Puget Sound Area Electric Reliability Plan

Economic and Technical Evaluation Appendix C

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DRAFT ENVIRONMENTAL IMPACT STATEMENT
PUGET SOUND AREA ELECTRIC RELIABILITY PLAN

Appendix C
Economic and Technical Evaluation

Bonneville Power Administration
U.S. Department of Energy

Prepared as part of a coordinated plan to address a power system problem in the Puget Sound Area. Utilities participating in planning include: Bonneville Power Administration, Puget Sound Power and Light, Seattle City Light, Snohomish County Public Utility District No. 1, and Tacoma City Light.

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1 Introduction

In this Appendix, the study framework and evaluation system for economic and technical factors are explained. This material documents the analysis performed for Section 4.8 of the EIS. Coupled with the environmental analysis, the evaluation factors described below will be used to judge the relative merits of our four alternatives:

- Alternative Strategy 1 – Transmission Line
- Alternative Strategy 2 – Voltage Support
- Alternative Strategy 3 – Demand Reduction
- Alternative Strategy 4 – Combustion Turbines

1.1 Study Framework

The evaluation factors include measures of economic impacts, risk, and social responsibility. For simplicity, this study assumes that the Puget Sound area is served by a single utility. Therefore, no distinction is made between private and public utilities or load served by BPA and load served by utility-owned generation. In addition, where appropriate, costs incurred by consumers are included as well as utility costs.

This study has two relevant time periods. First is the decision period, which extends from 1994 through 2003. It is during these ten years that utilities must take actions to meet peak loads in each year. The analysis continues beyond 2003 through 2010 in order to adequately capture the costs and benefits of actions taken through 2003. This longer study period is needed because not all costs and benefits occur equally in all years.

Where appropriate, a 5% inflation rate and 3% real discount rate are used.

As described in Section 3, local generation developed to meet energy needs is not included in the alternatives.

1.2 Evaluation Factors

Six evaluation factors are used in this study to characterize each alternative that solves the peak load problem in the Puget Sound area.

- Net Present Value
- Sensitivity to Load Growth
- Near Term Revenue Requirements
- Long Term Revenue Requirements
- Deliverability
- Reliability

The first five of these evaluation factors have been applied by utilities in the region for various resource planning exercises and have received public review during those processes. The last factor is new for this project and specifically addresses the issue of power system reliability. Section 2 explains the methods used for each evaluation factor.

1.3 Assembling Alternatives

Because of the nature of the problem in Puget Sound area and the characteristics of the individual measures, it is unlikely that any one measure alone will provide a satisfactory solution. For example, a transmission line might completely solve the problem, but it will take six or more years to site and build. On the other hand, conservation programs can be implemented quickly, deferring the need for a major new facility. Therefore we combine measures to take advantage of their individual strengths. Each alternative presented in the EIS has been assembled to meet the Reliability Criteria under the medium economic load growth. The process is described in Section 3.

2 Evaluation Factors

2.1 Net Present Value

This factor analyzes the quantifiable costs and benefits of the measures in each alternative to calculate the net present value (NPV). Net present value is a type of analysis that expresses costs and benefits occurring over a period of time as a single number or value. For this study costs and benefits are analyzed over the study period, 1994 to 2010. This calculation takes a societal perspective including costs and benefits to BPA, utilities and consumers.

The costs for this calculation include the costs to build, operate and maintain (O&M) the measures in each alternative. The value of any power produced or saved by an alternative is included as a benefit since this power allows utilities to avoid purchasing other resources to meet power system needs. The analysis is done in real terms, without inflation and all numbers are reported in 1990 dollars.

The NPVs were calculated using a LOTUS 123 spreadsheet, which are in Tables 2.1-1 through 2.1-4 at the back of this Appendix. The spreadsheet is divided into five sections: Section 1 which is for inputs, Sections 2-4 which perform the calculations and Section 5 which summarizes the output. Table 2.1-1 has the sections labeled for reference.

SECTION 1 is where the characteristics of the measures are defined that will be used to calculate the NPV of the alternative. The first input required is the name of the alternative. The rest of input requirements are described below starting with the far left column:

<i>Selection Variable</i> -	Allows user to select a measure for the alternative (1=yes 0=no).
<i>Measure</i> -	Name of Measure.
<i>Total Cap Cost</i> -	Capital costs and NPV of fixed O&M for the resource life in 1990 \$/kw.
<i>Yearly Var Cost</i> -	Annual variable costs (fuel, O&M) in 1990 \$/kW

<i>Resource Life -</i>	Expected life of the resource in years.
<i>Fixed Cost Escalat-</i>	Percentage above inflation that fixed costs escalate over time.
<i>Variable Cost Escalat-</i>	Percentage above inflation that variable costs escalate over time.
<i>Energy:Capacity Ratio -</i>	Average firm energy produced as a percent of peak capacity.
<i>Power Nov-Feb -</i>	Percent of energy produced November-February. Used to determine seasonality.

The remaining columns of section one are for the input of the incremental peak megawatts of each measure in the alternative. The on-line year assumes that measures are installed in time to meet that years winter peak. On-line year 1994 means that measures must be installed before November 1, 1994 and are available for the 1994-1995 winter. For the evaluation the MW represent the normal cold weather peak. Since northwest energy planners are more accustomed to planning for average megawatts working in peak megawatts may take some mental adjustment.

The real discount rate is section one's final input. For this analysis a 3 percent rate is used. Sections 2-5 take the inputs of Section 1 and calculate the alternative's NPV.

SECTION 2 describes the alternative. It also calculates the levelized fixed costs and the capacity situation after the measures are implemented. The levelized fixed cost is calculated by amortizing the input total capital cost/kw over the resource life using the 3% real discount rate. The variable cost and incremental megawatts are copied from Section 1 but in Section 2 only the measures selected in the alternative are shown.

The final two rows examine the severity of the problem in the Puget Sound Area. The deficit line shows the forecast capacity deficit with medium load growth and no action. The last line shows the capacity surplus or deficit as the expected resources described in Section 3 and the measures in the alternative come on-line.

SECTION 3 calculates the costs associated with each alternative. This section aggregates the costs and MW from Section 2. The levelized fixed costs of the measures and the variable costs of operation are multiplied by the incremental MW and added together for each measure in each year. Fixed and variable escalation are included if applicable. The levelized fixed and O&M costs from previously added MW as well as incremental MW are included in each calculation. If a measure wears out before the end of the study period it is replaced.

The matrix of costs are then summed to get the totals for each year for the alternative. Using the real discount rate these total are then brought back to 1990 dollars and summed to give the present value of costs.

SECTION 4 begins on sheet two of the table, and calculates the power benefits associated with the alternative. Within Section 4 are three subsections: marginal cost, cumulative aMW and benefit calculations.

Some of the measures acquired for Puget Sound reliability also produce or save power. This allows the region to avoid acquiring the power from another source. BPA's 1990 long run incremental cost for medium load growth is used to value this power. This analysis took the marginal cost stream and applied weighting factors which represent the seasonality of the value of power. Power produced or saved in the winter is worth more than summer power.

The cumulative aMW subsection simply multiplies the matrix of incremental megawatts in Section 2 by the energy/capacity ratio, keeping track of cumulative MW. This yields a matrix in units more familiar to energy planners in the northwest, average megawatts.

The benefit calculation multiplies the cumulative matrix by the marginal cost, yielding a yearly total benefit for each measure. The benefits are then summed and present valued to 1990 dollars in the same way as costs.

SECTION 5 summarizes the costs and benefits that are calculated in the rest of the spreadsheet. The first row shows the cumulative present values of the alternative in each year. Positive numbers indicate benefits outweighing costs and negative numbers indicate greater costs. The last three rows summarize the present value of the alternatives.

The following table summarizes the NPV for the alternatives. Alternative 2 has benefits which far exceed their costs.

NPV of Alternatives
Millions 1990\$

Alternative 1	+ 67
Alternative 2	+105
Alternative 3	-128
Alternative 4	+ 40

2.2 Sensitivity to Load Growth

The Alternative Strategies are constructed to meet medium load growth. However, if loads take off at a lower or higher rate than anticipated, utilities will need to adjust their actions accordingly. This decision factor looks at the economic consequences of being wrong. Load growth scenarios (low, medium, and high) are depicted in Figure 1-2 of the EIS and are described in more detail in Appendix A, Chapter II.

This analysis assumes that the change in growth begins in 1994 and utilities begin to take actions in 1998. Using 1998 allows time for collection of load growth information so that utilities are convinced that the growth they are experiencing is more than an aberration. The analysis uses the same framework as the NPV analysis except that the deficits and the value of the power to the system change.

For low load growth conservation, load management and fuel switching programs are stopped in 1999. Some pre-1998 load management and conservation is self-limiting due to lower load growth. Within the four alternatives peaking CTs are the only other measures that can be delayed or stopped after 1998 so alternative 4 has less CTs with low growth. Expected resources also decrease, to 300 MW since energy deficits decrease under low load growth.

For high load growth contract curtailment is acquired to cover deficits before other measures can be brought on-line. The alternatives are then adjusted to cover the additional peak deficits from high load growth. Alternative 1 has enough excess capacity to cover the additional load. Alternative 2 adds a transmission line in 2002. Alternative 3 and 4 both add Voltage Support 2 in 2001. In addition Alternative 4 also adds more CTs from 2001-2003. Some conservation savings accelerate due to higher load growth. Expected resources in Puget Sound also increase under high loads to 800 MW as utilities acquire power to meet their energy deficits.

In addition to the resource changes described above, the spreadsheet itself is adjusted to reflect the changes in load growth. As mentioned earlier the forecast deficit is increased. The most substantial change however is in the marginal cost of power. Under low load growth the region is in surplus so the power is worth less than with medium growth. Under higher load growth the region has to acquire more and higher cost sources of power so the value increases. BPA's low load growth marginal cost is used for the low load growth scenario and the high load growth marginal cost are used for the high scenario.

Besides the low, medium and high NPVs a range is reported, indicating the distance between each alternative's most positive and the most negative NPV. The table below summarizes the results, listing the NPVs for the alternatives under the three growth scenarios and the range of those values. While Alternative 3 has the highest costs under all three load growth scenarios, it has the smallest range.

Sensitivity to Load Growth
NPV 1990 \$ Millions

	Low	Medium	High	Range
Alternative 1	- 88	+ 67	+109	196
Alternative 2	- 21	+105	+ 97	126
Alternative 3	-212	-128	-131	84
Alternative 4	- 35	+ 39	- 63	102

Spreadsheets used to calculate the low NPVs (2.2-1 through 2.2-4) and high NPVs (2.2-5 through 2.2-8) are provided. These tables also show the forecast deficits and the marginal cost streams for low and high growth.

2.3 Near Term Revenue Requirements

This decision factor looks at the amount utilities pay to acquire the measures in each alternative from 1996-1998. The analysis looked at the Puget Sound Region as a single

utility. In contrast to the NPV calculations this analysis only looks at utility costs. The amount calculated represents the actual dollars utilities would need to pay for the alternatives but does not include the effects of lost revenues or changes that would occur in system operations. Results reported are average gross impacts on revenue requirements for the years 1996-1998.

Revenue Requirements were calculated using Bonneville's spreadsheet model MICROFIN and results were given a reality check with Puget Power and Light's financial model ECON. Microfin was used to develop yearly costs for single megawatt increments of each of the measures. These expected yearly costs were fed into a post processing spreadsheet (Tables 2.3-1 through 2.3-4). This spreadsheet combined the information for the revenue requirements per MW and the number of megawatts of each measure alternative to calculate the total revenue requirement. As in the NPV analysis measures that wear out before the end of the study period are replaced.

MICROFIN Financial Inputs

Price Level	1990
Federal Tax	34.0%
Insurance	0.18%
Private State Tax	0.0%
Publics Property Tax	0.0%
Private Property Tax	1.14%
Gross Revenue Publics	9.0%
Gross Revenue Private	6.71%
Publics Debt Fraction	100.0%
Private Debt Fraction	60.0%
Publics Nominal Interest Rate	7.4%
Private Nominal Interest Rate	9.0%
Private Equity Return	12.8%
Inflation Rate	5.0%

Project Description

	Sponsorship Public	Sponsorship Private	Years to Construct
Acc Weatherization	65%	35%	1
Acc Industrial	75%	25%	1
Low Flow Shower Heads	65%	35%	1
Commercial Retrofit	65%	35%	1
Transmission Line	100%	0%	6
Voltage Support 1	100%	0%	2
Voltage Support 2	100%	0%	3
Water Heater Controls	65%	35%	1
Time of Use Rates	65%	35%	1
Fuel Switching	<i>Not Included</i>		
Peaking CTs	55%	45%	4

The tables above show the financial assumptions used to calculate the revenue requirements and the public/private sponsorship fractions used to develop the assumed single Puget Sound Area Utility.

The near Term Revenue Requirements are summarized in the table below. Notice that revenue requirements are not included for fuel switching in alternative 3; it is unclear what electric utilities would pay for this measure (See Appendix D on reduce use options for discussion of possible costs). Results are expressed in terms of the average yearly revenue requirement between 1996-1998. Alternatives 2 and 4 have about one-half of the revenue requirements of the remaining two alternatives.

Near Term Revenue Requirements
\$ Millions/year

Alternative 1	50
Alternative 2	25
Alternative 3 *	50
Alternative 4	20

* Doesn't include fuel switching

2.4 Long Term Revenue Requirements

This decision factor is the same as and is calculated the same way as Near-Term Revenue Requirements except it looks at the years 2006-2008. Long-Term impacts are also important to consider. Alternative 2 has significantly lower revenue requirements than the others.

Long-Term Revenue Requirements
\$ Millions/year

Alternative 1	75
Alternative 2	40
Alternative 3 *	110
Alternative 4	105

* Doesn't include fuel switching

2.5 Deliverability

In every decision process, factors other than economic or financial impacts affect the final decision. These influences are largely political and/or social and can strongly affect whether an alternative strategy is practical and achievable, regardless of its economic attractiveness. Certain technologies or actions may be well known and proven, but public acceptance may keep them from occurring. This evaluation factor attempts to assess the impact of factors such as regulatory influences, institutional complexity, and public acceptability on the ability to implement each alternative strategy.

There likely will be some overlap with the environmental impacts as well as other evaluation factors. However, this factor assesses how the perception of environmental impacts affects the feasibility, or deliverability, of a particular alternative. It does not necessarily follow that the alternative with the fewest or most benign environmental impacts will be the most deliverable. Finally, in contrast to the other evaluation factors, this element is largely the result of judgement.

Members of the Sounding Board were asked to rank each measure on a scale ranging from deliverable (1) to undeliverable (4). Rankings of the 19 members present were averaged (Table 2.5-1). Only the measures that differ between the alternatives are presented in the table below. Rankings for a transmission line range from 1.6 if existing right-of-way segments are used to 3.1 for new corridor segments. We assumed that a new line would use existing corridor segments to the maximum extent possible.

Alternative 3, which has three measures not used in the other alternatives, was scored based on the measure with the highest value, or least deliverable. We find that there is little difference between the alternatives. Conservation measures, included in all four alternatives, are ranked as deliverable to somewhat deliverable (1.4 to 1.9). For comparison, a nuclear plant was rated as undeliverable (3.7).

Deliverability

Alternative 1	1.6
Transmission Line	1.6
Alternative 2	1.5
Voltage Support 2	1.5
Alternative 3	2.0
Water Heater Control	2.0
Time of Use Rates	<i>not ranked</i>
Fuel Switching	1.8
Alternative 4	1.7
Combustion Turbines	1.7

1 = Deliverable 4 = Undeliverable

2.6 Reliability

Reliability is a measure of the capability of the power system to meet consumer demands over a period of time. It is typically measured in terms of unreliability, such as how often outages occur, how long they last, and how much load is affected. In contrast, the goal is to maximize reliability to the extent economically justifiable.

Planners use a set of rules, such as the BPA Reliability Criteria, to establish reliability requirements for the power system. All proposed alternatives must meet the tests specified in the Criteria. However, even after meeting the tests, each alternative may provide a different level of reliability. For example, two transmission circuits on the same tower pose a greater risk than two transmission circuits on different towers.

Existing transmission reliability models are not capable of examining the Puget Sound peak load problem because of the complexity of the system and the difficulty of predicting voltage collapse. Therefore, a simplified analysis will be performed for this evaluation factor that qualitatively ranks the alternatives according to their respective reliability.

The following factors were considered for each measure (see Table 2.6-1):

- Number of units (100,000's water heaters vs. two transmission circuits)
- Failure rate (based on experience, how often it is *not* available)
- Common mode outages (loss of one tower with two circuits)

All of the measures were ranked on a scale of highly reliable (1) to not very reliable (4). Of the measures that are different between the alternatives, only fuel switching stands out as highly reliable (1). This is because an appliance, such as an electric water heater, is removed and can not add to the peak load problem. At the other extreme, a nuclear plant, with a lot of eggs in one large basket, was ranked as not very reliable (4). We can not differentiate between the alternatives based on measure reliability.

Reliability

Alternative 1	2
Transmission Line	2
Alternative 2	2
Voltage Support 2	2
Alternative 3	2
Water Heater Control	2
Time of Use Rates	2
Fuel Switching	1
Alternative 4	2
Combustion Turbines	2

2.7 Excess Capacity

One factor which is not captured by the evaluation is the potential benefit of excess capacity provided by each alternative. Some measures, such as the transmission line, provide more capacity than needed during the decision period. By 2003, the following margins remain:

	Margin (MW)
Alternative 1	1600
Alternative 2	600
Alternative 3	400
Alternative 4	30

These margins provide for additional reliability throughout the decision period should the deficit increase due to higher load growth or a delay in expected generation or

conservation. In addition, the margin can serve load growth beyond the decision period without requiring further investment.

2.8 Summary

Findings for the six evaluation factors are tabulated below. The alternative which ranks highest, or group of high ranking alternatives, are shown in **bold**.

Economic and Technical Evaluation Summary

	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Net Present Value	67	105	-128	39
Sensitivity to Load Growth	196	126	84	102
Near Term Rev Rqmts	50	25	50	20
Long Term Rev Rqmts	75	40	110	105
Deliverability	1.6	1.5	2.0	1.7
Reliability	2	2	2	2

3.0 Assembling Alternatives

For our preliminary analysis we combined the measures identified in Appendix A, Chapter IV to assemble 11 test cases, each of which solves the peak load problem.

- A Conservation, Load Management, Curtailment
- B Conservation, Load Management, Curtailment, Line
- C Conservation, Load Management, Cogeneration
- D Conservation, Load Management, Cogeneration, Fuel Switching
- E Voltage Support, Combustion Turbines
- F Voltage Support
- G Voltage Support, Line
- H Curtailment, Line
- I Cogeneration, Small Hydro, Coal
- J Combustion Turbines, Cogeneration, WNP3
- K Conservation, Load Management, Fuel Switching, Voltage Support

The test cases were examined using the evaluation factors and the findings discussed with the Sounding Board. We also made a rough assessment of the individual measures. Our approach was then to determine which measures should be excluded from further consideration, which measures should be in all alternatives, and finally, how the alternatives should be differentiated.

Generators that produce energy over the year, called base load plants, cost about ten times as much as transmission alternatives when compared based on their contribution to fixing the peak load problem. Given this price difference, generation acquisition decisions will be driven by energy needs rather than for peaks. We have therefore

removed most generation from the list of solutions to the problem, while recognizing that resources acquired in the Puget Sound will reduce the peak load problem.

Analysts have conservatively estimated that 400 MW (peak) of new but currently uncommitted resources will be developed in the Puget Sound by 2003 to meet the energy needs of utilities. Plans for new resources are typically outlined in each utility's least-cost plan, and are presented below in summary form. Note that these quantities are in addition to the conservation in the load forecast (EIS Table 1-1) and generation in the Puget Sound (EIS Table 1-2). We then assumed that 60 MW will be acquired in each year from 1994 through 1998, with 20 MW additional each year through the evaluation period.

Expected Resources	Peak MW
Conservation	40
Cogeneration	310
Combustion Turbines	35
Hydro	15
Total	400

Based on the considerations above, cogeneration, small hydro, coal, and WNP3 do not appear in the four alternatives. Combustion turbines installed to meet system peaks and located in the Puget Sound are the basis for Alternative 4.

After analyzing the costs and impacts of curtailment, the utilities decided that depending on curtailment for *long-range* planning is inappropriate. However, curtailment is included as a contingency measure in all alternatives.

Accelerated conservation programs in the residential, commercial and industrial sectors and a high-efficiency shower head program were found to be cost-effective, have low environmental impacts, and are somewhat deliverable. Therefore these measures appear in all four alternatives.

Transmission planners divided the voltage support measures into two options. Voltage Support 1, consisting of shunt capacitors at Echo Lake substation, was found to be cost-effective, have low environmental impacts, and is deliverable. This option is included in all four alternatives. Voltage Support 2 adds a new 500-kV substation north of Ellensburg, Washington, and is the prime component of Alternative 2.

Load management and fuel switching are the foundation for Alternative 3, while Alternative 1 uses a transmission line.

TABLE 2.1-1
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WULF SAND AREA ELECTRIC RELIABILITY PLAN
09-Jun-91

Alternative Scenario 1	Line Voltage Support & Conservation				Power		INCREMENTAL MEGAWATTS																		
	Total	Yearly	Cap Cost	Var Cost	Resource	Life	Escalator	Ratio	Nov-Feb	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	
Expected Generation	0	0	0	0	0	0	0.0%	0.0%	0%	0.0%	60.0	60.0	60.0	60.0	60.0	60.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0
Acc Weather	0	61.6	50	0	0.0%	0.0%	23%	70.0%	0.0%	9.6	9.6	10.4	10.4	10.4	10.5	10.4	10.5	-8.2	-8.2	-8.2	-8.2	-8.2	-8.2	-8.2	-8.2
Acc Industrial	0	56	20	0	0.0%	0.0%	98%	33.3%	0.0%	4.2	4.2	3.2	3.2	3.2	3.2	3.2	3.1	3.4	3.4	3.4	3.4	-5.9	-6.0	-2.7	-2.6
Efficient Shd Hds	335	0	7	0	0.0%	0.0%	44%	33.3%	0.0%	0.0	7.2	7.1	7.0	7.0	4.1	4.0	4.0	3.9	3.9	3.9	0.0	0.0	0.0	0.0	0.0
Cons Retrofit	1420	0	30	0	0.7%	0.7%	64%	33.3%	0.0%	3.7	3.6	10.3	10.3	10.4	10.3	10.3	10.4	6.8	6.9	6.8	6.8	0.0	0.0	0.0	0.0
Voltage Support 1	10	0.5	35	0	0.5%	0.8%	0%	0.0%	0%	0	300	300	0	0	0	0	0	0	0	0	0	0	0	0	0
Voltage Support 2	40	1	35	0	0.5%	0.8%	0%	0.0%	0%	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0
Line	130	1.2	40	0	1.2%	0.7%	1%	60.0%	0%	0	0	0	0	0	2000	0	0	0	0	0	0	0	0	0	0
Water Mtr Control	323.6	28.9	12	0	0.0%	0.0%	2%	33.3%	0%	40.1	39.2	43.4	43.5	43.5	42.4	43.6	43.4	22.8	21.8	22.9	0	0	0	0	0
Use of Use Rates	249	48	20	0	0.0%	0.0%	0%	0.0%	0%	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	5.2	0	0	0	0	0
Praking Cts	505	15.65	30	0	1.2%	2.3%	5%	60.0%	0%	0	0	0	0	0	0	0	140	70	140	70	0	0	0	0	0
Discount Rate	3.0%																								

Section 1

OUTPUT

ALTERNATIVE STRATEGY 1 Line Voltage Support & Conservation
Lev Fix Vrlly Var Incremental megawatts

	1990\$/kW	1990\$/kW	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Expected Generation	0.00	0.00	0.0	60.0	60.0	60.0	60.0	60.0	20.0	20.0	20.0	20.0	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acc Weather	0.00	61.60	0.0	9.6	9.6	10.4	10.4	10.5	10.4	10.5	-8.2	-8.2	-8.2	-8.2	-8.1	-6.2	-6.0	-6.1	-6.1	-6.1
Acc Industrial	0.00	56.00	0.0	4.2	4.2	3.2	3.2	3.2	3.2	3.1	3.4	3.4	3.4	-5.9	-6.0	-2.7	-2.6	-2.7	-2.6	-2.7
Efficient Shd Hds	53.77	0.00	0.0	0.0	7.2	7.1	7.0	4.1	4.0	4.0	3.9	3.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cons Retrofit	72.45	0.00	0.0	3.7	3.6	10.3	10.4	10.3	10.3	10.4	6.8	6.9	6.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Voltage Support	0.47	0.50	0.0	300.0	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Line	5.62	1.20	0.0	0.0	0.0	0.0	2000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Mtr Control	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Use of Use Rates	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Praking Cts	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Section 2

COSTS INACCUMULATED FROM ALTERNATIVE STRATEGY 1: Line Voltage Support & Cons (Thousands 1990\$)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Expected Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acc Weather	0	591	1183	1823	2464	3111	3751	4398	3693	3368	2883	2378	1879	1497	1127	752	376	0
Acc Industrial	0	235	470	650	829	1008	1187	1361	1551	1742	1411	1081	745	594	448	297	151	-0
Efficient Shd Hds	0	0	387	769	1145	1366	1581	1796	2006	2215	2215	2215	2215	2215	2215	2215	2215	2215
Cons Retrofit	0	276	561	1339	2130	2919	3714	4521	5053	5597	6136	6136	6136	6136	6136	6136	6136	6136
Voltage Support	0	297	598	600	603	605	608	610	613	616	618	621	624	626	629	632	635	637
Line	0	0	0	0	0	0	14912	14930	14948	14966	15002	15021	15039	15058	15077	15096	15115	15134
Water Mtr Control	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Use of Use Rates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Praking Cts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yearly Totals	0	1399	3199	5181	7171	9321	11571	13921	16371	18821	21271	23721	26171	28621	31071	33521	35971	38421
Cost Per (\$1990)	\$242.121																	

Section 3

TABLE 2.1-1
SH 20-2

Section 5[illegible]

TABLE 2.1-2 SM 10F2

PUGET SOUND AREA ELECTRIC RELIABILITY PLAN

09-Jun-91

ALTERNATIVE STRATEGY 2: Voltage Support & Conservation

Select	Yearly Cap Cost	Yearly Var Cost	Resource	Life	Escalat	Escalat Ratio	Energy Capacity	Produced % during	Power	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2443	2444	2445	2446	2447	2448	2449	2450	2451	2452	2453	2454	2455	2456	2457	2458	2459	2460	2461	2462	2463	2464	2465	2466	2467	2468	2469	2470	2471	2472	2473	2474	2475	2476	2477	2478	2479	2480	2481	2482	2483	2484	2485	2486	2487	2488	2489	2490	2491	2492	2493	2494	2495	2496	2497	2498	2499	2500	2501	2502	2503	2504	2505	2506	2507	2508	2509	2510	2511	2512	2513	2514	2515	2516	2517	2518	2519	2520	2521	2522	2523	2524	2525	2526	2527	2528	2529	2530	2531	2532	2533	2534	2535	2536	2537	2538	2539	2540	2541	2542	2543	2544	2545	2546	2547	2548	2549	2550	2551	2552	2553	2554	2555	2556	2557	2558	2559	2560	2561	2562	2563	2564	2565	2566	2567	2568	2569	2570	2571	2572	2573	2574	2575	2576	2577	2578	2579	2580	2581	2582	2583	2584	2585	2586	2587	2588	2589	2590	2591	2592	2593	2594	2595	2596	2597	2598	2599	2600	2601	2602	2603	2604	2605	2606	2607	2608	2609	2610	2611	2612	2613	2614	2615	2616	2617	2618	2619	2620	2621	2622	2623	2624	2625	2626	2627	2628	2629	2630	2631	2632	2633	2634	2635	2636	2637	2638	2639	2640	2641	2642	2643	2644	2645	2646	2647	2648	2649	2650	2651	2652	2653	2654	2655	2656	2657	2658	2659	2660	2661	2662	2663	2664	2665	2666	2667	2668	2669	2670	2671	2672	2673	2674	2675	2676	2677	2678	2679	2680	2681	2682	2683	2684	2685	2686	2687	2688	2689	2690	2691	2692	2693	2694	2695	2696	2697	2698	2699	2700	2701	2702	2703	2704	2705	2706	2707	2708	2709	2710	2711	2712	2713	2714	2715	2716	2717	2718	2719	2720	2721	2722	2723	2724	2725	2726	2727	2728	2729	2730	2731	2732	2733	2734	2735	2736	2737	2738	2739	2740	2741	2742	2743	2744	2745	2746	2747	2748	2749	2750	2751	2752	2753	2754	2755	2756	2757	2758	2759	2760	2761	2762	2763	2764	2765	2766	2767	2768	2769	2770	2771	2772	2773	2774	2775	2776	2777	2778	2779	2780	2781	2782	2783	2784	2785	2786	2787	2788	2789	2790	2791	2792	2793	2794	2795	2796	2797	2798	2799	2800	2801	2802	2803	2804	2805	2806	2807	2808	2809	2810	2811	2812	2813	2814	2815	2816	2817	2818	2819	2820	2821	2822	2823	2824	2825	2826	2827	2828	2829	2830	2831	2832	2833	2834	2835	2836	2837	2838	2839	2840	2841	2842	2843	2844	2845	2846	2847	2848	2849	2850	2851	2852	2853	2854	2855	2856	2857	2858	2859	2860	2861	2862	2863	2864	2865	2866	2867	2868	2869	2870	2871	2872	2873	2874	2875	2876	2877	2878	2879	2880	2881	2882	2883	2884	2885	2886	2887	2888	2889	2890	2891	2892	2893	2894	2895	2896	2897	2898	2899	2900	2901	2902	2903	2904	2905	2906	2907	2908	2909	2910	2911	2912	2913	2914	2915	2916	2917	2918	2919	2920	2921	2922	2923	2924	2925	2926	2927	2928	2929	2930	2931	2932	2933	2934	2935	2936	2937	2938	2939	2940	2941	2942	2943	2944	2945	2946	2947	2948	2949	2950	2951	2952	2953	2954	2955	2956	2957	2958	2959	2960	2961	2962	2963	2964	2965	2966	2967	2968	2969	2970	2971	2972	2973	2974	2975	2976	2977	2978	2979	2980	2981	2982	2983	2984	2985	2986	2987	2988	2989	2990	2991	2992	2993	2994	2995	2996	2997	2998	2999	3000	3001	3002	3003	3004	3005	3006	3007	3008	3009	3010	3011	3012	3013	3014	3015	3016	3017	3018	3019	3020	3021	3022	3023	3024	3025	3026	3027	3028	3029	3030	3031	3032	3033	3034	3035	3036	3037	3038	3039	3040	3041	3042	3043	3044	3045	3046	3047	3048	3049	3050	3051	3052	3053	3054	3055	3056	3057	3058	3059	3060	3061	3062	3063	3064	3065	3066	3067	3068	3069	3070	3071	3072	3073	3074	3075	3076	3077	3078	3079	3080	3081	3082	3083	3084	3085	3086	3087	3088	3089	3090	3091	3092	3093	3094	3095	3096	3097	3098	3099	3100	3101	3102	3103	3104	3105	3106	3107	3108	3109	3110	3111	3112	3113	3114	3115	3116	3117	3118	3119	3120	3121	3122	3123	3124	3125	3126	3127	3128	3129	3130	3131	3132	3133	3134	3135	3136	3137	3138	3139	3140	3141	3142	3143	3144	3145	3146	3147	3148	3149	3150	3151	3152	3153	3154	3155	3156	3157	3158	3159	3160	3161	3162	3163	3164	3165	3166	3167	3168	3169	3170	3171	3172	3173	3174	3175	3176	3177	3178	3179	3180	3181	3182	3183	3184	3185	3186	3187	3188	3189	3190	3191	3192	3193	3194	3195	3196	3197	3198	3199	3200	3201	3202	3203	3204	3205	3206	3207	3208	3209	3210	3211	3212	3213	3214	3215	3216	3217	3218	3219	3220	3221	3222	3223	3224	3225	3226	3227	3228	3229	3230	3231	3232	3233	3234	3235	3236	3237	3238	3239	3240	3241	3242	3243	3244	3245	3246	3247	3248	3249	3250	3251	3252	3253	3254	3255	3256	3257	3258	3259	3260	3261	3262	3263	3264	3265	3266	3267	3268	3269	3270	3271	3272	3273	3274	3275	3276	3277	3278	3279	3280	3281	3282	3283	3284	3285	3286	3287	3288	3289	3290	3291	3292	3293	3294	3295	3296	3297	3298	3299	3300	3301	3302	3303	3304	3305	3306	3307	3308	3309	3310	3311	3312	3313	3314	3315	3316	3317	3318	3319	3320	3321	3322	3323	3324	3325	3326	3327	3328	3329	3330	3331	3332	3333

TABLE 2.1-2
SH 20FZ

[illegible]

ALTERNATIVE STRATEGY 2 Voltage Support & Conservation						
COST-BENEFIT SUMMARY (million \$1990)						
	0	700	2956	6578	9678	14865
■ Cum PV (DISC 90%)	0	700	2956	6578	9678	14865
■ Costs PV	-141.0					
■ Benefits PV	245.5					
■ Net PV	104.5					
	89716	95167	100093	104510		

TABLE 2.1-3
SH 10F2

PUGET SOUND AREA ELECTRIC RELIABILITY PLAN																							
04-juni-91																							
ALTERNATIVE STRATEGY 3 Load Mgmt, Fuel Switching, Voltage Support & Conservation																							
Select	Total		Yearly		Fuel Switching		Voltage Support & Conservation		Power														
	Cap	Cost	Var	Cost	Resource	Life	Escalat	Fixed	Cost	Var	Capacity	%	Produced	Energy									
1ay 00N	90\$/kW	90\$/yr/kW	Life	Escalat	Life	Escalat	Ratio	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb	Nov-Feb
1 Expected Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Acc Weather	0	61.6	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Acc Industrial	0	36	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Flow Shm Hds	335	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Comm Refit	1420	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Voltage Support1	10	0	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Voltage Support2	40	1	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
0 Line	130	1	40	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Water Htr Control	323.6	28.9	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Time of Use Rates	249	48	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Fuel Switching	600.5	31.2	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3 0%																							
=====																							
ALTERNATIVE STRATEGY 3 Load Mgmt, Fuel Switching, Voltage Support & Conservation																							
Incremental megawatts																							
1ev Fix	Yrly Var	Cost	19903/kW	19903/kW	Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1 Expected Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Acc Weather	0	61.60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Acc Industrial	0	56.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Flow Shm Hds	53.77	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Comm Refit	72.45	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Voltage Support1	0	47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Voltage Support2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Water Htr Control	32	51	28	90	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Time of Use Rates	16	74	48	00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Fuel Switching	25	67	31	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
=====																							
ALTERNATIVE STRATEGY 3 Load Mgmt, Fuel Switching, Vo (Thousands 1990\$)																							
Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
1 Expected Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Acc Weather	0	598	1183	1823	2446	3055	3647	4226	3721	3222	2729	2242	1768	1404	1053	696	351	0	0	0	0	0	
1 Acc Industrial	0	235	470	650	829	1008	1187	1361	1551	1742	1411	1081	745	594	448	297	151	-0	0	0	0	0	
1 Flow Shm Hds	0	0	382	753	1113	1317	1511	1699	1887	2070	2070	2070	2070	2070	2070	2070	2070	2070	2070	2070	2070	2070	
1 Comm Refit	0	276	561	1336	2130	2919	3714	4521	5053	5597	6136	6136	6136	6136	6136	6136	6136	6136	6136	6136	6136	6136	
1 Voltage Support1	0	297	598	600	603	605	608	610	613	616	618	621	624	626	629	632	635	637	637	637	637	637	
1 Voltage Support2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1 Water Htr Control	0	1873	4870	8640	11797	14824	17692	20437	23102	25651	27739	27739	27739	27739	27739	27739	27739	27739	27739	27739	27739	27739	
1 Time of Use Rates	0	1198	2771	4299	5794	6118	6428	6739	7076	7412	7412	7412	7412	7412	7412	7412	7412	7412	7412	7412	7412	7412	
1 Fuel Switching	0	1216	2597	4845	7109	9518	12081	14869	16457	18451	20517	20912	21318	21737	22168	22612	23069	23540	23540	23540	23540	23540	
=====																							
Yearly Totals	0	5692	13431	22949	31820	39365	46868	54263	59461	64760	68633	68213	67812	67719	67656	67594	67563	67535	67535	67535	67535	67535	
=====																							
COST OF \$1990\$																							
\$591,603																							

TABLE 2.1-3
SM 20F 2

[illegible]

69-1011-67

5,

.....

CONCLUSIONS FROM ALTERNATIVE SIMULATIONS

3245 081 *

TABLE 2.2-1
SH 20F2

[illegible][illegible]

MUET SOUND AREA ELECTRIC RELIABILITY PLAN LOW CASE
08-jun-91

output

	-400	-300	-200	-100	0	100	200	300	400
Puget Area Deficit									
Cum Post-Action L/W Bal	1626.4	1730.1	1730.1	1730.1	1730.1	1742.5	652.1	561.7	277.1

TABLE 2.2-2
SH 20FZ

POWER BENEFITS FROM ALTERNATIVE STRATEGY 2 - Voltage Support & Conservation Case																		
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MARGINAL COSTS																		
Winter AC mill/kWh	31.5	15.2	17.0	16.8	16.4	17.3	16.2	18.7	17.9	18.1	19.2	19.8	20.4	19.5	21.0	20.7	20.7	20.7
Summer AC mill/kWh	29.3	14.2	15.8	15.6	15.2	16.1	15.1	17.4	16.7	16.8	17.8	18.4	19.0	18.2	19.5	19.2	19.2	19.2
CUMULATIVE AVOID																		
Expected Generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acc Weather	0.0	2.2	4.3	6.7	9.0	11.4	11.4	11.4	11.4	11.4	10.5	8.7	6.9	5.5	4.1	2.7	1.4	0.0
Acc Industrial	0.0	3.7	7.6	10.2	12.7	15.4	15.4	15.4	15.4	15.4	15.4	15.4	10.4	8.3	6.3	4.2	2.1	0.0
Efficient Sheds	0.0	0.0	3.2	6.3	9.4	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
Cons Retrofit	0.0	2.4	4.8	11.4	18.0	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6
Voltage Support 1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Voltage Support 2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BENEFIT CALCULATIONS (Thousands 1990\$)																		
Expected Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acc Weather	0	282	630	959	1265	1686	1980	1822	1746	1763	1732	1474	1201	915	741	487	243	0
Acc Industrial	0	474	1085	1428	1741	2224	2085	2404	2305	2323	2462	2543	1771	1360	1099	727	355	0
Efficient Sheds	0	0	450	882	1281	1615	1514	1746	1674	1687	1788	1847	1906	1824	1958	1929	1929	1929
Cons Retrofit	0	301	681	1597	2486	3561	3338	3849	3691	3720	3943	4072	4202	4022	4317	4252	4252	4252
Voltage Support 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Voltage Support 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yearly Total	0	1057	2845	4866	6753	9087	8517	9821	9416	9492	9925	9936	9080	8121	8115	7395	6779	6181
Net PV (\$1990)																		
ALTERNATIVE STRATEGY 2 - Voltage Support & Conservation																		
COST BENEFIT SUMMARY (million \$1990)																		
Cons PV (Cost 90\$)	0	-284	-560	-767	-3453	-5653	-8734	-9778	-11578	-13279	-14489	-15330	-16200	-17339	-18160	-19097	-20081	-21098
Cons PV																		
Benefits PV																		
Net PV																		

ALTERNATIVE STRATEGY 2 - Voltage Support & Conservation

COST BENEFIT SUMMARY (Million \$1990)

CUM PV (2010 \$)	0	-284	-560	-767	-3453	-5653	-8734	-9776	-11576	-13279	-14489	-15330	-16200	-17339	-18160	-19087	-20081	-21095
COSTS PV	0	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3	-109.3
Benefits PV	0	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2	88.2
Net PV	0	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1	-21.1

TABLE 2.2-3
SH 20F2

[illegible][illegible]

TABLE 2.2-4
S1110F2

PROJECT SUGAR AREA ELECTRIC RELIABILITY PLAN - Low Case																			
08-Jun-91																			
ALTERNATIVE STRATEGY 4 - Peaking CTS Voltage Support & Conservation																			
Select	Inv Cost	Var Cost	90\$/yr/kw	Life	Escalat	Escalat Ratio	Energy Produced Nov-Feb	INCREMENTAL MEGAWATTS											
								1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 Expected Generation	0	0	0	0	0	0%	0%	0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
1 Acc Weather	0	61.6	50	0	0	0%	23%	70.0%	0	9.6	9.6	10.4	10.4	10.4	10.5	0.0	0.0	0.0	0.0
1 Acc Industrial	0	56	20	0	0	0%	98%	33.3%	0	3.8	4.0	2.6	2.6	2.7	0.0	0.0	0.0	0.0	0.0
1 Efficient Shrs Hds	335	0	7	0	0	0%	44%	33.3%	0	0	7.2	7.1	7.0	4.1	0.0	0.0	0.0	0.0	0.0
1 Comm Retrofit	1420	0	30	0	0	0%	64%	33.3%	0	3.7	3.8	10.3	10.4	10.3	0.0	0.0	0.0	0.0	0.0
1 Voltage Support1	10	0.5	35	0	0	0%	0%	0.0%	0	300	300	0	0	0	0	0	0	0	0
1 Voltage Support12	40	1	35	0	0	0%	0%	0.0%	0	0	0	0	0	0	0	0	0	0	0
3 Line	130	1.2	40	1	2%	0.7%	1%	60.0%	0	0	0	0	1000	0	0	0	0	0	0
0 Water Mtr Control	323.6	28.9	12	0	0	0%	2%	33.3%	0	40.1	39.2	43.4	43.5	42.4	43.6	43.4	22.8	23.8	22.9
0 Time of Use Rates	249	45	20	0	0	0%	0%	0.0%	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	5.1
1 Peaking CTS	505	15.65	30	1	2%	2.3%	5%	60.0%	0	0	0	0	0	0	0	140	0	0	0
=====																			
Discount Rate	3.0%																		
=====																			
ALTERNATIVE STRATEGY 4 - Peaking CTS Voltage Support & Conservation																			
Select	Inv Cost	Var Cost	90\$/yr/kw	Life	Escalat	Escalat Ratio	Energy Produced Nov-Feb	INCREMENTAL MEGAWATTS											
								1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 Expected Generation	0	0	0	0	0	0%	0%	0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
1 Acc Weather	0	61.60	50	0	0	0%	23%	70.0%	0	9.6	9.6	10.4	10.4	10.4	10.5	0.0	0.0	0.0	0.0
1 Acc Industrial	0	56.00	20	0	0	0%	98%	33.3%	0	3.8	4.0	2.6	2.6	2.7	0.0	0.0	0.0	0.0	0.0
1 Efficient Shrs Hds	53.77	0.00	7	0	0	0%	44%	33.3%	0	0	7.2	7.1	7.0	4.1	0.0	0.0	0.0	0.0	0.0
1 Comm Retrofit	72.45	0.00	30	0	0	0%	64%	33.3%	0	3.7	3.8	10.3	10.4	10.3	0.0	0.0	0.0	0.0	0.0
1 Voltage Support1	0.47	0.50	35	0	0	0%	0%	0.0%	0	300	300	0	0	0	0	0	0	0	0
1 Voltage Support12	0	1	35	0	0	0%	0%	0.0%	0	0	0	0	0	0	0	0	0	0	0
3 Line	130	1.2	40	1	2%	0.7%	1%	60.0%	0	0	0	0	1000	0	0	0	0	0	0
0 Water Mtr Control	323.6	28.9	12	0	0	0%	2%	33.3%	0	40.1	39.2	43.4	43.5	42.4	43.6	43.4	22.8	23.8	22.9
0 Time of Use Rates	249	45	20	0	0	0%	0%	0.0%	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	5.1
1 Peaking CTS	505	15.65	30	1	2%	2.3%	5%	60.0%	0	0	0	0	0	0	0	140	0	0	0
=====																			
Discount Rate	3.0%																		
=====																			
ALTERNATIVE STRATEGY 4 - Peaking CTS Voltage Support & Conservation																			
Select	Inv Cost	Var Cost	90\$/yr/kw	Life	Escalat	Escalat Ratio	Energy Produced Nov-Feb	INCREMENTAL MEGAWATTS											
								1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 Expected Generation	0	0	0	0	0	0%	0%	0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
1 Acc Weather	0	61.60	50	0	0	0%	23%	70.0%	0	9.6	9.6	10.4	10.4	10.4	10.5	0.0	0.0	0.0	0.0
1 Acc Industrial	0	56.00	20	0	0	0%	98%	33.3%	0	3.8	4.0	2.6	2.6	2.7	0.0	0.0	0.0	0.0	0.0
1 Efficient Shrs Hds	53.77	0.00	7	0	0	0%	44%	33.3%	0	0	7.2	7.1	7.0	4.1	0.0	0.0	0.0	0.0	0.0
1 Comm Retrofit	72.45	0.00	30	0	0	0%	64%	33.3%	0	3.7	3.8	10.3	10.4	10.3	0.0	0.0	0.0	0.0	0.0
1 Voltage Support1	0.47	0.50	35	0	0	0%	0%	0.0%	0	300	300	0	0	0	0	0	0	0	0
1 Voltage Support12	0	1	35	0	0	0%	0%	0.0%	0	0	0	0	0	0	0	0	0	0	0
3 Line	130	1.2	40	1	2%	0.7%	1%	60.0%	0	0	0	0	1000	0	0	0	0	0	0
0 Water Mtr Control	323.6	28.9	12	0	0	0%	2%	33.3%	0	40.1	39.2	43.4	43.5	42.4	43.6	43.4	22.8	23.8	22.9
0 Time of Use Rates	249	45	20	0	0	0%	0%	0.0%	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	5.1
1 Peaking CTS	505	15.65	30	1	2%	2.3%	5%	60.0%	0	0	0	0	0	0	0	140	0	0	0
=====																			
Discount Rate	3.0%																		
=====																			
ALTERNATIVE STRATEGY 4 - Peaking CTS Voltage Support & Conservation																			
Select	Inv Cost	Var Cost	90\$/yr/kw	Life	Escalat	Escalat Ratio	Energy Produced Nov-Feb	INCREMENTAL MEGAWATTS											
								1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 Expected Generation	0	0	0	0	0	0%	0%	0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
1 Acc Weather	0	61.60	50	0	0	0%	23%	70.0%	0	9.6	9.6	10.4	10.4	10.4	10.5	0.0	0.0	0.0	0.0
1 Acc Industrial	0	56.00	20	0	0	0%	98%	33.3%	0	3.8	4.0	2.6	2.6	2.7	0.0	0.0	0.0	0.0	0.0
1 Efficient Shrs Hds	53.77	0.00	7	0	0	0%	44%	33.3%	0	0	7.2	7.1	7.0	4.1	0.0	0.0	0.0	0.0	0.0
1 Comm Retrofit	72.45	0.00	30	0	0	0%	64%	33.3%	0	3.7	3.8	10.3	10.4	10.3	0.0	0.0	0.0	0.0	0.0
1 Voltage Support1	0.47	0.50	35	0	0	0%	0%	0.0%	0	300	300	0	0	0	0	0	0	0	0
1 Voltage Support12	0	1	35	0	0	0%	0%	0.0%	0	0	0	0	0	0	0	0	0	0	0
3 Line	130	1.2	40	1	2%	0.7%	1%	60.0%	0	0	0	0	1000	0	0	0	0	0	0
0 Water Mtr Control	323.6	28.9	12	0	0	0%	2%	33.3%	0	40.1	39.2	43.4	43.5	42.4	43.6	43.4	22.8	23.8	22.9
0 Time of Use Rates	249	45	20	0	0	0%	0%	0.0%	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	5.1
1 Peaking CTS	505	15.65	30	1	2%	2.3%	5%	60.0%	0	0	0	0	0	0	0	140	0	0	0
=====																			
Discount Rate	3.0%																		
=====																			
ALTERNATIVE STRATEGY 4 - Peaking CTS Voltage Support & Conservation																			
Select	Inv Cost	Var Cost	90\$/yr/kw	Life	Escalat	Escalat Ratio	Energy Produced Nov-Feb	INCREMENTAL MEGAWATTS											
								1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
1 Expected Generation	0	0	0	0	0	0%	0%	0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
1 Acc Weather	0	591	1183	0	0	0%	3111	3111	3111	3111	3111	3111	3111	3111	3111	3111	3111	3111	3111
1 Acc Industrial	0	213	437	0	0	0%	879	879	879	879	879	879	879	879	879	879	879	879	879
1 Efficient Shrs Hds	0	0	387	0	0	0%	1366	1366	1366	1366	1366	1366	1366	1366	1366	1366	1366	1366	1366
1 Comm Retrofit	0	276	561	0	0	0%	2919	2919	2919	2919	2919	2919	2919	2919	2919	2919	2919	2919	2919
1 Voltage Support1	0	297	598	0	0	0%	603	603	603	603	603	603	603	603	603	603	603	603	603
1 Voltage Support12	0	0	0	0	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Line	0	0	0	0	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Water Mtr Control	0	0	0	0	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0
0 Time of Use Rates	0	1377	3165	0	0	0%	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880
1 Peaking CTS	0	0	0	0	0	0%	0	0	0	0	0	0	0	0	0	0	0	0	0
=====																			
Yearly Totals	0	1377	3165	0	0	0%	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880	8880
=====																			
COST PV (\$1990)	\$131.129																		

TABLE 2.2-4
SM 20F2

ALTERNATIVE STRATEGY 4. Peakling CTS Voltage Support Low Case																		
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MARGINAL COSTS																		
Winter av. mill/kwh	31.5	15.2	17.0	16.8	16.4	17.3	16.2	18.7	17.9	18.1	19.2	19.8	20.4	19.5	21.0	20.7	20.7	20.7
Summer av. mill/kwh	29.3	14.2	15.6	15.6	15.2	16.1	15.1	17.4	16.7	16.8	17.8	18.4	19.0	18.2	19.5	19.2	19.2	19.2
COMPARATIVE ANAL																		
Expected Generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acc Weather	0.0	2.2	4.3	6.7	9.0	11.4	11.4	11.4	11.4	11.4	10.5	8.7	6.9	5.5	4.1	2.7	1.4	0.0
Acc Industrial	0.0	3.7	7.6	10.2	12.7	15.4	15.4	15.4	15.4	15.4	15.4	15.4	10.4	8.3	6.3	4.2	2.1	0.0
Efficient Str Inds	0.0	0.0	3.2	6.3	9.4	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2
Cons Net Profit	0.0	2.4	4.8	11.4	18.0	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6
Voltage Support	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PEAKLING CTS																		
Peakling CTS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
BENEFIT CALCULATIONS (Thousands 1990\$)																		
Expected Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acc Weather	0	282	630	959	1265	1686	1560	1822	1746	1763	1732	1474	1201	915	741	487	243	0
Acc Industrial	0	474	1085	1428	1741	2224	2085	2404	2305	2323	2462	2543	1771	1360	1099	727	355	0
Efficient Str Inds	0	0	450	882	1281	1615	1514	1746	1674	1687	1788	1847	1906	1824	1958	1929	1929	1929
Cons Net Profit	0	301	681	1597	2466	3561	3336	3849	3691	3720	3943	4072	4202	4022	4317	4252	4252	4252
Voltage Support	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEAKLING CTS																		
Peakling CTS	0	0	0	0	0	0	0	1115	1068	1078	1143	1180	1217	1164	1251	1233	1233	1233
Yearly Total	0	1057	2845	4866	6753	9087	8517	10936	10484	10570	11068	11116	10997	9285	9366	8627	8012	7413
																		\$96,474

[illegible]

TABLE 2.2-5
SM 10F2

ALTERNATIVE STRATEGY 1										ALTERNATIVE STRATEGY 2										ALTERNATIVE STRATEGY 3													
Project		Cap Cost		Vol Cost		Voltage Support & Conservation		Energy		Power		Cap Cost		Vol Cost		Voltage Support & Conservation		Energy		Power		Cap Cost		Vol Cost		Voltage Support & Conservation		Energy		Power			
Name		\$/kW		\$/kVAr/kW		Life		Escal		Cost Var		Cost		Escal		Life		Escal		Cost Var		Cost		Escal		Life		Escal		Cost Var		Cost	
1993		1994		1995		1996		1997		1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17	
1		2		3		4		5		6		7																					

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[illegible]

UNITED STATES ALTERNATIVE STRATEGY FUND, VOLTAGE SUPPORT & CONTROL (THOUSANDS 1990\$)

[illegible]

TABLE 2.2-5
SH 20F2

[illegible]

ALTERNATIVE STRATEGY 1	Line	Voltage Support	Conservation
COST BENEFIT STATEMENTS (million \$1990)			
CUM PV (DISC 90%)	0	1012	3638
		5825	7510
		12197	20747
		31989	45045
		55922	66772
		75216	82861
		89575	95242
		100481	104907
		108521	108521
COSTS PV	-254.3		
BENEFITS PV	362.0		
NET PV	108.5		

ALTERNATIVE STRATEGY 2		Voltage Support & Conservation										INCREMENTAL MEGAWATTS										Power		
Sector	Sub-Sector	Total		Cap cost 90\$/km	Yearly cost	Resource life	Fixed		Energy		Produced dur ing Nov-Feb	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
		cost	var cost				cost	var cost	cost	var cost														
1	Expected Generation	0	0	0	0	0	0	0	0	0%	0	0	80	80	80	80	80	80	80	80	80	80	80	80
1	Acc Weather	0	61.6	50	0	0	0	0	0	23%	70	0	9.6	9.6	10.4	10.4	10.5	10.4	10.5	-8.2	-8.2	-8.2	-8.2	-8.2
1	Acc Industrial	0	56	20	0	0	0	0	0	98%	33	0	4.4	5.1	3.7	3.9	4.2	4.5	4.8	4.9	5.2	5.2	5.2	5.2
1	Efficient Shmody	315	0	7	0	0	0	0	0	44%	33	0	0	7.2	7.1	7.0	4.1	4.0	4.0	3.9	3.9	3.9	3.9	3.9
1	Comm Refr Profit	1420	0	10	0	0	0	0	0	7%	64%	33	0	3.7	3.8	10.3	10.3	10.3	10.4	10.3	10.3	10.3	10.3	10.3
1	Voltage Support 1	10	0.5	35	0	0	0	0	0	0%	0	0	300	300	0	0	0	0	0	0	0	0	0	0
1	Voltage Support 2	40	1	35	0	0	0	0	0	0%	0	0	0	0	0	1000	0	0	0	0	0	0	0	0
1	Water	130	1.2	40	0	0	0	0	0	1%	60	0	0	0	0	0	0	0	0	0	0	0	0	0
0	Water rate control	333.6	28.9	17	0	0	0	0	0	2%	33	0	40.1	39.2	43.4	43.5	42.4	43.6	43.4	22.8	21.8	22.9	22.9	22.9
0	Time of use rates	249	48	20	0	0	0	0	0	0%	0	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	5.2	5.2	5.2
1	Conservation	0	20	1	0	0	0	0	0	0%	0	0	5	0	180	-185	0	0	45	215	-260	0	0	0
Account rate		1.0%																						

ESTIMATED VOLTAGE /		(\$/KWH)													
Voltage Support & Conservation		Incremental Requirements													
	1993/Year	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cost	Cost														
Required Generation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Peak Weather	0.00	61.60	0.00	9.6	10.4	10.4	10.5	10.5	-6.2	-8.2	-8.2	-8.2	-8.1	-6.2	-6.2
Peak Industrial	0.00	56.00	0.00	4.4	3.7	3.9	4.3	4.8	4.9	5.7	-6.9	-7.4	-7.9	-3.1	-3.4
Efficient Sheds	53.77	0.00	0.00	0.0	7.2	7.0	4.1	4.0	3.9	3.9	0.0	0.0	0.0	0.0	0.0
Comp Retrofit	72.45	0.00	0.00	3.7	3.6	10.3	10.3	10.4	6.8	6.9	6.8	0.0	0.0	0.0	0.0
Voltage Support 1	0.47	0.50	0.00	300.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Voltage Support 2	1.86	1.00	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Line	5.62	1.20	0.00	0.0	0.0	0.0	0.0	0.0	0.0	2000.0	0.0	0.0	0.0	0.0	0.0
Voltage Support	0.00	20.00	0.00	5.0	0.0	180.0	-185.0	0.0	0.0	215.0	-260.0	0.0	0.0	0.0	0.0
Project Area Deficit	0	-400	-800	-1100	-1400	-1800	-2100	-2400	-2700	-3100	-3400	0	0	0	0
Cum Post-Act L/R Bal	0.0	2.7	6.4	0.0	626.6	335.7	144.9	0.0	3.0	1429.6	1201.5	0	0	0	0

[illegible]

POWER BENEFITS FROM ALTERNATIVE STRATEGY 2 - Voltage Support & Conservation/High Case																		
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MARKET COSTS																		
Winter AC mil/kwh	31.5	35.7	35.3	37.0	37.6	38.5	41.0	41.6	41.9	37.5	38.7	37.7	39.0	38.7	38.3	39.0	39.0	39.0
Summer AC mil/kwh	29.3	33.2	32.6	34.4	35.2	35.6	38.1	38.7	39.0	34.9	36.0	35.1	36.2	36.0	35.6	36.2	36.2	36.2
CONSERVATIVE ASSESSMENT																		
Expected Generation	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Acc Weather	-0.0	2.2	4.3	6.7	9.0	11.4	13.7	16.1	14.2	12.4	10.5	8.7	6.9	5.5	4.1	2.7	1.4	0.0
Acc Industrial	0.0	4.3	9.3	12.9	16.8	20.9	25.3	30.0	34.8	39.9	33.1	25.9	18.1	15.1	11.8	8.1	4.2	-0.0
Efficient Shd Inds	0.0	0.0	3.2	6.3	9.4	11.2	12.9	14.7	16.4	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
Comm Retrofit	0.0	2.4	4.8	11.4	18.0	24.6	31.2	37.9	42.2	46.7	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Voltage Support1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Voltage Support2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Line	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6
Contingment	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
BENEFIT CALCULATIONS (Thousands 1990\$)																		
Expected Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acc Weather	0	661	1309	2115	2919	3752	4816	5727	5111	3978	3497	2806	2293	1816	1352	917	459	0
Acc Industrial	0	1284	2746	4000	5293	6711	8657	10409	12175	12483	10713	8146	5898	4681	3759	2646	1371	-2
Efficient Shd Inds	0	0	934	1945	2960	3593	4429	5101	5744	5674	5863	5708	5697	5863	5794	5897	5897	5897
Comm Retrofit	0	705	1416	3522	5700	7922	10693	13152	14783	14602	16497	18061	16593	16497	16303	16593	16593	16593
Voltage Support1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Voltage Support2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Line	0	0	0	0	0	0	0	0	0	7850	8112	7698	8160	8112	8017	8160	8160	8160
Contingment	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Yearly Total	0	2650	6405	11582	16872	21978	28597	34389	37812	44587	44681	40822	38841	37168	35224	34213	32459	30662
Bene FY (\$1990) = 3337.017 *																		

[illegible]

TABLE 2.2-7
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INLET SUPPLY AREA ELECTRIC RELIABILITY PLAN HIGH CASE

08-JUN-91

ALTERNATIVE STRATEGY 3 FUEL SWITCHING LOAD MANAGEMENT VOLTAGE SUPPORT & CONSERVATION

SELECT ITEM	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EXPECTED GENERATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACC WEATHER	0	61.6	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACC INDUSTRIAL	0	56	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EFFICIENT SHR IND	335	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMM RETIREMENT	1420	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOLTAGE SUPPORT 1	10	0.5	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOLTAGE SUPPORT 2	40	1	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUEL SWITCHING	680	31.2	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WATER INT CONTROL	323.6	28.9	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TIME OF USE RATES	249	48	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONFINEMENT	0	20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DISCOUNT RATE	3.0%																	

ALTERNATIVE STRATEGY 3 FUEL SWITCHING LOAD MANAGEMENT VOLTAGE SUPPORT & CONSERVATION

SELECT ITEM	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EXPECTED GENERATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACC WEATHER	0	61.60	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACC INDUSTRIAL	0	56.00	70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EFFICIENT SHR IND	33.77	0.00	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
COMM RETIREMENT	72.45	0.00	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOLTAGE SUPPORT 1	0.47	0.50	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VOLTAGE SUPPORT 2	1.86	1.00	35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUEL SWITCHING	26.43	31.20	50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WATER INT CONTROL	32.51	28.90	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TIME OF USE RATES	16.74	48.00	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CONFINEMENT	0.00	20.00	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BUDGET AREA DEFICIT	0	-400	-800	-1100	-1400	-1800	-2100	-2400	-2700	-3100	-3400							
CUM POST-ACTIVITY RATIO	0	77.6	191.4	116.7	65.8	1.6	3.6	3.9	540.6	308.2	144.5							

ALTERNATIVE STRATEGY 3 FUEL SWITCHING LOAD MANAGEMENT (THOUSANDS 1990\$)

SELECT ITEM	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EXPECTED GENERATION	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ACC WEATHER	0	598	1183	1823	2446	3055	3647	4226	4771	5279	5749	6186	6586	6946	7263	7537	7763	7943
ACC INDUSTRIAL	0	246	332	739	958	1193	1445	1714	1988	2279	2589	2907	3234	3570	3916	4272	4638	4914
EFFICIENT SHR IND	0	0	38.2	753	1113	1317	1511	1699	1887	2070	2250	2426	2600	2771	2939	3104	3267	3428
COMM RETIREMENT	0	276	561	1339	2130	2919	3714	4521	5333	6136	6936	7731	8521	9306	10086	10861	11631	12396
VOLTAGE SUPPORT 1	0	297	598	600	603	605	608	610	613	616	618	621	624	626	629	632	635	638
VOLTAGE SUPPORT 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FUEL SWITCHING	0	1286	2685	4961	7316	9866	12488	15182	17140	19309	21493	23724	25927	28104	30254	32384	34494	36584
WATER INT CONTROL	0	2340	5944	10366	13817	17146	20320	23372	26342	29219	31926	34576	37076	39526	41926	44276	46576	48826
TIME OF USE RATES	0	1347	3133	4881	6616	7030	7432	7846	8312	8785	9261	9736	10211	10686	11161	11636	12111	12586
CONFINEMENT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YEARLY TOTALS	0	6389	15018	25462	34998	45752	55784	65771	74183	81463	87946	93746	98946	103546	107546	111046	114046	116546
COST BY 1990\$	0	6389	15018	25462	34998	45752	55784	65771	74183	81463	87946	93746	98946	103546	107546	111046	114046	116546

FROM ALTERNATIVE STRATEGY 3. Fuel Switching, Load Management Case

ALTERNATIVE SIMULATED FUEL SWITCHING LOAD MANAGEMENT VOLTAGE SUPPORT & CONSERVATION

COST BENEFIT SUMMARY (million \$1990)																			
Cost	PV (DISC 40%)	0	-1519	-5318	-10282	-15585	-22110	-27364	-32567	-34738	-42049	-49766	-60002	-70288	-81328	-93319	-105154	-117762	-132281
Benefit	PV	0	679	2105	3500	4780	5960	7050	8060	8990	9840	10610	11300	11920	12470	12950	13360	13700	13970
Net	PV	0	-840	-3213	-6782	-10805	-16625	-23464	-30507	-32748	-40089	-49156	-60002	-70288	-81328	-93319	-105154	-117762	-132281

TABLE 2.2-8
SM 20PZ

[illegible][illegible]

04-1111-1
 Reactive Strategy 1 Transmission Line
 Reactive & Conservation
 Project Coordination Reliability Plan
 Resource Requirements Spreadsheet

Variable & Measure	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Fuel Switching	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pecking CIs	0	0	0	0	0	0	0	140	70	140	70	0	0	0	0	0
Weather	0	300	300	0	0	0	0	0	0	0	0	0	0	0	0	0
Time	0	0	0	0	0	2000	0	0	0	0	0	0	0	0	0	0
Weather2	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0
All Weather	0	9.6	9.6	10.4	10.4	10.5	10.4	10.5	-6.2	-6.2	-6.2	-6.2	-6.1	-6.2	-6	-6.1
All Industrial	0	4.2	4.2	3.2	3.2	3.2	3.2	3.1	3.4	3.4	-5.9	-5.9	-6	-2.7	-2.6	-2.7
Oil to Sh Inds	0	5.4	5.4	5.3	5.2	4.1	4.1	3.9	9.4	9.2	5.3	5.2	4.1	4.1	3.9	9.4
Comm Mfg Profit	0	30.5	48.8	61.4	51.4	49.3	46.7	44.7	43.4	41.5	34	0	0	30.5	48.8	61.4
Comm Mfg Profit	0	3.7	3.8	10.3	10.4	10.3	10.3	10.4	6.8	6.9	6.8	0	0	0	0	0
Ind Rates	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	0	0	0	0	0	0

[illegible]

Average Realty Revenue Requirements	
• 1990-98	\$51.680
• 2000-08	\$74.478

TABLE 2.3-2

PROJECT SOUND ELECTRIC RELIABILITY PLAN																	
Revenue Requirements Spreadsheet																	
Alternative Strategy 2 - Reductive & Conservation																	
04 - June-91																	
PACKAGE & AM DESIGNATION																	
Select	measure	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	fuel switching	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	Peakng CTS	0	0	0	0	0	0	0	140	70	140	70	0	0	0	0	0
3	Reductivel	0	300	300	0	0	0	0	0	0	0	0	0	0	0	0	0
4	Reductivel	0	0	0	0	0	2000	0	0	0	0	0	0	0	0	0	0
5	Reductivel	0	0	0	0	1000	0	0	0	0	0	0	0	0	0	0	0
6	ACC Reductivel	0	9.6	9.6	10.4	10.4	10.5	10.4	10.5	-8.2	-8.2	-8.2	-8.2	-8.1	-6.2	-6	-6.1
7	ACC Industrial	0	4.2	4.2	3.2	3.2	3.2	3.2	3.1	3.4	3.4	-5.9	-5.9	-6	-2.7	-2.6	-2.7
8	LU Flu Shrdns	0	5.4	5.4	5.3	5.2	4.1	4.1	3.9	9.4	9.2	5.3	5.2	4.1	4.1	3.9	9.4
9	Cons Reductivel	0	30.5	48.8	61.4	51.4	49.3	46.7	44.7	43.4	41.5	34	0	0	30.5	48.8	61.4
10	Cons Reductivel	0	3.7	3.8	10.3	10.4	10.3	10.3	10.4	6.8	6.9	6.8	0	0	0	0	0
11	LUW Rates	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	0	0	0	0	0	0

[illegible]

ANNUAL	Yearly Revenue Requirements
1990-98	\$22,999
2000-08	\$40,204

TABLE 2.3-3

PORTLAND ELECTRIC RELIABILITY PLAN																
Revenue Requirements Spreadsheet																
Alternative Strategy 3: Load Mgmt Fuel Switching, Reactive & Conservation																
(Revenue Requirements Without Fuel Switching)																
(04-Jun-91)																
PACKAGE & MEASURE DESIGNATOR																
Select Measure	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
YES Fuel Switching	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NO Peaking Cts	0	0	0	0	0	0	0	140	70	140	70	0	0	0	0	0
YES Reactive1	0	300	300	0	0	0	0	0	0	0	0	0	0	0	0	0
NO Reactive2	0	0	0	0	0	2000	0	0	0	0	0	0	0	0	0	0
YES ACC Weather	0	9.7	9.5	10.4	10.1	9.9	9.6	9.4	-8.2	-8.1	-8	-7.9	-7.7	-5.9	-5.7	-5.8
YES ACC Industrial	0	4.2	4.2	3.2	3.2	3.2	3.2	3.1	3.4	3.4	-5.9	-5.9	-6	-2.7	-2.6	-2.7
YES LO FLO SHR HD	0	0	7.1	6.9	6.7	3.8	3.6	3.5	3.5	-0.5	6.9	6.7	3.8	3.6	3.5	3.5
YES WTR HTR CONTR	0	30.5	48.8	61.4	51.4	49.3	46.7	44.7	43.4	41.5	34	0	0	30.5	48.8	61.4
YES COMM RETROFIT	0	3.7	3.8	10.3	10.4	10.3	10.3	10.4	6.8	6.9	6.8	0	0	0	0	0
YES FUE RATES	0	18.5	24.3	23.6	23.1	5	4.8	4.8	5.2	5.2	0	0	0	0	0	0

REVENUE REQUIREMENT CALCULATION (\$10000 DOLLARS)										
	1996	1997	1998	ST TOTAL	ST AVE	2006	2007	2008	LT TOTAL	LT AVE
YES					0					0
NO					0					0
YES					0					0
NO					0					0
YES					0					0
NO					0					0
Fuel Switching	1187	1215	1245	3648	1216	1558	1608	1661	4828	1609
NO					0					0
YES					0					0
NO					0					0
ALL Weather	2661	3747	4915	11323	3774	3338	2629	1824	7791	2597
NO					0					0
ALL Industrial	984	1319	1684	3988	1329	1465	1161	808	3434	1145
NO					0					0
LO FLO Storage	1879	2435	2825	7139	2380	6422	6553	5481	18457	6152
NO					0					0
WTR HT Unit	16634	23297	30033	69964	23321	87570	87070	74448	244039	81346
NO					0					0
COMM Metrolife	5434	8125	10902	24461	8154	20093	19750	19441	59284	19761
NO					0					0
LOC Water	7473	10448	11342	29263	9754	0	0	0	0	0

Average yearly Revenue Requirements			
1996-98	349,928		
2006-08	5112,611		

PARADE & MAY DISCUSSION

REVERSE REQUIREMENT CALCULATION
(Various nominal)

Average Yearly Revenue Requirements

TABLE 2.5-1

Deliverability Of Measures

Measures	Deliverable 1	Somewhat Deliverable 2	Somewhat Undeliverable 3	Undeliverable 4	Average
Reduce Demand					
Conservation					
Residential	11	8	0	0	1.4
Commercial	8	9	2	0	1.7
Industrial	6	8	5	0	1.9
Load Management	5	9	5	0	2.0
Fuel Switching	7	9	3	0	1.8
Transmission					
500-kV Line					
New Corridor	0	4	9	6	3.1
Expanded ROW	2	11	5	1	2.3
Existing ROW	10	7	2	0	1.6
Voltage Support					
Series Capacitors	9	9	0	0	1.5
Static Var Comp	10	7	0	0	1.4
Curtailement					
Industrial Contracts	2	11	5	0	2.2
Co-op Contracts	1	12	5	0	2.2
Local Generation					
Hydroelectric					
Large Impound	0	1	5	13	3.6
Small Impound	0	11	8	0	2.4
Run of River	1	11	4	2	2.4
Combust Turbines					
Hydro Firming	4	13	1	0	1.8
Peaking	8	9	2	0	1.7
Cogeneration					
Fuel - Gas	10	9	0	0	1.5
Fuel - Oil	4	8	5	1	2.2
Fuel - Biomass	4	5	8	0	2.2
Fuel - Coal	0	5	10	4	2.9
WNP-3	0	0	6	13	3.7
No Action	3	4	4	7	2.8

* Numbers reflect votes by 19 Sounding Board members

TABLE 2.6-1

Measure Reliability

		Unit Size	Number of Units	Fail Rate	Comm Mode	Rank
1	Acc Industrial	1 kW	100,000's	0.0%	N	1
2	Comm Retrofit	2 kW	1,000's	0.0%	N	1
3	Low Flo Shr Hds	0.06 kW	100,000's	0.0%	N	1
4	Fuel Switching	6 kW	100,000's	0.0%	N	1
5	Acc Weather	1 kW	100,000's	0.0%	N	1
6	Firming SCCT	70	5	11.0%	N	2
7	Small hydro	1-10	50	3.0%	N	2
8	Voltage Support 1	200	2	0.5%	Y	2
9	Transmission	1000	2	0.1%	Y	2
10	Voltage Support 2	200	5	0.5%	Y	2
11	Curtailement	0.1-100	500	?	Y	2
12	Cogen 1	0.1-500	20	10.0%	N	2
13	Peaking SCCT	70	11	11.0%	N	2
14	Water Htr Control	1 kW	100,000's	?	Y	2
15	Time of Use Rates	1 kW	100,000's	?	?	2
16	Cogen 2	0.1-500	20	10.0%	N	2
17	Coal	250	250	8.0%	N	3
18	WNP3	1240	1	24.0%	N	4

END

**DATE
FILMED**

01/10/92