AQUILA NETWORKS - MISSOURI
INTEGRATED RESOURCE PLAN

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PART 5
RISK ANALYSIS AND STRATEGY SELECTION

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5.1 INTRODUCTION

5.1.1 Objectives

This section of the IRP contains the risk analysis and strategy selection aspects of the Integrated Resource Plan for Aquila Networks - Missouri and is filed in accordance with 4 CSR 240-22.070 of the electric utility planning rules issued by the Missouri Public Service Commission. The objective of this section is to present the results of the risk analysis of the integrated resource plans presented in Part 4. In addition, this section of the IRP outlines the ANM preferred integrated resource plan and the implementation strategy to acquire the selected resources. Appendix 5-A contains responses to each of the filing requirements, referring to appropriate documentation within this report.

5.1.2 Risk Analysis and Strategy Selection Process

This subsection provides a general overview of the activities that will be required for the analysis in the following sections. Part 4 of the IRP presented the alternative resource plans. These plans were developed using base case assumptions for all inputs[1].

Constitution of a resource strategy for an electric utility is complicated by the wide range of uncertainty in every key variable that influences resource choices. These differences could be significant enough to change resource choices. Given the fact that the electric utility industry is highly capital intensive and the costs of revoking major resource decisions are extremely high, it is imperative that a utility's preferred plan be flexible and robust under most plausible scenarios.

Decision analysis, or risk analysis, can be defined as a logical procedure to consider factors that influence a decision. This procedure, as employed in this study, incorporates uncertainties, values, and preferences in a decision tree framework based on the resource plan. Such an approach would provide the expected performance of the resource plan for a range of discrete values of a key variable as well as a measure of the risk of the plan to that variable.

The first step in conducting a risk analysis is to construct a range of values for each of the key variables. A table of the ranges of key variables can be found in Section 5.2.

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[1] *Please refer to Volumes 1, 2, and 3 for base case assumptions related to load forecasting, supply-side options, and demand-side options.*

The next stage of the risk analysis is to develop decision trees. This approach was used to evaluate the sensitivity of each of the plans to values of key variables. Nodes were developed for the following uncertainties:

- Load forecasts - high and low cases
- Cost of capital
- Cost impact of potential carbon tax and price of SO_2, NOx, and Mercury (Hg) allowances
- Natural gas prices
- Coal prices
- Capital costs of all of the new generation in the integrated plan[2]
- Fixed and Variable O&M costs
- Forced outage rates
- Purchase power options – Purchase Power Agreements and Spot Market cost and availability
- Impacts of DSM Programs

The expected value of better information of critical variables will be calculated comparing the expected value of the optimal plans developed for the key variable uncertainties versus the expected value of the preferred plan with key variable uncertainties.

A combination of variables will be evaluated in Section 5.4 as scenarios. Each of the scenarios provides a realization of a combination of such uncertain variables. These scenarios do not completely capture the entire range of all possible outcomes but do provide a wide variety of combinations of key uncertainty variables. Optimal plans for each of the above scenarios will be evaluated using the Capacity Expansion Module of MIDAS. The scenarios provide the extent of overall risk related to the preferred plan and the flexibility of the plan.

Section 5.5 presents the preferred plan which was developed using the minimization of revenue requirements with probable environmental costs as the primary objective. ANM's implementation and resource acquisition strategy for the preferred resource plan is included in Section 5.6.

[2] *These costs include the siting, permitting, and construction costs involved in power plant construction.*

5.2 PROBABILITY ASSESSMENT AND DECISION TREES

5.2.1 Probability Assessment Procedure

Development of probabilities for a decision analysis model can be defined as the encoding of beliefs or preferences of a decision maker or an expert about key uncertainty variables. A decision analysis model has two types of input variables: decision variables and state variables. Decision makers can choose the values of the decision variables such as portfolio additions but the values of the state variables (i.e. fuel prices) are beyond their control. Therefore, encoding of probabilities is only meaningful with respect to state variables.

The following encoding principles were followed throughout this process:

(1) the state variables need to be important to the decision, as determined by a sensitivity analysis,

(2) the level of detail in the encoding process should be directly proportional to the sensitivity of the plan to a change in the variable, and

(3) the variables should be clearly defined.

5.2.2 Ranges for Key Uncertainty Variables

This subsection presents the plausible range of values for key state variables. Most of the ranges for values of key variables were developed through discussions with internal and external subject matter experts. Table 5-1 presents a summary of the ranges for the key variables and the sources of data used in the sensitivity analysis.

Table 5-1
Ranges of Key Uncertainty Variables and Sources of Data

Critical Factor	Base Case	High Case	Low Case	None
1. Emissions/CO_2 Tax	Sargent & Lundy Base Case	Sargent & Lundy High Case	Sargent & Lundy Low Case	Sargent & Lundy Base Case w CO_2 set to Zero
2. Gas Prices	Global Energy Decisions - Spring Ref Case	Global Energy Decisions - Terrorism & Turmoil Scenario	Global Energy Decisions - Global Economy Scenario	N/A
3. Construction Cost Forecast	Multiple Sources	+40% coal +75% nuclear +25% gas	-10% on all Technologies	N/A
4. Load Forecast	ANM Base Case (See IRP Part 1)	ANM High Case (See IRP Part 1)	ANM Low Case (See IRP Part 1)	N/A
5. Coal Prices	Global Energy Decisions - Spring Reference Case	Global Energy Decisions - Return to Reliability Scenario	Global Energy Decisions - Global Economy/ Technology Evolution Scenarios	N/A
6. Cost of Capital	Debt Wt- 52.5% Debt Rate - 7.75% Equity Rate - 11.5% ROR - 9.53% Tax - 38.39% WACC - 7.97% Based on ANM estimates	Debt Wt- 51.73% Debt Rate - 9.21% Equity Rate - 13.42% ROR - 11.24% Tax - 38.39% WACC - 9.41% Based on ANM estimates	Debt Wt- 63.84% Debt Rate - 7.28% Equity Rate - 8.5% ROR - 7.72% Tax - 38.39% WACC - 5.94% Based on ANM estimates	N/A
7. O&M Costs	Multiple Sources	Varies by technology as outlined in Appendix 2-G	Varies by technology as outlined in Appendix 2-G	N/A
8. DSM Impact	Base Case DSM Impact from Quantec	High Case DSM Impact from Quantec	Low Case DSM Impact from Quantec	N/A
10. Forced Outage Rates	Multiple Sources	10%	4%	N/A
11. Spot Power	Global Energy Decisions - Spring Reference Case	Global Energy Decisions - Technology Evolution Scenario	Global Energy Decisions - Return to Reliability Scenario	N/A
12. Contract Purchases	ANM Estimate Based on Recent Power Supply Proposals	+40% of fixed cost from base case	-10% of fixed cost from base case	N/A

5.2.3 Rationale for Decision Tree Analysis

The range of values, presented in the previous subsection, provides a notion of the degree to which a critical variable may vary during the planning horizon.

The various components of a resource decision can be formally integrated into a layout in the form of a decision tree. This tree integrates the relevant components of the decision analysis in a systematic manner suitable for the analytical evaluation of the optimal alternative (optimal plan). Decision trees consist of decision nodes and chance nodes with the latter representing outcomes beyond the control of ANM. The outcomes from a chance node are mutually exclusive and collectively exhaustive and, hence, the probabilities at each chance should equal unity.

In the sensitivity analysis presented in Section 5.3, there is only one decision node with one fork which is the resource plan being analyzed. The sensitivity analysis section involves the variability of the present value of revenue requirements with changes in critical variables modeled as chance nodes. Combinations of these critical variables are analyzed as scenarios in Section 5.4.

5.2.4 Sensitivity Analysis

This subsection presents the results of the sensitivity analysis conducted in MIDAS Gold using the alternative resource plans under the objective of minimization of revenue requirements with probable environmental costs. The high and low cases were based on the potential values of the critical variables. Optimal plans were not developed for each variation of the key variables and only the sensitivity of the alternative resource plans to changes in the key variables was analyzed.

Figures 5-1 through 5-5 present the results of the sensitivity analysis. The figures show the low and high case effects of chance variables on the alternative resource plans. The data referenced in these figures can be found in Appendix 5-B.

Figure 5-1
Sensitivity Analysis for "No Coal" ARP

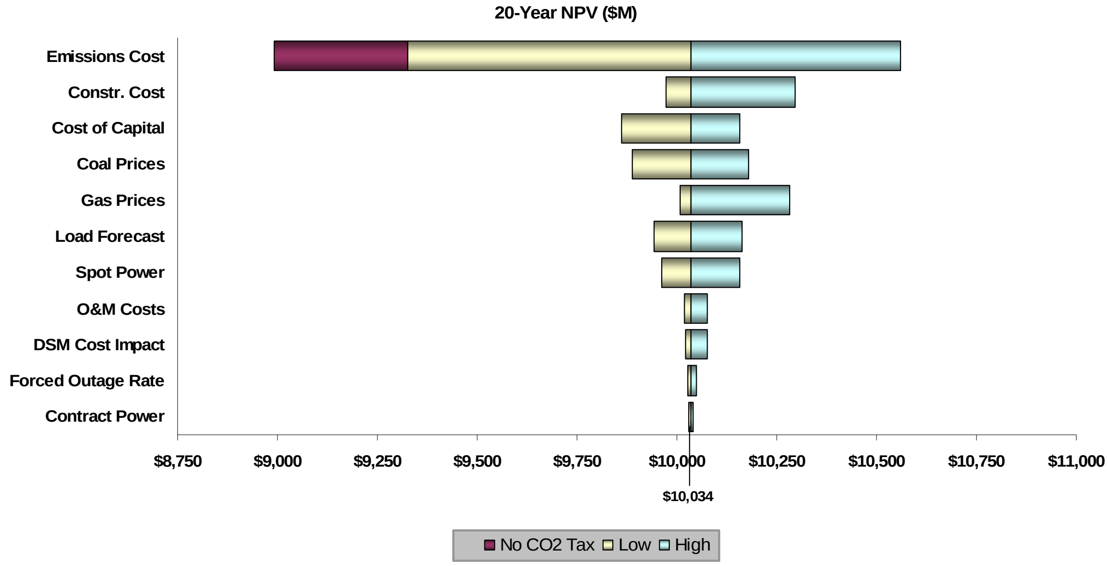


Figure 5-2
Sensitivity Analysis for "PPAs through 2012" ARP

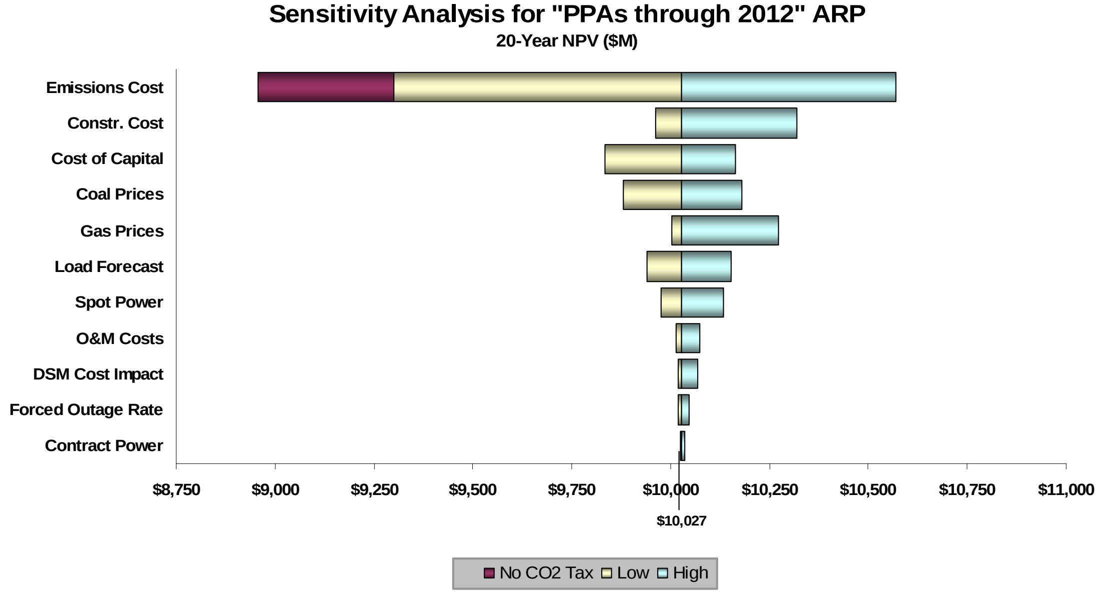


Figure 5-3
Sensitivity Analysis for "PPAs through 2009" ARP
20-Year NPV ($M)

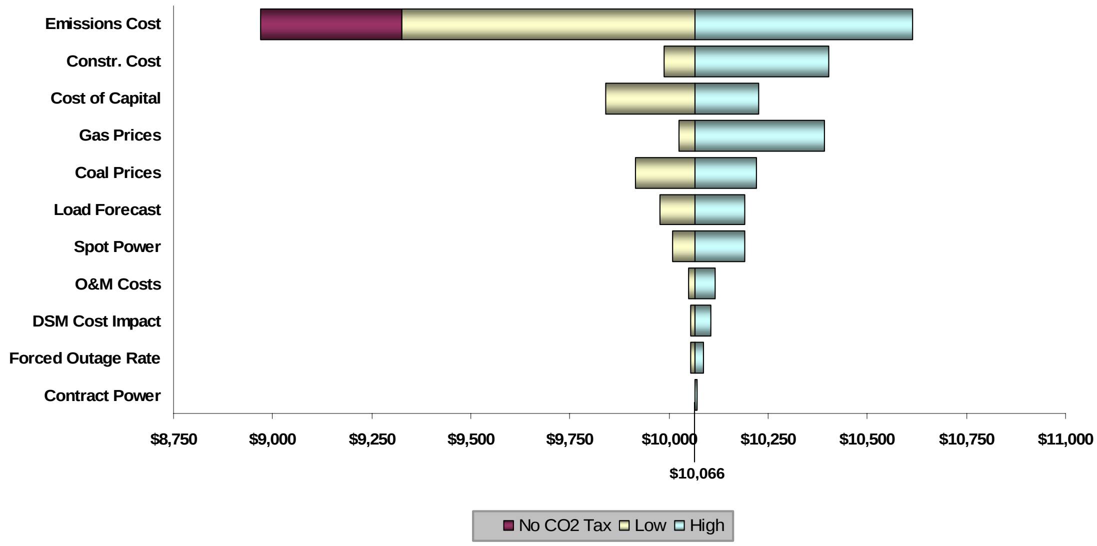


Figure 5-4
Sensitivity Analysis for "No Gas" ARP
20-Year NPV ($M)

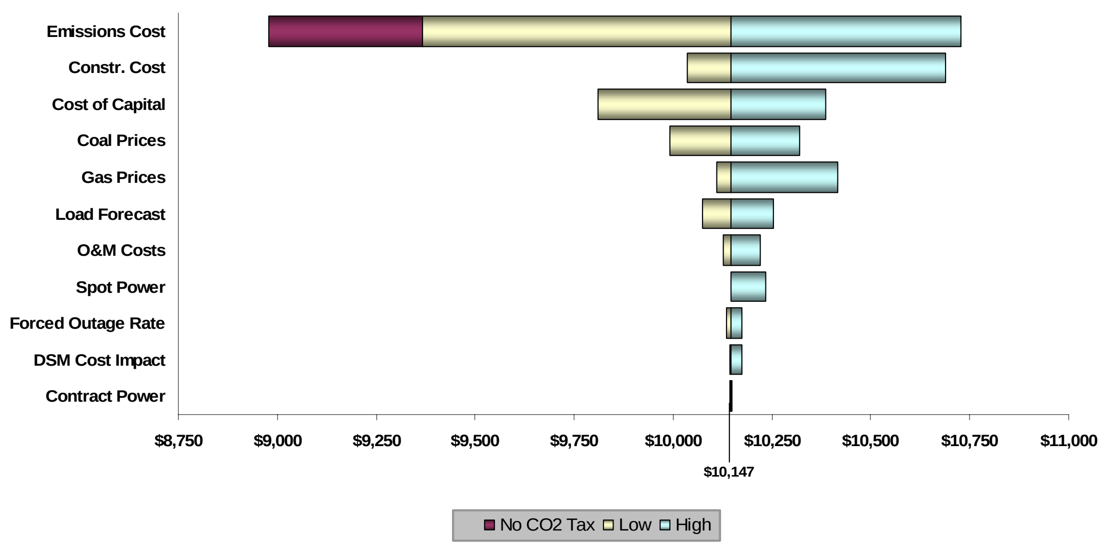
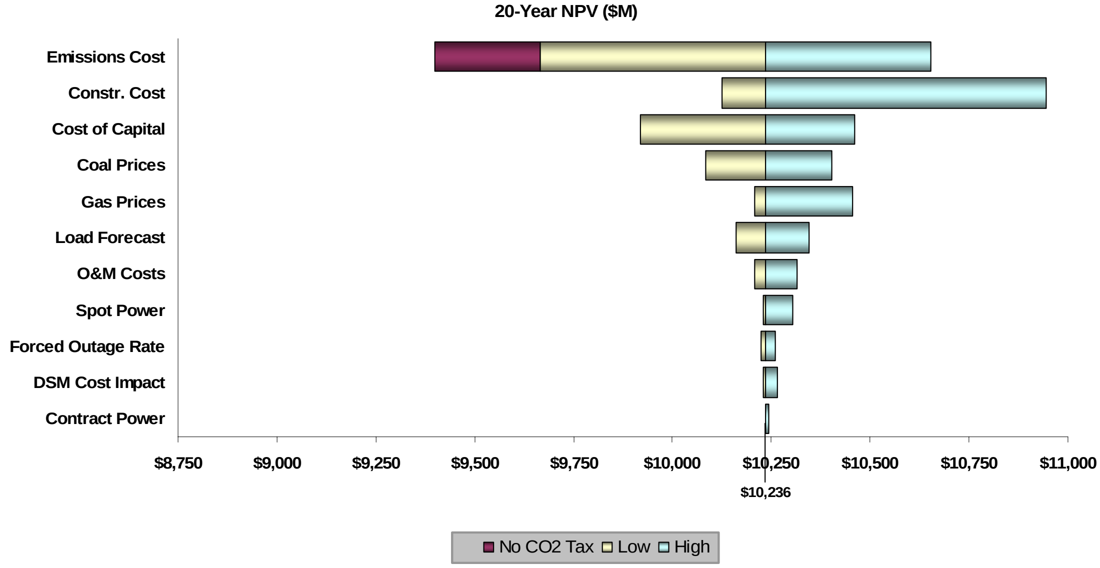


Figure 5-5
Sensitivity Analysis for "Green" ARP



As evidenced by Figures 5-1 through 5-5, the following are consistently the variables with the most downside risk:

- Probable Environmental Costs
- Cost of Capital
- Costs of Construction of New Generation Options
- Gas Prices

All of the alternative resource plans are more sensitive to the effect of environmental costs (particularly CO_2) than any other variable. Therefore, an analysis will be conducted in subsection 5.5.6 to calculate the expected value of better information on potential environmental costs for the preferred resource plan.

5.3 SCENARIO ANALYSIS

The previous section presented the sensitivity of the alternative resource plans to changes in individual variables. In this section, critical variables are combined into plausible scenarios for which optimal plans are developed using the Capacity Expansion Module in MIDAS. This exercise is undertaken to evaluate the robustness and flexibility of the optimal plan under these scenarios

The scenario analysis approach serves as a cost-effective approach to evaluate the inherent risk of the preferred plan to variations in a combination of critical variables. *A scenario can be defined as a realization of values of chance variables or events that are beyond the control of decision makers.* It is practically impossible to develop optimal plans for each of the vast number of scenarios that are possible in the future. An exhaustive evaluation of several million combinations of chance variables would still not cover all the possible scenarios and exposes the fallacy of the calculation of the expected value of "perfect" information.

A more practical approach would be to develop optimal plans for certain likely scenarios and evaluate the inherent risk of the optimal plan under each scenario. ANM purchased "Electric Power Horizons 2006 – Scenarios of the Global Energy Future" from Global Energy Decisions to more accurately model the impacts of four potential integrated scenarios. The Global Energy Decisions report is included as Appendix 5-C to this document.

A brief description of each of the four scenarios, as provided by Global Energy Decisions, is presented below:

<u>Terrorism & Turmoil</u>

"Domestic and global terrorist attacks cause a severe fuel supply constraint and economic slowdown."

<u>Technology Evolution</u>

"Undeniable evidence of global warming leads to regulation to reduce CO_2 and a societal shift to greater energy conservation and "benign" supply-side technologies."

<u>Global Economy</u>

"Collapse of major manufacturing industries in the United States force the elimination of trade barriers and development of international programs to stimulate a "global" economy."

<u>Return to Reliability</u>

"Natural disasters create transmission gridlocks that spread throughout the interconnected system. To address concerns, reliability protocols are created increasing reserve margins for regions."

As further described in the attached report, each scenario provides an integrated forecast of fuel, spot market energy, emissions costs, as well as demand and energy to capture the most significant impacts on future generation costs. ANM used the Capacity Expansion Module of MIDAS to determine the optimal portfolio additions for each of the four scenarios. Table 5-2 shows the optimal portfolios and the net present value of revenue requirements.

Table 5-2
Generation Additions and Capacity Purchases for EPH Scenarios

	Optimal Scenario Resource Plans			
Year	Terrorism & Turmoil	Technology Evolution	Global Economy	Return to Reliability
2007				
2008	300 MW PPA	300 MW PPA	200 MW PPA	300 MW PPA
2009	200 MW PPA	300 MW PPA	200 MW PPA	300 MW PPA
2010	50 MW PPA	200 MW PPA		250 MW PPA
2011	150 MW PPA	250 MW PPA		250 MW CC, 150 MW PPA
2012	150 MW PPA	250 MW PPA		250 MW CC
2013	200 MW Coal	250 MW CC		
2014				200 MW Coal
2015			75 MW CT	
2016				
2017			250 MW CC	100 MW Coal
2018	75 MW CT			
2019				75 MW CT
2020	100 MW Nuclear	200 MW Nuclear	300 MW Nuclear	100 MW Nuclear
2021			100 MW Nuclear	100 MW Nuclear
2022		100 MW Nuclear	100 MW Nuclear	100 MW Nuclear
2023	100 MW Nuclear		100 MW Nuclear	
2024		100 MW Nuclear	100 MW Nuclear	100 MW Nuclear
2025			100 MW Nuclear	100 MW Nuclear
2026			100 MW Nuclear	100 MW Nuclear
20-Year NPVRR ($M)	$9,796	$10,598	$9,515	$10,790
10-Year NPVRR ($M)	$5,635	$6,027	$5,000	$5,758

The decrease in forecasted load in the first two scenarios reduces the amount of capacity additions significantly compared to ANM's base load forecast. In the "Global Economy" scenario, the load growth is delayed until the later years of the planning horizon. Even with the decreased load, the capacity additions are mixed between coal participation, combustion turbines, combined cycle units and nuclear capacity participation in the later years. The "Return to Reliability" scenario incorporates many of the same resource additions as the lowest cost plans identified earlier but because of increased load growth and higher reserve requirements some resource additions are for higher capacity amounts.

The results of modeling ANM's "Preferred" resource plan with the assumptions of the scenarios will be described in Subsection 5.5.5 of the IRP.

5.4 PREFERRED PLAN SELECTION AND COMPARISON TO ALTERNATIVE RESOURCE PLANS

5.4.1 Introduction

This section presents the preferred resource strategy for Aquila Networks - Missouri and the required implementation plan to acquire these resources. As required by the electric utility planning rules, ANM files the preferred plan as the one with NPVRR minimization with probable environmental costs as the primary objective.

The financial analysis of the preferred plan is included in Subsection 5.5.3 and the environmental analysis is included in Subsection 5.5.4. Subsection 5.5.5 describes the flexibility and alternatives presented by the preferred plan. The sensitivity analysis of the preferred plan is included in Subsection 5.5.6. The reliability analysis of the preferred plan can be found in Subsection 5.5.7 with the expected unserved energy described therein. The financial and operating data output from the modeling of the preferred plan are included as Appendix 5-D.

5.4.2 Preferred Resource Plan Selection

The preferred plan is a combination of the features of several of the ARPs identified in Part 4. Similar to the "PPAs through 2009" plan, 225 MW of combustion turbine capacity is added in 2010. The second unit addition is a 250 MW combined cycle unit addition which was included in several of the ARPs. In the preferred plan this unit is installed in 2013. A 200 MW coal-fired generation participation is included in 2017. The final resource addition is 300 MW of nuclear capacity participation in 2022. This is a combination of the multiple nuclear resource additions identified in the other ARPs from 2020 to 2025. Table 5-3 provides the resource additions of the preferred plan which is also the least cost plan considering 20- and 10-year net present values of revenue requirements. Several other low-cost plans are included for comparison purposes. All references to PPAs in Table 5-3 represent the total PPA resource in that year. The PPA amounts are not additive from one year to the next.

Table 5-3
Generation Additions and Capacity Purchases for Alternative Resource Plans

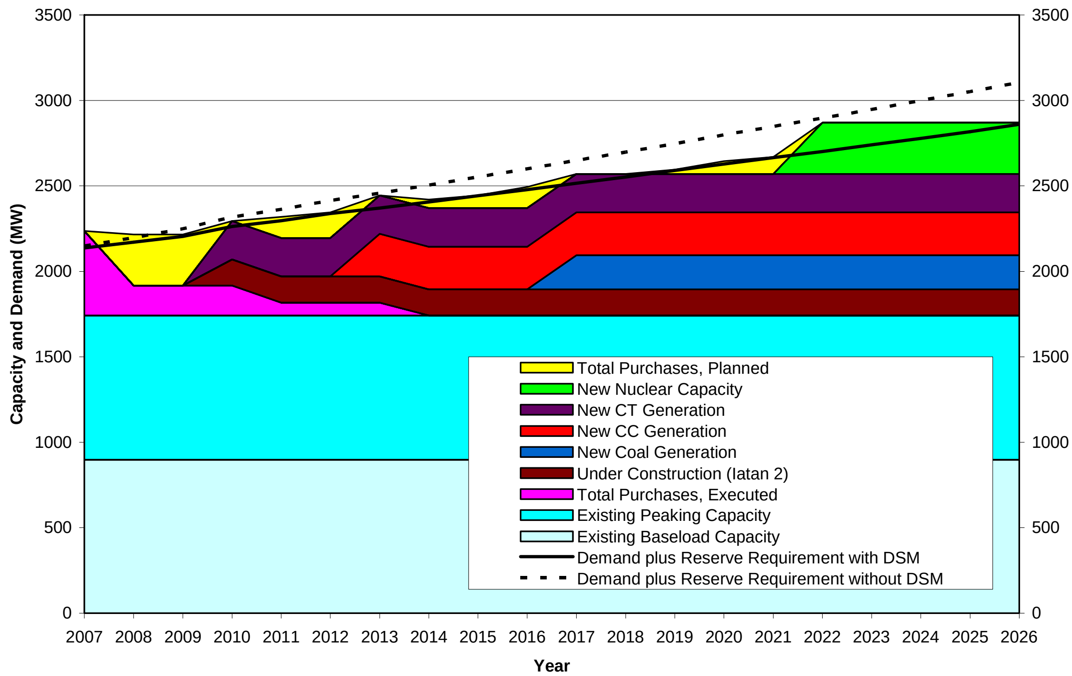
	Alternative Resource Plans			
Year	No Coal	PPAs through 2012	PPAs through 2009	Least Cost/Preferred
2007				
2008	300 MW PPA	300 MW PPA	300 MW PPA	300 MW PPA
2009	300 MW PPA	300 MW PPA	300 MW PPA	300 MW PPA
2010	200 MW PPA	200 MW PPA	225 MW CT	225 MW CT
2011	250 MW CC, 100 MW PPA	250 MW CC, 100 MW PPA	250 MW CC	125 MW PPA
2012	150 MW PPA	150 MW PPA		150 MW PPA
2013	250 MW CC	250 MW CC		250 MW CC
2014	75 MW CT	100 MW Coal Participation	100 MW Coal Participation	50 MW PPA
2015			100 MW Coal Participation	75 MW PPA
2016	150 MW CT	75 MW CT		125 MW PPA
2017				200 MW Coal Paticipation
2018			75 MW CT	
2019				25 MW PPA
2020	200 MW Nuclear Participation	100 MW Nuclear Participation	100 MW Nuclear Participation	75 MW PPA
2021				100 MW PPA
2022		100 MW Nuclear Participation	100 MW Nuclear Participation	300 MW Nuclear Participation
2023				
2024		100 MW Nuclear Participation	100 MW Nuclear Participation	
2025	100 MW Nuclear Participation			
2026				

20-Year NPVRR ($M)	$10,034	$10,029	$10,065	$10,026
% Above Min	0.1%	0.0%	0.4%	0.0%

10-Year NPVRR ($M)	$5,507	$5,522	$5,555	$5,495
% Above Min	0.2%	0.5%	1.1%	0.0%

Figure 5-6 is a plot of the loads and resources for the Preferred Expansion Plan including the resources outlined above and the addition of capacity from Iatan 2.

Figure 5-6
Loads and Resources with Preferred Expansion Plan



This preferred plan accomplishes several other objectives while remaining the lowest cost plan. The CT addition in 2010 reduces the reliance on large near-term power purchase agreements. The overall diversity of 200 MW of coal generation, 225 MW of peaking combustion turbines, and 250 MW of combined cycle reduces ANM's natural gas fuel supply risk and dependence on spot market energy purchases. By 2013, we expect certain high efficiency gas technologies to have matured. These include the General Electric LMS100 and Siemens Super Peaker. These technologies promise to combine the best features of peaking and combined cycle units but have limited operations at this time. Finally, the preferred plan minimizes the overlap of 2010 and 2013 construction schedules.

5.4.3 Financial Analysis of Preferred Plan

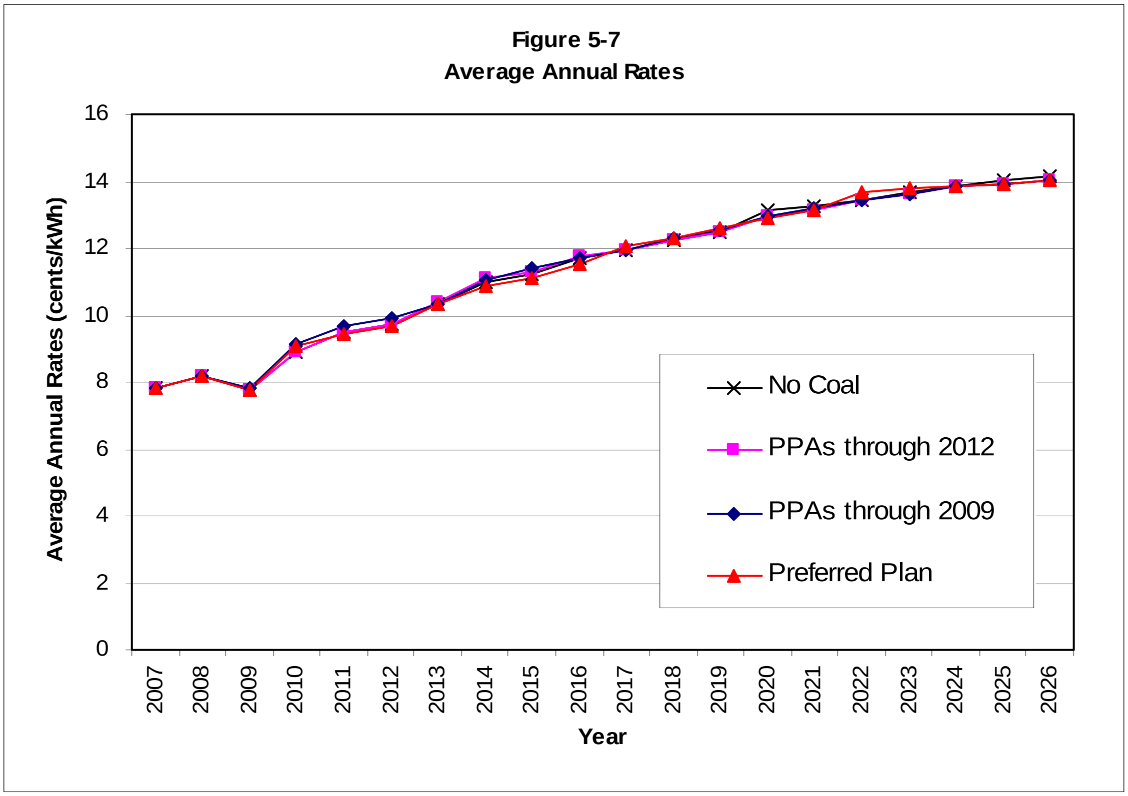
This section provides key shareholder value performance measures for the Preferred Resource Plan. Table 5-4 shows the annual revenue requirements for the preferred plan with several of the lower cost ARPs provided for comparison. Table 5-5 shows the annual average rates (cents/kWh) including the levelized rates over the study period and Figure 5-7 shows the annual average rates graphically.

Table 5-4
Revenue Requirement Comparison

	No Coal		PPAs through 2012		PPAs through 2009		Preferred Plan	
Year	Annual Revenue Requirements ($M)	% Increase	Annual Revenue Requirements ($M)	% Increase	Annual Revenue Requirements ($M)	% Increase	Annual Revenue Requirements ($M)	% Increase
2007	609.33		609.33		609.33		609.40	
2008	654.44	7.4%	654.44	7.4%	654.93	7.5%	654.93	7.5%
2009	641.41	-2.0%	641.42	-2.0%	643.33	-1.8%	642.64	-1.9%
2010	758.66	18.3%	759.36	18.4%	777.52	20.9%	774.05	20.4%
2011	829.57	9.3%	831.17	9.5%	847.62	9.0%	825.38	6.6%
2012	873.79	5.3%	875.98	5.4%	891.02	5.1%	870.52	5.5%
2013	951.55	8.9%	953.98	8.9%	947.88	6.4%	947.93	8.9%
2014	1,034.26	8.7%	1,043.20	9.4%	1,038.78	9.6%	1,025.69	8.2%
2015	1,080.00	4.4%	1,090.78	4.6%	1,098.22	5.7%	1,071.27	4.4%
2016	1,158.57	7.3%	1,160.46	6.4%	1,157.63	5.4%	1,140.49	6.5%
2017	1,205.99	4.1%	1,206.53	4.0%	1,205.67	4.1%	1,218.25	6.8%
2018	1,266.53	5.0%	1,263.28	4.7%	1,269.80	5.3%	1,273.70	4.6%
2019	1,323.57	4.5%	1,318.97	4.4%	1,326.34	4.5%	1,330.68	4.5%
2020	1,423.98	7.6%	1,404.96	6.5%	1,409.18	6.2%	1,402.11	5.4%
2021	1,472.46	3.4%	1,458.59	3.8%	1,460.93	3.7%	1,459.32	4.1%
2022	1,522.45	3.4%	1,521.18	4.3%	1,521.58	4.2%	1,547.44	6.0%
2023	1,585.08	4.1%	1,579.69	3.8%	1,577.64	3.7%	1,594.65	3.1%
2024	1,639.42	3.4%	1,641.24	3.9%	1,637.47	3.8%	1,641.31	2.9%
2025	1,699.38	3.7%	1,686.17	2.7%	1,683.23	2.8%	1,687.11	2.8%
2026	1,751.54	3.1%	1,737.92	3.1%	1,733.16	3.0%	1,737.99	3.0%
Maximum Single-Year Increase ($M)	117.25		117.94		134.19		131.41	

Table 5-5
Average Annual Rate Comparison

	No Coal		PPAs through 2012		PPAs through 2009		Preferred Plan	
	Average Annual Rates (cents/kWh)	% Increase	Average Annual Rates (cents/kWh)	% Increase	Average Annual Rates (cents/kWh)	% Increase	Average Annual Rates (cents/kWh)	% Increase
2007	7.795¢		7.795¢		7.795¢		7.796¢	
2008	8.158¢	4.7%	8.158¢	4.7%	8.164¢	4.7%	8.164¢	4.7%
2009	7.770¢	-4.8%	7.770¢	-4.8%	7.793¢	-4.6%	7.784¢	-4.7%
2010	8.892¢	14.4%	8.900¢	14.5%	9.113¢	16.9%	9.072¢	16.5%
2011	9.485¢	6.7%	9.503¢	6.8%	9.691¢	6.3%	9.437¢	4.0%
2012	9.726¢	2.5%	9.751¢	2.6%	9.918¢	2.3%	9.690¢	2.7%
2013	10.357¢	6.5%	10.383¢	6.5%	10.317¢	4.0%	10.318¢	6.5%
2014	10.985¢	6.1%	11.080¢	6.7%	11.033¢	6.9%	10.894¢	5.6%
2015	11.201¢	2.0%	11.313¢	2.1%	11.390¢	3.2%	11.111¢	2.0%
2016	11.714¢	4.6%	11.733¢	3.7%	11.704¢	2.8%	11.531¢	3.8%
2017	11.936¢	1.9%	11.941¢	1.8%	11.933¢	2.0%	12.057¢	4.6%
2018	12.245¢	2.6%	12.214¢	2.3%	12.277¢	2.9%	12.315¢	2.1%
2019	12.504¢	2.1%	12.461¢	2.0%	12.530¢	2.1%	12.571¢	2.1%
2020	13.120¢	4.9%	12.945¢	3.9%	12.984¢	3.6%	12.918¢	2.8%
2021	13.274¢	1.2%	13.149¢	1.6%	13.170¢	1.4%	13.156¢	1.8%
2022	13.430¢	1.2%	13.419¢	2.1%	13.423¢	1.9%	13.651¢	3.8%
2023	13.680¢	1.9%	13.633¢	1.6%	13.616¢	1.4%	13.762¢	0.8%
2024	13.842¢	1.2%	13.858¢	1.6%	13.826¢	1.5%	13.858¢	0.7%
2025	14.036¢	1.4%	13.927¢	0.5%	13.903¢	0.6%	13.935¢	0.6%
2026	14.152¢	0.8%	14.042¢	0.8%	14.003¢	0.7%	14.042¢	0.8%
Levelized Rates	10.505¢		10.503¢		10.545¢		10.498¢	
Maximum Single-Year Rate Increase (cents/kWh)	1.122¢		1.130¢		1.320¢		1.288¢	



As discussed previously, all plans show a large increase in revenue requirements and the resulting rates in the year 2010 due to the additions of Iatan 2 and planned environmental projects. The decrease in revenue requirements in the year 2009 is largely the result of forecasted natural gas price decreases which leads to lower forecasted spot market energy prices. The preferred plan has the lowest levelized rates over the 20-year planning horizon as shown in Table 5-5.

The pretax interest coverage ratio (including allowance for funds used during construction (AFUDC)), ratio of total debt to total capital, and ratio of net cash flow to capital expenditures for the preferred plan are included in Appendix 5-E.

5.4.4 Environmental Analysis of Preferred Plan

Table 5-6 shows the annual emission levels of NOx, SO_2, Hg, and CO_2 for the preferred plan and Table 5-7 shows the annual emission cost comparison. The annual costs are largely driven by the forecast of CO_2 emissions costs as described in Part 2 of the IRP.

Table 5-6
Emission Level Comparison

	No Coal				PPAs through 2009				PPAs through 2012				Preferred Plan			
	NO_X	SO_2	Hg	CO2	NO_X	SO_2	Hg	CO2	NO_X	SO_2	Hg	CO2	NO_X	SO_2	Hg	CO2
Year	(tons)	(tons)	(lbs)	(tons)	(tons)	(tons)	(lbs)	(tons)	(tons)	(tons)	(lbs)	(tons)	(tons)	(tons)	(lbs)	(tons)
2007	1,053	17,109	71	5,708,574	1,053	17,109	71	5,708,574	1,053	17,109	71	5,708,574	1,053	17,109	71	5,707,901
2008	1,062	16,697	69	5,576,739	1,062	16,697	69	5,576,739	1,062	16,697	69	5,576,739	1,062	16,697	69	5,576,739
2009	1,065	17,553	72	5,781,230	1,065	17,553	72	5,781,230	1,065	17,553	72	5,781,230	1,063	17,553	72	5,772,835
2010	1,224	17,519	79	6,401,310	1,239	17,473	79	6,457,296	1,224	17,519	79	6,401,310	1,240	17,523	79	6,469,896
2011	1,362	17,784	84	7,100,587	1,363	17,758	84	7,145,906	1,362	17,784	84	7,100,587	1,345	17,783	84	6,953,220
2012	1,380	18,274	87	7,335,520	1,392	18,227	87	7,379,615	1,380	18,274	87	7,335,520	1,360	18,269	87	7,132,692
2013	1,431	18,351	87	7,614,820	1,424	18,367	87	7,500,826	1,431	18,351	87	7,614,820	1,425	18,441	87	7,504,390
2014	1,480	18,864	89	8,003,302	1,535	18,596	96	8,263,446	1,542	18,571	96	8,402,332	1,468	18,893	89	7,783,470
2015	1,502	18,870	88	8,111,477	1,611	18,279	102	8,735,470	1,563	18,616	95	8,509,393	1,482	18,940	89	7,832,618
2016	1,515	18,987	89	8,208,856	1,620	18,546	103	8,869,143	1,574	18,849	97	8,633,878	1,490	19,025	89	7,867,892
2017	1,527	18,958	89	8,242,700	1,650	18,658	103	8,901,336	1,595	18,869	96	8,671,592	1,652	18,698	103	8,905,339
2018	1,545	19,038	89	8,380,226	1,669	18,862	104	9,049,550	1,615	19,013	97	8,831,356	1,669	18,889	104	9,041,963
2019	1,556	19,041	89	8,440,559	1,684	18,960	104	9,082,290	1,627	19,075	97	8,885,848	1,681	19,010	104	9,080,283
2020	1,455	18,360	87	7,982,962	1,635	18,473	102	8,892,190	1,586	18,747	96	8,712,022	1,690	19,110	105	9,154,316
2021	1,472	18,467	87	8,014,903	1,647	18,636	102	8,925,275	1,594	18,818	95	8,718,792	1,695	19,212	104	9,146,985
2022	1,484	18,628	88	8,132,372	1,589	18,150	101	8,719,784	1,549	18,443	94	8,524,031	1,512	17,291	97	8,322,167
2023	1,500	18,706	87	8,174,232	1,603	18,368	101	8,766,512	1,564	18,574	94	8,583,273	1,529	17,577	98	8,407,646
2024	1,522	18,851	88	8,295,826	1,559	17,855	99	8,561,490	1,515	18,194	93	8,380,113	1,563	17,812	99	8,548,736
2025	1,529	19,869	92	8,433,605	1,627	19,156	104	8,984,220	1,587	19,590	98	8,799,956	1,628	19,210	104	8,997,760
2026	1,538	19,956	92	8,506,108	1,640	19,307	105	9,056,006	1,592	19,675	99	8,858,304	1,641	19,372	105	9,074,332

Table 5-7
Total Emission Cost Comparison ($M)

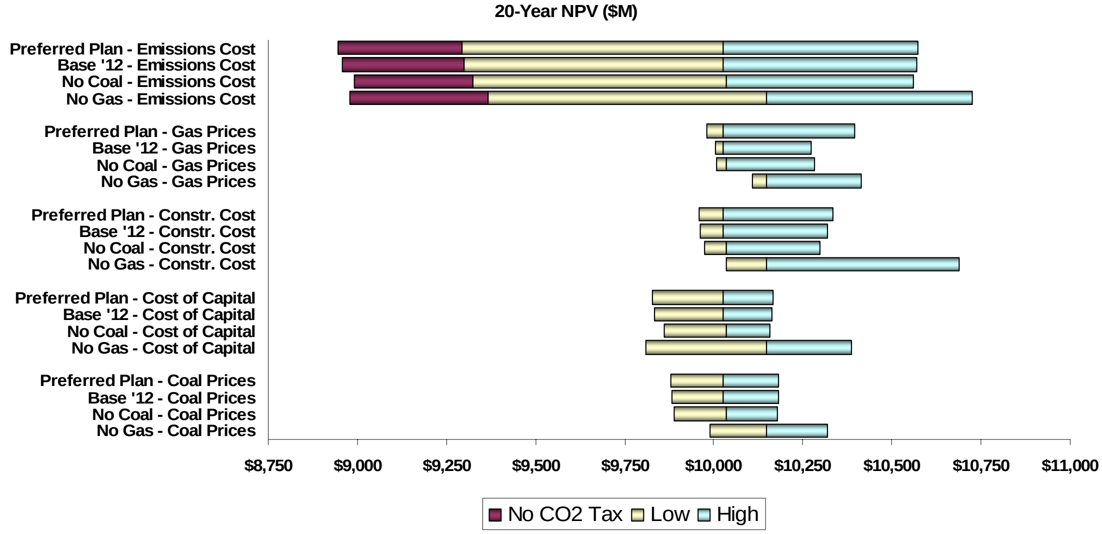
	No Coal	PPAs through 2012	PPAs through 2009	Preferred Plan
2007	$17.19	$17.19	$17.19	$17.19
2008	$15.93	$15.93	$15.93	$15.93
2009	$17.71	$17.71	$17.71	$17.71
2010	$52.72	$52.72	$52.99	$53.10
2011	$70.10	$70.10	$70.40	$69.03
2012	$86.28	$86.28	$86.66	$84.40
2013	$104.22	$104.22	$102.96	$103.06
2014	$125.38	$130.71	$128.90	$122.52
2015	$143.36	$149.51	$152.97	$139.18
2016	$161.71	$169.23	$173.34	$155.88
2017	$179.14	$187.67	$192.27	$192.39
2018	$199.05	$208.99	$213.87	$213.73
2019	$217.71	$228.49	$233.36	$233.36
2020	$222.75	$242.06	$246.75	$254.09
2021	$232.57	$251.92	$257.59	$264.09
2022	$244.90	$255.81	$261.24	$249.34
2023	$255.22	$267.09	$272.45	$261.29
2024	$268.13	$270.15	$275.52	$275.12
2025	$282.64	$293.87	$299.39	$299.87
2026	$293.45	$304.59	$310.81	$311.47
20-Year NPV	$1,185	$1,230	$1,249	$1,227
10-Year NPV	$461	$470	$473	$452

5.4.5 Preferred Plan Sensitivity Analysis

5.4.5.1 Sensitivity Analysis of Key Variables

The sensitivity analysis of key variables on the preferred plan and the other lowest cost ARPs is shown in Figure 5-8. The sensitivities of the preferred plan are very similar to the “PPAs through 2012” and “No Coal” expansion plans because of the similarity of resource additions. A more pronounced difference is seen between the preferred and “No Gas” plans with the “No Gas” plan having significantly higher risk associated with emissions costs, construction costs, and cost of capital.

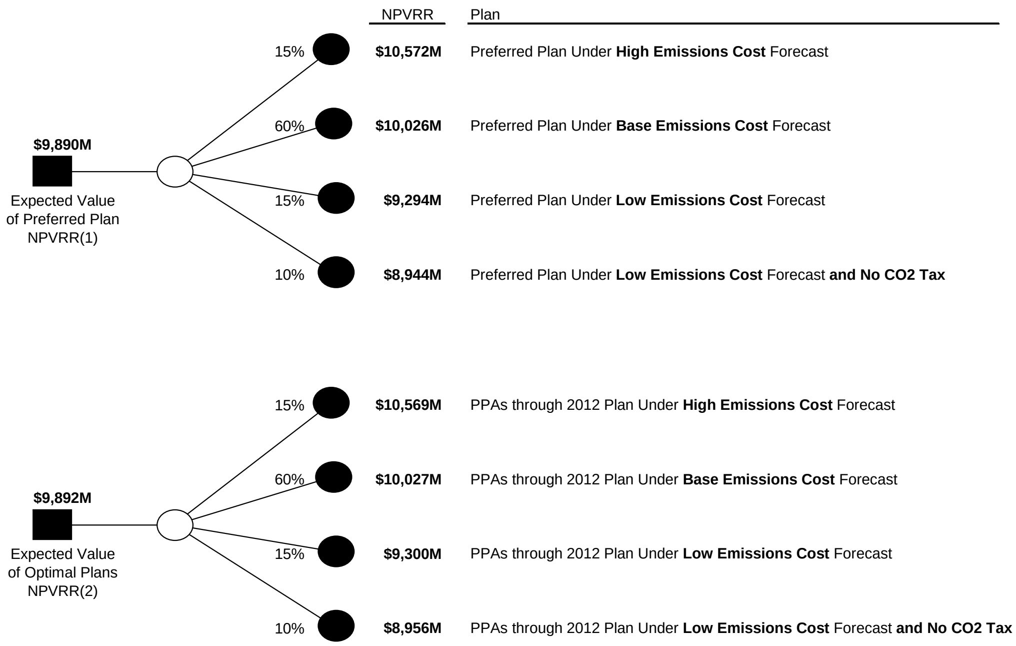
Figure 5-8
Sensitivity Analysis for "Preferred" ARP



5.4.5.2 Decision Tree Analysis of Key Variables

Figure 5-9 shows the decision trees for the comparison of emissions cost risks between the preferred plan and the PPAs through 2012 plan. As shown in the figure, the expected weighted NPVRR of the preferred plan is $2M less (0.0%) than the expected NPVRR of the PPAs through 2012 plan. A similar decision tree analysis was performed for gas price sensitivity with the weighted NPVRR of the preferred plan 0.2% higher than the weighted NPVRR of the PPAs through 2012 plan.

Figure 5-9
Decision Tree Analysis of Emissions Costs



Weighted Benefit of Preferred Case = NPVRR(2) - NPVRR(1) = $2M

5.4.5.3 Scenario Analysis

Table 5-8 shows the NPVRR of the preferred and PPAs through 2012 expansion plans under the Electric Power Horizons scenarios. This table shows that even under extreme load growth changes the preferred scenario provides the flexibility to be within 2.3% of the optimal expansion plan NPVRR. The table also shows that the two alternative resource plans are almost identically impacted by the future scenarios with the preferred case having a slightly lower 20-year NPVRR in the Technology Evolution and Global Economy scenarios and slightly higher NPVRR in the Terrorism & Turmoil scenario. In reality, if these scenarios came to fruition, future capacity additions would be delayed and/or cancelled to even further lower the NPVRR of the two alternative resource plans.

Table 5-8
NPVRR in EPH Scenarios

	Scenario			
	Terrorism & Turmoil	Technology Evolution	Global Economy	Return to Reliability [1]
20-Year NPVRR ($M)				
Preferred Plan	$9,935	$10,765	$9,666	
% above Optimal Plan	2.3%	1.8%	1.8%	
PPAs through 2012 Plan	$9,934	$10,772	$9,688	
% above Optimal Plan	2.3%	1.8%	2.0%	
10-Year NPVRR ($M)				
Preferred Plan	$5,704	$6,099	$5,112	
% above Optimal Plan	1.2%	1.2%	2.2%	
PPAs through 2012 Plan	$5,740	$6,138	$5,170	
% above Optimal Plan	1.9%	1.8%	3.4%	

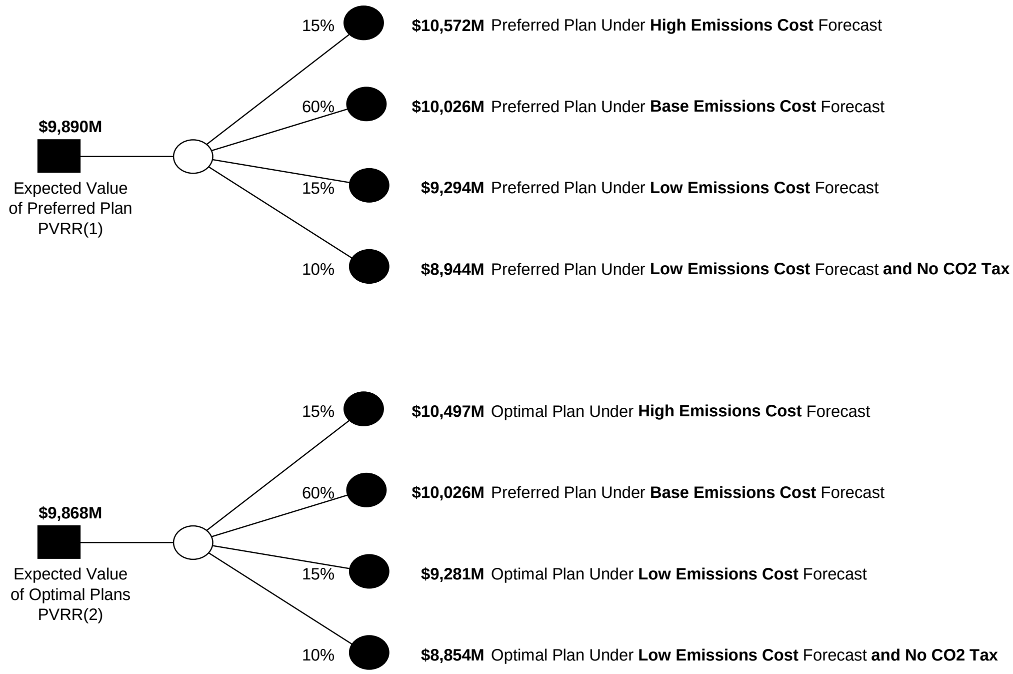
[1] Because of higher load growth in the Return to Reliability Scenario, the Preferred Plan does not provide enough capacity to meet reserve requirements making a valid comparison impossible.

5.4.6 Expected Value of Better Information

This subsection provides a measure that shows the effect of obtaining “better” information about a critical variable. Perfect information can be obtained by considering all possible combinations of an independent critical uncertainty. It is virtually impossible to calculate the expected value of perfect information given the non-discrete nature of all the critical uncertainties considered in the Integrated Resource Energy Plan. The next best alternative is to calculate the expected value of better information about a critical variable.

Figure 5-10 provides an illustration of the methodology used to calculate the better information of the probable environmental costs. The top tree calculates the expected value of the preferred plan under four possible realizations of the environmental costs, while the lower tree calculates the expected value of the optimal plans for the four environmental cost scenarios using MIDAS Capacity Expansion Module optimization. The difference can be interpreted as the additional value to be gained from better information about the environmental costs. If the range of values of the critical variable does not yield a change in the preferred plan, there is no value in obtaining better information.

Figure 5-10
Expected Value of Better Emissions Cost Forecast Information



Expected Value of Better Information = PVRR(1) - PVRR(2) = $22M

The two variables that have the greatest impact on the preferred case in the sensitivity analysis are emissions costs and natural gas prices. The expected value of better information for environmental costs on the preferred case is $22 million and the expected value of better information on natural gas prices is $61 million. This analysis indicates that ANM can cost-effectively spend no more than $22 million in developing a better forecast of projected emission costs and no more than $61 million in developing/purchasing a better forecast of projected natural gas prices.

5.4.7 Preferred Plan Alternatives and Flexibility

The integrated resource analysis produced not only a preferred plan, but also a substantial insight into possible alternative supply-side resource opportunities. ANM will embark in the direction of the preferred plan but attempt to maintain and enhance the flexibility to take advantage of resource opportunities that may develop. This subsection will expand upon the inherent flexibility available in the preferred plan.

The integrated analysis was performed considering an objective to minimize utility revenue requirements. This analysis indicated that the upcoming resource decision between combustion turbines and a combined cycle unit was only marginally different in cost impact. The final cost estimates of these technologies and the costs of power purchases (resulting from the Request for Proposals (RFP) to be issued in February 2007) will be the final determination in the ultimate preferred resource plan. In addition, because the current offers for wind generation were marginally not cost effective, the bids received for wind power in the upcoming RFP may be cost-effective and may alter the preferred plan.

The choice of combustion turbines in 2010 provides contingency benefits for natural gas fuel supply issues and purchase power availability. A significant reduction of the risk of gas supply issues during peak generating periods can be realized by making the combustion turbines dual-fuel capable. In addition, the combustion turbines reduce the dependence on the price and availability of PPAs in 2010.

The preferred plan utilizes 200 MW of new coal-fired generating capacity in 2017. This assumes that ANM will be able to purchase a 200 MW portion of a larger coal-fired resource. If this opportunity is not available or not available at a cost-effective price ANM may be able to replace the planned resource with a 200 MW fluidized bed unit at one of its existing sites to maintain the fuel diversity provided by a coal-fired resource addition.

Similarly the preferred plan calls for ANM to acquire 300 MW of nuclear generation participation in 2022. This opportunity may not be available to ANM. Even with the carbon tax that was included in the probable environmental costs, the inclusion of nuclear generation over coal-fired generation reduces the 20-year NPV by only a marginal amount.

Significant changes could occur during the next two years due to: capital costs of generation, fuel prices, load growth, and new generation technologies. Therefore, ANM could switch the later resources from the coal and nuclear resource participation to new turbine technologies, integrated gasification combined cycle units, and improved renewable resources, or a combination of these resources. Although these resources are not listed explicitly as part of the preferred plan, they are integral elements of contingency options available in the preferred strategy.

5.4.8 Reliability Analysis

Under 4 CSR 240-22.070, “the trend of expected unserved hours for the preferred resource plan must not indicate a consistent increase in the need for emergency imported power over the planning horizon.” The expected unserved hours were developed under weather-normalized loads.

Appendix 5-D provides the expected unserved energy per year for the preferred plan. The unserved energy for the other ARPs is included in the Appendices for Part 4. The MIDAS Gold production cost model projects only a few MWhs of unserved energy in any of the plans.

5.5 IMPLEMENTATION AND RESOURCE ACQUISITION STRATEGY

5.5.1 Demand-Side Implementation

All of the cost-effective demand-side programs will begin to be implemented upon approval of the programs and establishment of an appropriate cost recovery mechanism by the Missouri Public Service Commission. Various implementation strategies will be investigated with input from Quantec.

The initial planning strategy is to promote customer awareness through brochures, bill inserts and other printed material; trade ally meetings; a program information telephone line; and through the Company web-site. Other options will be evaluated to promote energy-efficiency among customers including: (1) radio and television advertisements, (2) newspapers, magazines and billboards, (3) telemarketing, and (4) other innovative marketing methods. The demand-side programs will be implemented upon approval of the programs and establishment of an appropriate cost recovery mechanism by the Missouri Public Service Commission. Evaluation, measurement and verification of the programs will begin during 2008.

5.5.2 Supply-Side Implementation and Contingency Monitoring

The preferred plan includes the addition of the following four supply-side resources over the planning horizon 2007-2026.

- 225 MW Combustion Turbine Addition in 2010
- 250 MW Combined Cycle Addition in 2013
- 200 MW Coal Participation in 2017
- 300 MW Nuclear Participation in 2022

ANM will be receiving detailed cost estimates of combustion turbine and combined cycle technologies from vendors in the next few months. In addition, ANM will be issuing an RFP for PPAs and wind generation PPAs in February, 2007. Finally, ANM will also be evaluating the results of the brownfield site study being performed by Black & Veatch to determine the potential for utilizing existing sites for new generation and the potential need for unit retirements.

The ANM electric planning group will be monitoring the emissions costs and fuel prices and updating the load forecasts to ensure that there is an ability to evaluate any contingency and develop additional strategies to respond to extreme scenarios.

In addition, ANM will undertake the following activities in the 2008 through 2012 period:

- Monitor the development of CO_2 emissions reduction legislation.

- Continue discussions to renew purchase power contracts that currently expire in 2011 and 2014.

- Pursue discussions with area utilities and independent power developers to determine the potential for unit participation in either coal or nuclear generating units in the 2015-2026 timeframe.

- Continue to evaluate the viability of renewable generation technology options in ANM service territory.

All of the above activities will facilitate the consideration of different types of supply resources to meet customer demand in the 2008-2026 timeframe.

Aquila Networks - Missouri
2007 Integrated Resource Plan

The Resource Acquisition strategy contained in Aquila Networks - Missouri's 2007 Integrated Resource Plan was prepared under our direction and control. It is Aquila's intent to follow the Implementation and Resource Acquisition Strategy. The resource plan considers candidate resources using expected prices and availabilities. Actual prices and availabilities will be established by issuing a request for proposals and could result in changes to the preferred plan. If changed circumstances indicate that Aquila should deviate from this strategy, Aquila will provide to the Missouri Public Service Commission any notifications and/or revise energy plan filings required by Commission regulations.

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02/05/2007
Date