AQUILA NETWORKS - MISSOURI
INTEGRATED RESOURCE PLAN

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PART 3
DEMAND-SIDE RESOURCE ANALYSIS

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3.1 INTRODUCTION

3.1.1 Objectives

This Demand-Side Resource Analysis for Aquila Networks - Missouri was developed in compliance with the rules for Electric Utility Resource Planning (4 CSR 240-22.050) of the Missouri Public Service Commission. The objective of the Demand-Side Resource Analysis is to identify candidate end-use measures and demand-side programs that are the most cost-effective in reducing future load requirements. Appendix 3-A contains responses to the reporting requirements, referring to appropriate documentation within this report.

3.1.2 Demand-Side Planning Process

Aquila has analyzed a wide variety of demand side management (DSM) programs in support of the IRP process. The company has retained the services of Quantec, LLC to assist with the identification and evaluation of various DSM initiatives. The scope, methodology, and results of this study are detailed in Quantec's final report and are included as Appendix 3-B to this document.

The avoided energy costs used by Quantec in the screening of demand-side resources were calculated by ANM in the MIDAS Gold™ model with the optimal supply-side only resource plan including probable environmental costs described in Part 2. The hourly avoided energy costs for the 20-year resource planning horizon are included in Appendix 3-C.

Quantec used $100/kW-year (2006$, escalated) as a proxy for the avoided capacity costs. This value was based on Quantec's professional judgment as a reasonable proxy for avoided capacity costs. A tabulation of the annual avoided demand costs is included in Appendix 3-D.

3.2 DEMAND-SIDE SCREENING RESULTS

3.2.1 Energy Efficiency Results

Technical energy efficiency potentials in the residential and commercial sectors were based on an analysis of 130 unique electric measures. Six residential segments (existing single-family, manufactured, and multi-family; and new-construction single-family, manufactured, and multi-family) and 20 commercial segments (ten building types within each of the existing and new structure segments) were considered. Since many energy-efficiency measures are applied to multiple segments and building types, a total of 1,719 electric measure/structure combinations were included in the analysis. All major end uses in all 20 major industrial segments in Aquila's Missouri service areas were analyzed.

An accurate assessment of achievable EE potentials represented an important objective of this study. In addition, considering realistic market penetration rates, the achievable DSM potential analyses aggregated the estimates into "blocks" of available energy-efficiency resources that were sizable enough to compare to and evaluate against supply options on a balanced and consistent basis. The blocks, in this case, were the proposed Aquila programs:

- Comprehensive Commercial and Industrial
- Public Purpose
- Residential Audit
- Residential Envelope Measure Retrofit
- Residential HVAC and Appliance Rebates
- Residential Lighting
- Residential New Construction
- Residential Programmable Thermostats and HVAC

Program costs included equipment, installation, and administration costs, consistent with the program design described later in this report. All measures included in the various programs passed an economic screen utilizing the Missouri Public Service Commission's Probable Environmental Benefits Test.

The residential and commercial blocks provide approximately 90% of the achievable potential, resulting in an estimated 20-year achievable annual conservation potential of 722 GWh of electricity. Further breakouts by end use are provided in Appendix 3-B.

3.2.2 Demand Response Results

Estimates of expected load impacts resulting from various demand-response (DR) strategies were based on data available from studies by Lawrence Berkeley National Laboratories (e.g., Goldman, 2004), and the experiences of other utilities with similar DR programs.

The results of this assessment indicate that direct load control and critical peak pricing, with respective achievable potentials of 12 MW and 11 MW, offer the largest opportunities for demand-response interventions. Opportunities resulting from curtailment contracts and demand buy-back are expected to be relatively small, estimated at 0.5% and 0.3% of system peak, respectively.

3.2.3 Program Portfolio Overview

Aquila's DSM programs for Missouri were designed to capture the achievable energy-efficiency and demand-response potential identified above. The portfolio of proposed programs is displayed in Table 3-1.

Table 3-1
Aquila Proposed Programs

Category	Sub-Category (If Applicable)
Residential Programs	
Residential Lighting	
Residential Audits	
Thermal Envelope Improvements	
HVAC Equipment and Appliances	
Programmable Thermostats & HVAC Maintenance	
Residential New Construction	
Non-Residential Programs	
Comprehensive Commercial and Industrial Program	Audits
	Custom and Prescriptive Rebates
Public Purpose Programs	
Low-income Assistance	Weatherization
	Energy Education through Community-Based Organizations
	Affordable Housing Initiative
School-Based Energy Education	
Research & Development	
Energy Efficiency	
Demand Response Programs	
Direct Load Control	
Curtailable Rates	
Demand Buyback	
Critical Peak Pricing	

Quantec incorporated information from various sources throughout the development of this portfolio. The objective was to create a comprehensive set of programs that serves the needs of Aquila customers and the state of Missouri by advancing the efficient use of energy.

3.2.4 Program Budgets and Cost-Effectiveness

Program budgets are summarized in Table 3-2. Budgets were designed to:

- Target cost-effective energy-efficiency potential,
- Provide balance across sectors,
- Capture cross-program delivery efficiencies and minimize administrative costs,
- Provide significant incentives to potential participants to encourage adoption of energy efficient technologies and practices,
- Engage trade allies and other third-party partners that will serve as part of the program delivery infrastructure,
- Inform customers of program availability and increase awareness of the importance of energy efficiency, and
- Continue support of public purpose program efforts already in place.

The budget starts at approximately $7.8 million in 2006, growing to over $10.2 million in 2010. The 2010 budget represents an estimated two percent of Aquila electric revenues in Missouri.

Table 3-2
Program Budget Summaries

Program	Year 1 Budget (2007)	Year 2 Budget (2008)	Year 3 Budget (2009)	Year 4 Budget (2010)	Year 5 Budget (2011)
Residential Programs					
Lighting	$56,000	$88,000	$127,000	$137,000	$148,000
Thermal Envelope Improvements	$283,000	$455,000	$718,000	$728,000	$740,000
HVAC Equipment and Appliances	$228,000	$382,000	$571,000	$575,000	$579,000
Programmable Thermostats & HVAC Maintenance	$63,000	$80,000	$107,000	$109,000	$112,000
Residential New Construction	$199,000	$350,000	$518,000	$490,000	$490,000
Residential Audit	$154,000	$242,000	$377,000	$383,000	$390,000
Non-Residential Programs					
Comprehensive C& I Program	$1,568,000	$2,846,000	$4,242,000	$4,215,000	$4,403,000
Public Purpose Programs					
Weatherization	$300,000	$450,000	$600,000	$600,000	$600,000
Low-Income Energy Education	$50,000	$75,000	$100,000	$100,000	$100,000
Affordable Housing	$80,000	$120,000	$160,000	$160,000	$160,000
School Based Energy Education	$60,000	$90,000	$120,000	$120,000	$120,000
Research and Development					
Energy Efficiency[1]	$30,000	$52,000	$76,000	$76,000	$80,000
Demand Response Programs					
Direct Load Control	$2,310,000	$2,463,000	$2,942,000	$1,533,000	$1,605,000
Curtailable Rates	$478,000	$332,000	$442,000	$454,000	$476,000
Demand Buyback	$479,000	$184,000	$190,000	$167,000	$171,000
Critical Peak Pricing	$1,465,000	$1,097,000	$1,130,000	$347,000	$353,000
Total	*$7,803,000*	*$9,306,000*	*$12,420,000*	*$10,194,000*	*$10,527,000*

[1] Roughly 1% of total energy efficiency program spending will go to ongoing DSM research and development.

The analysis of the programs' cost-effectiveness is an important part of the planning process, both in terms of meeting the regulatory requirements and designing and selecting the various programs. Table 3-4 through Table 3-6 show the program cost-effectiveness results.

The projected impacts of the energy-efficiency programs are shown in Table 3-3.

Table 3-3
Energy Efficiency Plan Impacts

	Incremental Impacts		Cumulative Impacts	
	kW	kWh	kW	kWh
Year 1	3,711	9,090,062	3,711	9,090,062
Year 2	7,824	19,414,689	11,535	28,504,751
Year 3	13,512	33,712,997	25,048	62,217,748
Year 4	13,577	33,907,729	38,625	96,125,478
Year 5	13,803	34,530,618	54,428	130,656,095

The cost-effectiveness of the residential programs together is shown in Table 3-4.

Table 3-4
Residential Programs Cost-Effectiveness Results

	Benefits	Costs	Net Benefits	B/C
Total Resource	$139,128,254	$62,472,551	$76,655,703	2.23
Utility	$139,128,254	$37,914,460	$101,213,794	3.67
Participant	$205,305,108	$24,558,091	$180,747,017	8.36
Ratepayer Impact	$139,128,254	$243,219,568	$(104,091,314)	0.57

The cost-effectiveness results of the Comprehensive C&I Program are shown in Table 3-5.

Table 3-5
Comprehensive C& I Program Cost-Effectiveness Results

	Benefits	Costs	Net Benefits	B/C
Total Resource	$177,976,377	$81,189,374	$96,787,002	2.19
Utility	$177,976,377	$45,542,697	$132,433,680	3.91
Participant	$185,479,494	$35,646,677	$149,832,817	5.20
Ratepayer Impact	$177,976,377	$231,022,191	$(53,045,814)	0.77

The cost-effectiveness of the total program portfolio, including the public purpose programs, is shown in Table 3-6.

Table 3-6
Total Program Portfolio Cost-Effectiveness Results

	Benefits	Costs	Net Benefits	B/C
Total Resource	$317,104,631	$143,661,925	$173,442,706	2.21
Utility	$317,104,631	$83,457,157	$233,647,474	3.80
Participant	$433,518,671	$60,204,768	$373,313,903	7.20
Ratepayer Impact	$317,104,631	$516,975,829	$(199,871,198)	0.61

The cost-effectiveness of the total demand response program portfolio is shown in Table 3-7.

Table 3-7
Total Demand Response Program Portfolio Cost-effectiveness Results

	Benefits	Costs	Net Benefits	B/C
Total Resource	$55,724,478	$31,582,842	$24,141,636	1.76
Utility	$55,724,478	$39,413,549	$16,310,928	1.41

3.3 CONCLUSIONS

Based on the Quantec analysis of DSM programs, the twelve energy efficiency programs and four demand response programs were evaluated against the supply-side resources using the MIDAS Gold production cost model. Further description of this analysis is included in Part 4 - Resource Integration.