bidder and his customers will have an incentive to spend up to 13 ¢ to save a kWh.

C. Irrelevant Criteria

1. Efficient investments in demand reduction will have the effect of reducing the total costs incurred to achieve a given level of service, such as space conditioning, by power suppliers and customers together; but, by the same token, reduction of a consumer's total or average electricity bill alone is not necessarily an accurate sign of whether investments in conservation have or have not been efficient. Excessive investments in conservation, which have the effect of increasing the total costs of achieving a given level and quality of service, may well reduce average electricity bills.

2. In contrast with the average total cost of achieving a given level of service, including the costs and sacrifices incurred by consumers, the level of total utility company costs or the size of the average customer bill are not rational measures or criteria of economic welfare; they are a measure of nothing except themselves.

The same is true of average or total kWh sales. Declines in sales may be the consequence of either efficient or inefficient conservation; increases in kWh sales may reflect a failure to exploit opportunities for efficient conservation or real improvements in economic welfare.

D. Losers/No Losers

1. If the utility company finances efficient investments in conservation, and the beneficiaries pay for the kilowatt-hours saved at the same retail price they would otherwise have paid for the kilowatt-hours taken (as Cicchetti and Hogan have recommended),[2] average customer costs of achieving a given level of service will decline, and there will be no burden on non-participating customers — i.e., there will be no losers.

2. Subsidy payments by the utility company for such investments no greater than the amount by which marginal costs exceed the pertinent prices are necessary (although, as we will see, not necessarily sufficient) to elicit the economically efficient level of investment in conservation.

Such subsidies may necessitate increases in rates, depending upon whether customers would have made the investments in any event, but they will not increase rates to inefficient levels. Indeed, they will unequivocally contribute to economic efficiency, directly through the investments in conservation they induce and, indirectly, to the extent they do necessitate increases that bring rates closer to marginal cost.

3. If, however, customers have to be induced to undertake such efficient investments by subsidy payments greater (per kWh of electricity saved) than the amount by which marginal costs exceed the pertinent rates for power, economic efficiency may or may not be served, on balance. On the positive side will be the efficient investments induced in this way. On the negative side will be the tendency of such subsidies to encourage inefficient investments in conservation, unless the subsidies can be targeted precisely to induce the former and not the latter.

Moreover, whether those induced investments are efficient or not, such subsidies will inevitably result in average electricity rates higher than they would otherwise be. This means they will not only conflict unequivocally with the "no losers" test — that is, impose a burden on non-participants — but, if rates were previously at or above marginal cost, they will inefficiently discourage consumption generally.

The greater one's skepticism about the the costs of environmental hazards and the size of unexploited opportunities, the more apt one is to worry about overly exuberant regulatory intervention.

E. Competitive Distortions

Any such subsidies in excess of the amount by which marginal costs exceed price will also, by raising the average price of electricity, create a danger of inefficient competition or self-generation. The same will be true of any imposition on the utility companies or introduction into their planning decisions of environmental costs that would otherwise not be internalized, if the same burdens are not imposed also on those competitors.

These seem to me the pertinent economic principles and their corollaries. So far as I can see, there can be no quarrel with any of them.

II. The Empirical Issues[3]

In a sense, the critical questions are the factual ones. The larger one's estimate of our present failure to exploit opportunities for efficient conservation and of the economic costs of such environmental hazards as global warming, the more radical the institutional changes one is apt to advocate — and for good reason, because the larger the evidence it would provide of the inadequacy of our present institutions.

Conversely, the greater one's skepticism about the dimensions of these costs and unexploited opportunities, the more apt one is to worry about overly exuberant regulatory intervention designed to correct those deficiencies.

A. Energy Savings through Efficiency and Barriers to It

We have in recent years been

presented with assurances of truly stupendous potential savings in the use of energy, assertedly without sacrifice in the quality of the services it provides and at costs only a small fraction of the cost of additional supplies. The most dramatic of these (to my knowledge) have come from Amory Lovins' Rocky Mountain Institute, which estimates

> a long-term potential to save about 75% of the electricity at an average cost of .6 cent per kilowatt-hour — several times lower than just the cost of fuel for a coal or nuclear plant.[4]

In the very article in which Lovins and others make the foregoing assertion, the authors cite a 1990 EPRI report[5] whose estimates of potential savings diverge quite dramatically from those of Lovins. According to it,

> it is *technically feasible* to save from 24 to 44 percent of U.S. electricity by 2000—some of it rather expensively—in addition to the 9 percent already included in utility forecasts.[6]

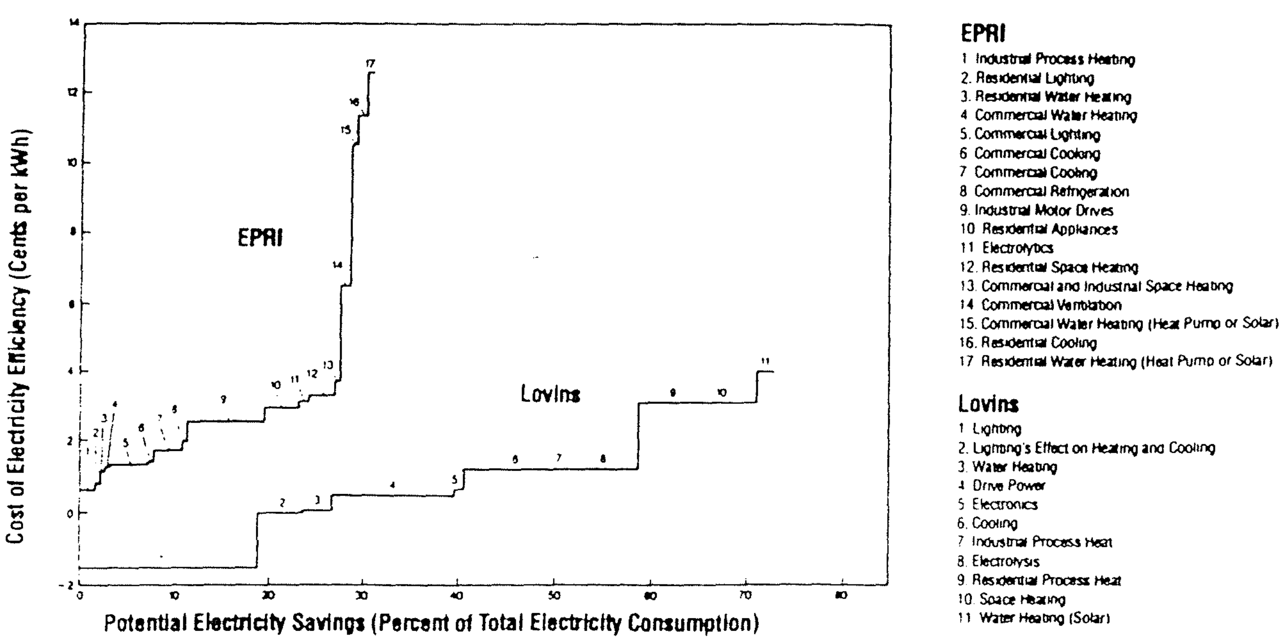
As the accompanying chart from that article shows, Lovins asserts that the supply curve of this "resource" is very flat, with the costs of most of the kWhs that can be saved running less than 2.0 cents. According to the EPRI estimates, in contrast, most of the savings would come at a cost of more than 2.0 cents per kWh, and the cost curve rises very sharply beyond savings of 25%.

Even the considerably more modest EPRI findings promise immense savings, however, and clearly imply that they would eliminate the need to construct any new capacity for many years. Those promises would seem to be confirmed, albeit at a much more modest level, by Lewis Perl's review and analysis of numerous reports by electric utility companies,[7] which estimate that their DSM programs have saved substantial amounts of power at costs ranging approximately from 2.1 to 3.6 cents per kWh.

The economist is forced irresistibly to question these estimates: if there are such enormous opportunities available, why aren't consumers taking advantage of them? If the answer is a lack of information, or lethargy, why then aren't there hordes of entrepreneurs vying strenuously to overcome those obstacles? And if the contention is an unwillingness or inability of consumers to assume the debt necessary to make such investments, with assertedly one to two year payouts, how can one reconcile that explanation with the size of home mortgage debt (amounting to over $2.5 trillion) or the responsiveness to the price of gasoline seen in the kinds of cars consumers buy, likewise heavily debt-financed?[8]

This doesn't mean we can't think of possible reasons; it means only that our principal reaction will be one of skepticism about their sufficiency.

Figure 1: Potential Electricity Savings



B. Bases for Skepticism about the Estimates

The Perl review suggests the following checklist of bases for skepticism about these messianic assertions:

1. Economics of Replacement. The more exuberant typically calculate the savings from replacing the entire existing stock of equipment with equipment embodying the most recent conservation technology— most of it assertedly less than a year old.[9] Setting aside the question of whether technologies "less than a year old" represent equipment actually currently available, any such comparison will egregiously exaggerate the untapped potential for economically efficient conservation: it would be wildly uneconomic to replace the existing stock all at once—all the more so because the technology will continue to improve—and some large part of the available savings will in any event be realized over time, without government intervention, as it becomes economic to replace existing equipment.

2. Administrative Costs. Many of the assessments of potential conservation ignore the costs of informing consumers about program opportunities, determining the applicability of each program to their individual circumstances, supervising the investment and monitoring the results, and the trouble and inconvenience to consumers themselves. These last — the bother of following up on the invitations and arranging to be at home at the appointed time — are undoubtedly part of the reason for the disappointingly low response rates of householders to some offers by utility companies to wrap their water heaters or distribute energy-efficient light bulbs to them free of charge.

3. Savings Less Than Estimates. The figures of potential savings and their costs typically quoted are based on engineering estimates; and the few studies we have of actual experience typically demonstrate achieved savings of only a fraction — although sometimes a large fraction — of those estimates. There are apparently several reasons for this discrepancy.

> *The few studies we have of actual experience typically demonstrate achieved savings of only a fraction — although sometimes a large fraction — of estimates.*

a. Investments in conservation lower the effective price of consumption. For example, the cost of heating is less in a well-insulated house than in a poorly insulated one. Consumers tend to respond by setting their thermostats higher in winter and lower in summer. This so-called "snap-back" effect is in no sense a sign of failure in economic terms — conservation investments are equally valuable whether used to save energy or increase comfort. But it does diminish their effectiveness in reducing consumption.

b. Engineering assessments may assume more perfect installation and performance of conservation investments than is achieved in practice.

c. Similarly, some of them ignore or underestimate the costs of administering the programs and the difficulty of eliciting full cooperation by customers.

4. Basis of Savings Measurements. Even where the estimates of savings from utility company programs are based on comparisons of participants' bills before and after, the methods of measuring the results frequently fail to meet the standards of carefully controlled experiments. Some simply use the change in the bills to estimate the savings, ignoring both the fact that some of the participants might have undertaken the measures in question without utility company assistance and the probable influence of other, exogenous factors, such as changes in price or weather.

A second method tries to correct for the first deficiency by asking participants whether they would have undertaken the specific conservation investment anyway — probably not a very reliable method of doing so.

Other studies attempt to correct for both these deficiencies by looking to changes in consumption by non-participants as well. Yet even many of these exaggerate the gains because the participants are volunteers: customers who elect to accept loans or take the trouble to obtain rebates on their purchases of energy-efficient appliances would probably have been more likely than the average nonparticipant to have made such purchases or undertaken other conservation measures without assistance.

5. *Free Rider Questions.* This free-rider phenomenon deserves separate emphasis, because almost all the estimates of unexploited opportunities for conservation, when used to justify remedial governmental action, ignore it. As I have pointed out, it may confidently be predicted that a very large portion of the opportunities presented by the most recent technologies will in any event be seized when and as it becomes economic to do so.

C. An Impressionistic Summary

There seems to be no reason to doubt that there is a good deal of economically efficient investment in conservation that is not being undertaken; this means there are undoubtedly market imperfections that justify vigorous governmental corrections.

But, second, the literature abounds with exaggerations. Accurate measurement of the results of utility company ventures in support of conservation is costly and difficult.[10] It is therefore tempting for commissions and companies — so long as the former reward the latter sufficiently — to employ casual measurement of results, declare victory, and claim the rewards. Our reading of the empirical literature suggests that commissions are well-advised to consider what the companies they regulate might do to encourage conservation; but that they ought to be cautious about coercing or inducing the companies to undertake major programs that will necessitate increases in rates to customers at large.

It is tempting for commissions and companies — so long as the former reward the latter sufficiently — to employ casual conservation measures, declare victory, and claim the rewards.

III. Institutional Arrangements

When an economist is asked how society can best make efficient choices, he or she will begin instinctively with the market — with the decisions made severally by buyers and sellers, each in pursuit of his or her self-interest. That conception is nothing to sneer at, as socialist regimes all over the world are discovering.

Under this arrangement, it is the responsibility of neither producers nor government agencies to make least-cost choices between production expansion and demand restraint. Rather, they emerge from competition among suppliers to sell their products — electric power, products that use energy more and less efficiently, and goods and services, like insulation, that reduce the need for it — on the one side, and the purchase decisions of customers on the other, guided by prices that tell them the incremental cost to society of their taking more or less of each of the alternatives and by their own individual circumstances, preferences and habits.

The market provides and processes all the voluminous relevant information, assesses all the conflicting promises of competing suppliers in relation to consumers' tastes and preferences, and — to the extent that markets are even tolerably well organized — responds with far greater efficiency than any governmental planning agency.

By this conception, the basic orientation of "integrated least-cost planning," as commonly conceived, is wrong-headed.[11]

A. Market Imperfections on the Supply Side: Monopoly

For markets to function properly, they must, of course, be free of major imperfections. The first and most relevant one, in the present context, is that electric utility companies are for the most part not subject to effective competition — which is why we regulate them.

It is worth reminding ourselves, however, of the historic purpose of that regulation: it is to protect consumers from monopolistic exploitation by emulating as closely as possible the results that would be produced by effective competition: a supply of utility services of optimal quality and reliability at minimum cost. To this end, regulators have long recognized a responsibility for assuring themselves, as best they could, that the companies operate as efficiently as possible. Specifically, and especially after the outbursts of inflation in the 1970s, they have increasingly insisted on reviewing supply expansion plans to be certain that they are neither excessive nor excessively costly — distorted by neither Averch-Johnson (i.e., rate base-inflating) nor reverse Averch-Johnson (i.e., capital-avoiding) incentives.

The initiation of these least-cost planning regulatory exercises was stimulated, in important measure, by the suspicion that electric companies were giving inadequate recognition to the effect of soaring energy prices on the levels of demand during this period and had, therefore, to be restrained from overbuilding. The purpose was not, however, to restrain demand. Sellers in a competitive market, which is what we were trying to emulate, do not look for ways to restrain demand for what they are trying to sell, but only to make sure estimates of its future course were not unrealistically high and therefore driving electric rates up needlessly.

That certainly did not mean that we at the New York Commission, in the middle 1970s, had no regard for environmental values. We recognized that the provision of electric power to the people of our state at minimum cost encompassed consideration of direct environmental costs imposed on them. That meant, for example, siting generating stations in such a way as to minimize adverse environmental effects (more precisely, to strike the best balance between those adverse effects and

Our goal was the lowest possible electric rates for service of a given quality and reliability. The goal today, increasingly, is conservation and environmental protection for their own sake.

the relative costs of different sites). But apart from recognizing those direct costs, we did not consider it our function to make environmental policy, as such.

We thought of ourselves also as ardent proponents of energy conservation.[12] Our overriding purpose in that advocacy, however, was as always the provision of service at minimum cost. Recall that the context was a dramatic increase in real energy costs; above all else, it was our goal to do everything we could to dampen that spiral. That explains our heavy emphasis on marginal cost pricing, the purpose of which was not substantially to impose our own program of demand restraint but simply to give customers the proper signals about the soaring incremental costs of their energy consumption.

Second only to our goal of holding down average rates was our aversion to discrimination and cross-subsidization. For that reason, when even so apparently worthy a project was recommended to us as the institution of lifeline rates, we urged the legislature to introduce such a program, specifically targeted at low-income families and taxpayer- financed, in order to avoid our having to engage in cross- subsidization. (We objected also because an undifferentiated low rate for, say, the first 250 kWh of consumption is a dreadfully inefficient way of achieving the legitimate social purpose.) Helping poor people pay their electric bills strikes me as a goal at least as worthy as the promotion of conservation.

What has changed in recent years, therefore, is not just that regulatory commissions have been insisting increasingly that utility companies practice least-cost planning and be given incentives to do so; we had those same concerns 15 years ago. But our goal was the lowest possible electric rates for service of a given quality and reliability. The goal today, increasingly, is conservation and environmental protection for their own sake. To the extent that these efforts represent a deviation from the historic goal of regulation, I believe they should be undertaken only with great restraint, and only after carefully designed and evaluated pilot programs demonstrate that they will indeed minimize costs for the people of the state, regarded collectively.

B. Market Imperfections on the Demand Side

Regulators attempting to fulfill their historic mission must, of course, recognize the imperfections on the buyers' side of the market, imperfections of knowledge, of access to credit, and the landlord/tenant relationship, all of which bias consumer choices between supply expansion and demand restraint.

But the logical remedy, economists would insist, is a direct attack: offer the necessary information and credit, impose building standards and require proper metering. The utility companies would seem to be especially well-equipped to provide some of these remedies, such as information and advice, loans on better terms than most customers can obtain for themselves, with repayments through normal billing procedures. They can also provide a kind of insurance by guaranteeing minimum bill reductions to customers who participate in particular programs: by pooling experience, they can diminish the risk to the individual customer of conservation achievements falling short of promises.

Interventions by utility companies to fulfill functions such as these could be essentially compatible with both the historic purpose of regulation and economic efficiency.

C. The Value of a No-Losers Test.

In the last analysis, however, I believe most economists would stop short of endorsing the imposition on utility companies of responsibilities and net costs (i.e., net of repayments) greater than the amount by which the marginal cost of the power they sell

exceeds the price at which they sell it, at the expense of non-participants.

This is not because they would deny the likelihood that even with offers of economically acceptable assistance and subventions, limited in the way I have just prescribed, consumers would nevertheless fail to take full advantage of conservation opportunities that would in fact leave them better off. It is, however, to say at least three things on the other side.

First, that there is a very great value in individual responsibility. If the only way consumers can be induced to do things that are in their own interest is to be subsidized by others, then many of us would contend it is a better society that permits them to suffer the consequences of their errors than one that, paternalistically, acts for them at the expense of others who have behaved prudently. Departures from this principle have the unhappy side effect of discouraging responsible behavior by third parties. If the utility company is going to subsidize people who will not act in their own interest, it becomes rational for others to refrain, in order to qualify for the subsidy.

Second, non-economists chronically underestimate the power of an efficient price. The best way, by far, to ensure efficient conservation is to price energy correctly. In circumstances where private costs fall short of total social costs, the best remedy, by far, is a tax: the way to secure greater automobile fuel efficiency is to put a heavy tax on gasoline; the way to forestall the greenhouse effect, to the extent it is economically efficient to do so, is to impose a tax on energy proportioned to CO_2 emissions.

Third, we have learned in recent years to set off against the phenomenon of market imperfections and failures the phenomenon of regulatory or governmental errors.[13] I suggest we add to the conventional wisdom about the "capture" of regulatory agencies by the companies they are supposed to regulate a recognition of the possibility of capture instead by public interest intervenors, who may find the regulatory process more responsive to their persuasions than legislators, on the one side, or the market, on the other. Most economists would suspect that if indeed consumers, offered advice, credit and proper prices, still refuse the bargain — if they have to be bribed, in addition, with funds raised from their fellow customers — there is a real possibility that the bargain is not a good one. And — to revert to my first observation — if the bargain really is a good one and they still reject it, then to hell with them![14]

This means, when confronted with the ultimate question, I think most economists would defend the "no-losers" test — not rigidly, but in its essential thrust. Our taking that position is somewhat ironical: ardent conservationists have learned all too well the difference between net social welfare losses and "mere" income transfers. But no economist I know contends that the distribution of income and income transfers should be ignored in the formulation of public policy. Nor should any regulator.

More important in the present context, the requirement of "no-losers" — a proscription of deliberate governmentally-enforced cross-subsidization — like the goal of minimizing electric rates, is a powerful safeguard of efficiency: programs that do not meet the test are much more likely to be inefficient than ones that do. The test, in short, sets a limit, in principle, to the possibilities of regulatory error.

The power to regulate is the power to tax. If that power is no longer constrained by the obligation to hold rates to the minimum, or to avoid imposing burdens unfairly on non-participants in conservation programs, then a principal barrier to the irresponsible exercise of that power will have been lifted.

3. Environmental Costs

However well the advice to avoid doing harm to ratepayers applies to utility ventures into conservation, it applies much less comfortably to the recognition of environmental costs, where the essence of what economic efficiency requires, and the market fails to achieve, is raising prices in order to incorporate those costs.

The counsel of self-restraint on the part of public utility regulators is still salutary, however, for a number of reasons:

- Environmental damages and the benefits of their recognition in price are not coterminous with state boundaries. Far from it: the major external costs of electric generation are regional, national and global. It makes absolutely no sense — unless, to be sure, every other more logical expedient fails — for each of 50 state utility commissions to be imposing separate environmental standards, except where the pertinent effects are indeed primarily local.
- There is also a question of their competence to do so — their professional competence and their legal and political entitlement to assume responsibilities already explicitly entrusted to environmental protection agencies.
- The perils of piecemeal environmentalism. We regulate public utilities because they are natural monopolies, or we think they are. In an orderly society, the scope of that regulation would be confined to what is logically implied by that rationale. True, electric companies happen also to be powerful generators of externalities, positive as well as negative; but the category of "public utilities" does not coincide with the category of economic activities that give rise to large externalities. Nor does it coincide with the narrower category of activities that give rise to external, environmental costs similar to those engendered by public utilities because they produce or use energy, such as driving automobiles.

There is therefore an inherent, high probability of distortions and inefficiencies if utility commissions impose on only the companies subject to their jurisdiction environmental costs greater than they are already forced to bear under statewide and nationwide environmental controls, merely because they happen to be regulating them already for entirely different reasons (a variant of the game of "gotcha!") while imposing no controls on their unregulated competitors or customers of their competitors.

- There is the danger that regulatory commissions will be captured by special pleaders, however idealistically motivated, and tempted to use their power to tax for purposes that strike them as socially desirable, however remote from their authentic responsibility to control monopoly.

I speak from personal experience when I issue the warning — paraphrasing Longfellow, who in turn was paraphrasing a lot of other people — that those whom the gods would destroy, they first make regulators! ■

Footnotes

1. Twenty-three states plus the District of Columbia were actively involved in least-cost planning as of June 1990; another nine were considering adopting some such program. Twenty-one of them incorporate an obligation to consider demand-side management as an alternative to supply expansion. Thirteen of them call for some explicit recognition of (presumably uninternalized) environmental costs.

See Natl. Assn. of Reg. Util. Comm'rs, A Survey of State PUC Activities to Incorporate Environmental Externalities into Electric Utility Planning and Regulation, May 1990; Regulatory Research Associates, Utility Composite — State Regulatory Overview, June 4, 1990.

2. C. Cicchetti and W. Hogan, *Including Unbundled Demand-side Options in Electric Utility Bidding Programs*, PUB. UTIL. FORT., June 8, 1989, at 9-20. See also P. L. Joskow, *Understanding the 'Unbundled' Utility Conservation Bidding Proposal*, PUB. UTIL. FORT., Jan 4, 1990, at 18-28.

3. In the following survey, I will confine my attention to the various estimates that have been made of the opportunities for conservation. I will be unable to do justice to the size of the uninternalized external costs of increasing electricity production.

4. A. P. Fickett, C. W. Gellings and A. B. Lovins, *Efficient Use of Electricity*, SCI. AM., Sept. 1990, at 66.

5. Efficient Electricity Use: Estimates of Maximum Energy Savings, prepared by Barakat & Chamberlin, Inc. for EPRI, Project No. 2788, Mar. 1990.

6. *Id.* at 66. Emphasis is supplied, because of course what is "technically feasible" will typically exceed substantially what is economically efficient.

7. L. Perl, Demand-Side Management: The Utilities' Next Nuclear Plant?, Natl. Econ. Res. Assoc., Nov. 6, 1990.

8. Automobile installment debt runs at almost $300 billion.

9. Fickett, Gellings and Lovins, *supra* note 4 at 66.

10. It is even more difficult, for obvious reasons, to evaluate promises to reduce consumption, which some conservationists propose be permitted to compete "on a level playing field" directly with bids to provide additional power supplies, in distribution company auctions, on a cents per kilowatt basis. See K. P. Anderson, Least-Cost Planning—A Survey of Key Issues, Natl. Econ. Res. Assoc., Jan. 18, 1991, at 23-26.

11. For a powerful exposition of this proposition as well as a discussion of alternative approaches to encouraging investments in conservation, *see* P. Joskow, *Should Conservation Proposals Be Included in Competitive Bidding Programs?* in COMPETITION IN ELECTRICITY: NEW MARKETS AND NEW STRUCTURES 235-79 (Pub. Util. Rep. and QED Research, Apr. 1990).

12. *See, e.g.*, A. Kahn, *Between Theory and Practice: Reflections of a Neophyte Public Utility Regulator*, PUB. UTIL. FORT., Jan. 2, 1975, at 7.

13. To these we should add the errors of regulated franchised monopolists. There is a certain irony in the enthusiastic advocacy of electric utilities conducting major conservation programs by people who in other contexts describe those companies as poorly managed, inefficient providers of electricity.

14. I cannot, however, flatly reject an alternative, more paternalistic policy that would be consistent with the no-losers test. If there were circumstances in which the utility and regulatory commission both concluded (even after making full allowance for the possibility of error) there are major investments in efficient conservation that are not being exploited — and particularly if their exploitation is most efficiently done on some sort of overall company basis, for all subscribers, rather than for only the ones that choose to respond — perhaps they should undertake the expenditures and charge the costs directly to the beneficiaries, with or without the latter's consent. After all, neither utility managements nor commissioners require the consent of each individual customer to whatever mix of generating facilities they decide to install; arguably the same principle could apply to the mix they propose to employ of demand-limiting and output-expanding investments.

APPENDIX C

PUGET SOUND POWER & LIGHT COMPANY
FULLY ALLOCATED COST OF SERVICE
SUMMARY RESULTS OF OPERATIONS

WICFUR RECOMMENDATIONS INCLUDING MINIMUM DISTRIBUTION SYSTEM

LINE	DESCRIPTION		TOTAL	Residential	Secondary General Service 0-50kw	Secondary General Service 51-350kw	Secondary General Service >350 kw	Primary General Service	High Voltage Service	Lighting	Firm Resale
	OPERATING REVENUEWS										
1	SALES OF ELECTRICITY		1,019,725,621	540,359,957	114,437,063	127,373,020	71,997,870	64,619,883	88,022,423	8,940,212	3,975,193
2	OTHER OPERATING REVENUE (UB, 451,454)		13,441,414	7,330,799	1,753,783	596,714	405,748	643,177	2,612,113	83,817	15,263
3	Remaining Revenue		46,219,902	23,046,410	4,840,597	5,194,240	3,139,681	3,432,333	6,138,331	151,768	276,542
4	TOTAL OPERATING REVENUE		1079386937	570737166	121031443	133163974	75543299	68695393	96772867	9175797	4266998
	OPERATING EXPENSES										
5	OPER. AND MAIN.		717,345,174	419,311,346	68,909,736	69,621,470	40,304,433	42,518,904	70,216,481	3,234,340	3,228,467
6	DEPR. AND AMORT.		109,079,943	70,420,677	10,379,777	9,034,232	4,987,357	5,416,487	7,472,238	984,718	384,458
7	TAXES OTHER THAN FIT		76,491,885	44,764,055	7,953,450	7,997,235	4,495,592	4,373,533	6,117,763	646,350	143,906
8	TOTAL OPERATING EXP. LESS FIT		902,917,002	534,496,078	87,242,963	86,652,938	49,787,381	52,308,925	83,806,482	4,865,408	3,756,831
9	TOTAL INCOME BEFORE FIT		176,469,935	36,241,088	33,788,480	46,511,036	25,755,918	16,386,468	12,966,385	4,310,389	510,167
10	FEDERAL INCOME TAX		45,046,516	14,337,049	7,524,786	9,801,208	5,420,761	3,684,294	3,209,030	933,239	136,150
11	NET OPERATING INCOME		131,423,419	21,904,040	26,263,695	36,709,828	20,335,157	12,702,174	9,757,355	3,377,151	374,018
12	TOTAL RATEBASE		2,051,809,870	1,337,937,332	194,613,374	167,493,217	91,542,742	100,599,873	132,636,175	19,991,684	6,995,474
13	RATE OF RETURN ON RATEBASE		6.41%	1.64%	13.50%	21.92%	22.21%	12.63%	7.36%	16.89%	5.35%
14	REQUIRED RATE OF RETURN ON RATEBASE		10.03%	10.03%	10.03%	10.02%	10.02%	10.03%	10.03%	10.04%	10.03%
15	ADDITIONAL REVENUE REQUIRED		74,360,013	112,299,343	(6,751,819)	(19,918,898)	(11,159,027)	(2,607,048)	3,540,152	(1,370,637)	327,950
16	ADJUSTED FOR CONVERSION FACTOR	1.583820949	117,772,947	177,862,052	(10,693,673)	(31,547,968)	(17,673,901)	(4,129,097)	5,606,967	(2,170,843)	519,414
17	TOTAL SALES OF ELECTRICITY		1,062,046,519	562,216,736	119,067,864	132,049,727	74,862,043	67,451,773	93,139,370	9,065,099	4,193,907
18	REVENUE REQUIRED FOR RATES		1,179,819,466	740,078,788	108,374,191	100,501,758	57,188,142	63,322,677	98,746,337	6,894,256	4,713,321
19	REVENUE TO REVENUE REQUIREMENT		90%	76%	110%	131%	131%	107%	94%	131%	89%
20	ADJ. REVENUE TO REVENUE REQUIREMENT		100%	84%	122%	146%	145%	118%	105%	146%	99%

PUGET SOUND POWER & LIGHT COMPANY
FULLY ALLOCATED COST OF SERVICE
SUMMARY RESULTS OF OPERATIONS

WICFUR RECOMMENDATIONS EXCLUDING MINIMUM DISTRIBUTION SYSTEM

LINE	DESCRIPTION		TOTAL	Residential	Secondary General Service 0-50kw	Secondary General Service 51-350kw	Secondary General Service >350 kw	Primary General Service	High Voltage Service	Lighting	Firm Resale
	OPERATING REVENUEWS										
1	SALES OF ELECTRICITY		1019725621	540359957	114437063	127373020	71997870	64619883	88022423	8940212	3975193
2	OTHER OPERATING REVENUE (UB, 451,454)		13441414	7330799	1753783	596714	405748	643177	2612113	83817	15263
3	Remaining Revenue		46219902	23046410	4840597	5194240	3139681	3432333	6138331	151768	276542
4	TOTAL OPERATING REVENUE		1079386937	570737166	121031443	133163974	75543299	68695393	96772867	9175797	4266998
	OPERATING EXPENSES										
5	OPER. AND MAIN.		717345174	413191028	68588862	72571301	41922047	44282675	70216481	3244070	3328712
6	DEPR. AND AMORT.		109079943	67208094	10227725	10717457	5909400	6129086	7472238	990983	424959
7	TAXES OTHER THAN FIT		76491885	43780448	7906653	8512094	4777628	4592246	6118209	648255	156351
8	TOTAL OPERATING EXP. LESS FIT		902917002	524179571	86723240	91800851	52609076	55004008	83806928	4883308	3910023
9	TOTAL INCOME BEFORE FIT		176469935	46557595	34308203	41363123	22934223	13691385	12965939	4292489	356975
10	FEDERAL INCOME TAX		45046516	15932372	7606248	9014415	4989373	3252847	3208704	930920	111636
11	NET OPERATING INCOME		131423419	30625223	26701955	32348708	17944851	10438538	9757235	3361569	245339
12	TOTAL RATEBASE		2051809870	1270768652	191434282	202686082	110820834	115498896	132636175	20122678	7842272
13	RATE OF RETURN ON RATEBASE		6.41%	2.41%	13.95%	15.96%	16.19%	9.04%	7.36%	16.71%	3.13%
14	REQUIRED RATE OF RETURN ON RATEBASE		10.03%	10.03%	10.03%	10.03%	10.02%	10.03%	10.02%	10.07%	10.04%
15	ADDITIONAL REVENUE REQUIRED		74360013	96841749	-7509680	-12028744	-6836695	1150945	3535920	-1335235	541756
16	ADJUSTED FOR CONVERSION FACTOR	1.583820949	117772947	153379991	-11893988	-19051377	-10828101	1822891	5600264	-2114773	858044
17	TOTAL SALES OF ELECTRICITY		1062046519	562216736.3	119067864	132049727	74862043.11	67451773.4	93139370	9065098.921	4193907.06
18	REVENUE REQUIRED FOR RATES		1179819466	715596727	107173876	112998350	64033942	69274665	98739634	6950326	5051951
19	REVENUE TO REVENUE REQUIREMENT		90%	79%	111%	117%	117%	97%	94%	130%	83%
20	ADJ. REVENUE TO REVENUE REQUIREMENT		100%	87%	123%	130%	130%	108%	105%	145%	92%