APPENDIX A:

ENERGY EFFICIENCY AND DEMAND RESPONSE EVALUATIONS

OVERVIEW

Energy Efficiency and Affordability programs (EE) and Demand Response programs (DR) have been proposed as part of KCPL's Comprehensive Plan. This analysis assesses the integration of the demand-side programs with supply-side alternatives proposed in the Plan on an integrated resource planning basis. References to EE include both Energy Efficiency and Affordability programs. The recommendation included in the Comprehensive Plan calls for a 5-year pilot program to explore the cost, performance, system impacts and customer acceptance of numerous programs designed to reduce the end use of electricity and reduce loads across system peaks, which may offer alternatives that allow the Company to defer future capacity additions, reduce the need for high cost peak energy and to reduce the cost of emissions from KCP&L's generating system.

KCP&L's Energy Solutions Group developed the list of proposed programs in a collaborative effort in these workshops. The Affordability/Energy Efficiency Sub-Committee was formed as a sub-group of the Integrated Resource Planning Workshop Team A. The sub-committee combined the efforts of personnel from KCP&L, MPSC Staff, OPC, KCC, MDNR, City of KCMO, interveners, and outside consultants. Applied Energy Group supplied the majority of the expected cost data for various EE programs as well as projections of the expected penetration rates and load and energy impacts of the various EE programs. As part of the proposed Comprehensive Plan, the results and performance of the pilot programs would be reviewed after the first three years by the Company and interested stakeholder groups to evaluate the effectiveness of the programs and to redirect changes in design and spending as appropriate.

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This report will not address the specific details of each of the programs proposed. Specific details on program design can be found in the Sub-Committee's September 7, 2004 report to the Integrated Resource Planning Team. Updates to the September 7 committee report are available.

INTEGRATED RESOURCE PLANNING EVALUATION

The impacts of the DR and EE programs were evaluated against the proposed Comprehensive Plan (Base) and over several scenarios which adjust the amount of peaking and baseload capacity to test the integrated impact on cost on a net present value basis. Wind additions of 100 MW each in 2006 and 2008 occur in each scenario. The scenarios modeled are listed below:

- Scenario 1. 500 MW of Iatan 2, No DR or EE programs
- Scenario 2. 500 MW of Iatan 2, 5-year pilot DR, No EE
- Scenario 3. 500 MW of Iatan 2, No DR, 5-year pilot EE
- Scenario 4. 490 MW of Iatan 2, No DR, 5-Year pilot EE
- Scenario 5. 500 MW of Iatan 2, No DR, Double funding of pilot EE
- Scenario 6. 480 MW of Iatan 2, No DR, Double funding of pilot EE
- Scenario 7. 433 MW of Iatan 2, No DR, Double funding of pilot EE
- Scenario 8. (Base Case, Comprehensive Plan) 500MW of Iatan 2, 5-year pilot DR and EE
- Scenario 9. 490 MW of Iatan 2, 5-year pilot DR and EE
- Scenario 10. 500 MW of Iatan 2, 5-year pilot DR, Double funding of pilot EE
- Scenario 11. 490 MW of Iatan 2, 5-year pilot DR, Double funding of pilot EE

These scenarios were developed to assess the Net Present Value Revenue Requirements (PVRR) and Average System Rate (ASR) impacts of various levels of DR and EE penetration. Differing levels of capacity deferments and/or replacement of a portion of the proposed supply-side alternatives are modeled in these scenarios. Peak reductions as a function of increased demand reduction programs in the first 5 years of

the Plan would come from decreasing the level of capacity purchases, commonly acquired through Power Purchase Agreements (PPA's), and over the longer term, from the potential to delay or reduce future generation needs after Iatan 2. Various levels of participation in the Iatan 2 unit are also modeled to assess the effectiveness of the energy efficiency programs. Finally, these scenarios also assess the energy cost impacts of changing load shapes created by the EE programs.

DR Assumptions

The DR costs and the expected energy and load impacts included in the Comprehensive Plan are shown in the following 3 Tables.

Table A1

BASE CASE DR PROGRAM COSTS					
Program costs - nominal dollars	**2005**	**2006**	**2007**	**2008**	**2009**
Capital cost	$1,009,691	$2,358,016	$1,767,527	$2,709,966	$4,718,111
Variable O&M cost					
Customer energy payments	$ 173,829	$ 220,013	$ 262,394	$ 372,650	$ 575,239
Variable generation O&M	$ -	$ -	$ -	$ -	$ -
Fuel	$ -	$ -	$ -	$ -	$ -
Total Variable O&M cost	$ 173,829	$ 220,013	$ 262,394	$ 372,650	$ 575,239
Fixed O&M Cost					
Customer capacity payments	$ 745,298	$1,000,379	$1,205,573	$1,673,871	$2,471,380
Ongoing marketing expense	$ 138,912	$ 198,303	$ 237,645	$ 334,416	$ 498,933
Customer acquisition cost	$ 47,044	$ 124,134	$ 85,812	$ 141,460	$ 241,042
Fixed (per kW) admin/other	$ 52,008	$ 93,689	$ 121,600	$ 177,469	$ 272,777
Fixed (base) admin/other	$ 512,500	$ 525,313	$ 538,445	$ 607,097	$ 678,845
Total communication costs	$ 10,250	$ 10,506	$ 10,769	$ 11,038	$ 11,314
Maintenance total	$ 8,105	$ 36,853	$ 55,282	$ 85,622	$ 137,609
Fixed generation O&M	$ -	$ -	$ -	$ -	$ -
Total Fixed O&M cost	$1,514,117	$1,989,177	$2,255,126	$3,030,972	$4,311,900
O&M Cost	$1,687,946	$2,209,189	$2,517,520	$3,403,623	$4,887,139
Total Annual Cost	$2,697,637	$4,567,205	$4,285,047	$6,113,589	$9,605,249

Table A2

Implementation Impacts of DR (peak MW)					
	2005	2006	2007	2008	2009
June	20	29	36	50	74
July	39	59	73	101	148
August	39	59	73	101	148
September	20	29	36	50	74

Table A3

Implementation Impacts of DR (Energy MWh's)					
	2005	2006	2007	2008	2009
June	347	448	558	796	1,237
July	694	895	1,116	1,591	2,474
August	694	895	1,116	1,591	2,474
September	347	448	558	796	1,237

EE Assumptions

The 3 tables below indicate the costs and energy impact projected for the 5-year EE pilot. Applied Energy Group supplied the expected costs and energy impacts.

Table A4

EXPECTED COST OF EE PROGRAMS					
Capital	2005	2006	2007	2008	2009
Comprehensive Plan	$281,750	$464,850	$373,100	$378,050	$382,850
O&M					
Comprehensive Plan	$2,826,000	$4,554,500	$5,422,000	$5,354,500	$5,354,500

Table A5

Implementation Impacts Of EE Programs (Peak MW)					
	2005	2006	2007	2008	2009
January	0.2	2.1	5.6	10.0	14.3
February	0.3	2.2	5.4	9.2	13.0
March	0.5	2.6	6.1	10.3	14.4
April	0.9	4.0	8.7	13.8	18.9
May	1.3	5.3	10.9	17.0	23.2
June	1.8	6.7	13.5	20.7	28.0
July	2.2	7.6	15.0	22.9	30.9
August	2.5	8.1	15.6	23.4	31.2
September	2.5	7.6	13.9	20.5	27.1
October	2.2	6.5	11.8	17.2	22.6
November	1.6	4.8	8.8	12.9	16.9
December	1.9	5.4	9.8	14.2	18.6

Table A6

Implementation Impacts Of EE Programs (MWh's)					
	2005	2006	2007	2008	2009
January	37	521	1,473	2,700	3,926
February	66	536	1,411	2,509	3,606
March	108	656	1,625	2,810	3,995
April	150	752	1,752	2,935	4,117
May	236	1,033	2,281	3,709	5,136
June	423	1,645	3,419	5,369	7,319
July	663	2,343	4,634	7,085	9,536
August	695	2,320	4,489	6,784	9,078
September	503	1,621	3,111	4,676	6,241
October	393	1,277	2,491	3,754	5,016
November	391	1,250	2,415	3,604	4,793
December	452	1,408	2,676	3,944	5,212

Assumptions for Doubling Energy Efficiency Program Funding

The following 3 tables indicate the impacts modeled for the scenario where the spending on EE programs was doubled.

Table A7

Cost of EE Programs if Double Proposed Funding					
	2005	2006	2007	2008	2009
Capital	$281,750	$464,850	$373,100	$378,050	$382,850
O&M	$5,632,000	$8,890,500	$10,385,500	$10,262,000	$10,262,000

Table A8

Impacts of Double Funding EE Programs (MW)					
	2005	2006	2007	2008	2009
January	-	4.1	11.0	19.0	27.0
February	-	4.0	10.2	17.3	24.4
March	0.0	4.7	11.5	19.1	26.7
April	0.1	7.3	16.4	26.0	35.7
May	0.3	9.6	20.6	32.1	43.7
June	1.0	12.3	25.4	39.2	52.9
July	1.8	13.9	28.2	43.1	58.1
August	2.4	14.7	29.0	43.8	58.6
September	3.2	14.0	26.2	38.6	51.1
October	3.4	12.2	22.2	32.3	42.4
November	2.9	9.2	16.6	24.0	31.5
December	3.7	10.7	18.8	27.0	35.1

Table A9

Energy Impacts of EE if Double Funding (MWh's)					
	2005	2006	2007	2008	2009
January	-	1,005	2,890	5,126	7,362
February	-	1,006	2,723	4,724	6,726
March	3	1,206	3,090	5,251	7,412
April	49	1,366	3,299	5,465	7,632
May	106	1,886	4,290	6,922	9,554
June	289	3,081	6,500	10,144	13,789
July	627	4,431	8,849	13,474	18,098
August	788	4,352	8,506	12,822	17,138
September	678	3,033	5,851	8,766	11,680
October	611	2,411	4,658	6,969	9,280
November	700	2,429	4,564	6,731	8,897
December	902	2,814	5,123	7,433	9,743

Model Assumptions Regarding Impact on Future Resource Additions

In the scenarios in the economic evaluation, the level of PPA purchases were changed to reflect the impact of DR and EE programs. Also, CT installations, included in the Comprehensive Plan starting in 2014 were delayed or eliminated as appropriate. Four levels of participation in the latan 2 plant were modeled in the 11 scenarios; the Comprehensive Plan at 500 MW, and three reductions from that level. The 490 MW and 480 MW share of latan-2 were modeled based on the annual energy supplied by DR and EE programs. The 10 MW reduction in base load participation approximates the annual energy production from an 85% capacity factor base load unit. The 20 MW reduction matches the energy provided when EE funding is doubled. The final share of latan 2 was set at 433 MW to show the impact of a major reduction in the share of latan 2.

Uncertainties

The primary uncertainties associated with the above assumptions are the achievable level of customer penetration and the resulting impacts on peak and energy usage. The actual cost incurred to achieve the assumed levels of energy and capacity reductions is

also uncertain. Applied Energy Group did not provide ranges around the probable peak and energy impacts or ranges around the expected costs to achieve these reductions. Because these programs are new to KCP&L and our customers, the level of acceptance and the ultimate change in energy usage are unknowns. This is a primary reason for the recommendation of a pilot program. Committing to the pilot provides KCP&L and interested stakeholders the opportunity to evaluate these programs for their effectiveness. Testing the EE programs with double funding will provide results based on differing levels of peak and energy reductions.

The above uncertainties are greater for the EE programs than the DR program. EE includes programs encouraging more efficient products such as lighting and heating/cooling systems. Although it is easy to calculate the difference between these more efficient systems and the less efficient systems they replace, the realized benefits will be driven by how customers choose to operate these systems. This is a primary uncertainty associated with EE programs. For the DR programs, which include MPower, a redesign of the existing curtailment program, PLCC, or contracted capacity reductions, residential A/C cycling control, and commercial lighting control, the expected benefits can be more accurately determined. Still many of the DR and EE programs are new to KCP&L, and the overall evaluation of the actual benefits achieved will require monitoring and evaluation of actual system impacts over the pilot period.

Sensitivities

The following sensitivities were included for each of the 11 scenarios.

- High Load Forecast
- Low Load Forecast
- High Gas
- Low Gas
- The passage of CO2 reductions legislation

RESULTS OF THE IRP EVALUATION

Planning criteria for the assessment included the Net Present Value of Revenue Requirements (PVRR) and the Average System Rate (ASR) impacts of each scenario modeled in MIDAS. The PVRR criteria provides a metric to assess the difference in total cost of the alternatives. Because energy usage changes for each alternative, the average system rates criteria was also used to show the difference between plans on a unitized cost/MWh basis. Under sensitivities, the base case refers to the base assumptions for gas price, load and other key uncertainties. Scenario # 8 represents the Base Case or Comprehensive Plan as proposed by the Company, which includes the recommended DR and EE programs.

The results of the MIDAS modeling differ from earlier results based on the Rate Impact Model (RIM) tests. The differences are largely based on the assumptions and computation of costs and benefits applied to specific resource needs that an integrated resource planning process can identify. The differences as applied to the assessment of capacity and energy benefits of the programs are discussed below.

Capacity Benefits

In the RIM tests, each MW of capacity reduction was valued at the avoided cost of peaking capacity which was based on the market price for a power purchase agreement (PPA) priced as a Combustion Turbine (CT) product at $58.50/kW-Year in 2004, with an expectation of 2.5% per year escalation. This is also the capacity value utilized in the IRP model for capacity purchases; however, the IRP model only provided value to capacity reductions based on modeled purchases rather than applying this value to all peak reductions. The IRP valuation assumed that capacity requirements would be balanced around the need to maintain a 12% capacity margin as required by KCP&L's

participation in the SPP reliability region. In the RIM test, any excess MW acquired through DR or EE was sold at the PPA price, or reduced the need to purchase capacity to maintain the capacity margin at 12%. In 2005, for example, KCP&L will not have to purchase additional PPA's. Therefore, in the IRP model, there is no capacity value derived from DR or EE in 2005. Similarly, in 2010-2013, no PPA's purchases are required in the IRP model. The IRP model further assumes that sales of excess capacity will be conservatively valued at the current market price for a pure capacity product which is $15/kW-Year instead of the CT PPA value. This assumes KCP&L would sell low risk, market energy priced PPA's, rather than commit to firm CT priced capacity sales, which presents higher risks.

Energy Benefits

Additional differences between the RIM tests and the IRP model include the value of reduced energy usage. In the RIM tests, avoided energy costs were valued at $25/MWh in 2004 and escalated at 2.5% per year. In the IRP model, energy benefits were valued using the MIDAS hourly dispatch model, which provides higher granularity on the difference between production cost and actual market cost at the time the energy is provided by DR and EE.

Results

Under the demand-side analysis the RIM test results indicated that DR would reduce rates and EE would increase rates. In the IRP model, these results are reversed, as shown by comparing scenarios 2 & 3 in Table A10, below. Compared to scenario 1 (no DR or EE), Scenario 2 (DR-only) increases PVRR by 0.07%, while scenario 3 (EE-only) decreased PVRR by 0.07%. Due to the uncertainties discussed above, these results are a preliminary indication of the value of the programs and actual results derived from implementation of the pilot programs would be expected to provide a better indication of the value of the programs.

Impact of the programs on reducing the required share of Iatan 2

As the results in the table A10 below indicate, the impact of reducing KCP&L share of Iatan 2 would result in an increase in both PVRR and ASR.

Key findings regarding the implementation of DR and EE are discussed below.

- Under Base assumptions for the modeled sensitivities
  - Doubling the investment in EE programs reduces PVRR and ASR
  - Reducing participation in Iatan 2 INCREASES PVRR and ASR

- Under high load and high gas price scenarios, PVRR increases; however, the benefits of DR and EE increase from base assumptions of load and gas price.
- DR and EE programs have a higher impact under high gas and CO2 tax scenarios, which would be expected due to the increased energy costs associated with these scenarios

Table A10 (NOTE: DU indicates the DR programs)

PVRR

	Scenario #										
	1	2	3	4	5	6	7	8	9	10	11
DU & EE	None	DU-No EE	EE		EE x 2			DU & EE		DU & EE x 2	
Coal Size	500	500	500	490	500	480	433	500	490	500	480
Sensitivities											
Base Case	9,575.011	9,582.132	9,567.907	9,570.354	9,558.145	9,564.558	9,569.941	9,573.751	9,576.534	9,568.086	9,570.006
% of Base		0.07%	-0.07%	-0.05%	-0.18%	-0.11%	-0.05%	-0.01%	0.02%	-0.07%	-0.05%
High Load	9,810.610	9,796.657	9,798.545	9,800.473	9,786.111	9,785.434	9,809.814	9,785.107	9,790.708	9,776.370	9,780.803
		-0.14%	-0.12%	-0.10%	-0.25%	-0.26%	-0.01%	-0.26%	-0.20%	-0.35%	-0.30%
Low Load	9,406.231	9,420.127	9,399.637	9,399.746	9,394.645	9,394.855	9,399.342	9,416.442	9,416.540	9,411.605	9,411.799
		0.15%	-0.07%	-0.07%	-0.12%	-0.12%	-0.07%	0.11%	0.11%	0.06%	0.06%
High Gas	9,581.446	9,576.057	9,566.815	9,571.961	9,551.398	9,561.858	9,582.174	9,561.217	9,567.050	9,548.758	9,556.698
		-0.06%	-0.15%	-0.10%	-0.31%	-0.20%	0.01%	-0.21%	-0.15%	-0.34%	-0.26%
Low Gas	9,720.720	9,733.224	9,718.762	9,716.554	9,713.301	9,712.428	9,700.275	9,728.805	9,727.785	9,727.273	9,722.359
		0.13%	-0.02%	-0.04%	-0.08%	-0.09%	-0.21%	0.08%	0.07%	0.07%	0.02%
CO2 Tax	10,071.143	10,076.017	10,062.902	10,059.518	10,053.023	10,046.906	10,027.184	10,066.423	10,063.831	10,059.263	10,051.210
		0.05%	-0.08%	-0.12%	-0.18%	-0.24%	-0.44%	-0.05%	-0.07%	-0.12%	-0.20%

Avg System Rates

	Scenario #										
	1	2	3	4	5	6	7	8	9	10	11
DU & EE	None	DU-No EE	EE		EE x 2			DU & EE		DU & EE x 2	
Coal Size	500	500	500	490	500	480	433	500	490	500	480
Sensitivities											
Base Case	536.241	536.620	535.928	536.048	535.466	535.780	536.016	536.237	536.373	535.968	536.054
% of Base		0.07%	-0.06%	-0.04%	-0.14%	-0.09%	-0.04%	0.00%	0.02%	-0.05%	-0.03%
High Load	548.516	547.789	547.943	548.037	547.337	547.288	548.513	547.246	547.525	546.829	547.045
		-0.13%	-0.10%	-0.09%	-0.21%	-0.22%	0.00%	-0.23%	-0.18%	-0.31%	-0.27%
Low Load	527.465	528.183	527.175	527.173	526.954	526.950	527.141	528.032	528.029	527.820	527.815
		0.14%	-0.05%	-0.06%	-0.10%	-0.10%	-0.06%	0.11%	0.11%	0.07%	0.07%
High Gas	536.304	536.021	535.583	535.848	534.808	535.344	536.379	535.286	535.584	534.641	535.049
		-0.05%	-0.13%	-0.09%	-0.28%	-0.18%	0.01%	-0.19%	-0.13%	-0.31%	-0.23%
Low Gas	544.052	544.714	544.013	543.891	543.780	543.713	543.032	544.544	544.480	544.498	544.225
		0.12%	-0.01%	-0.03%	-0.05%	-0.06%	-0.19%	0.09%	0.08%	0.08%	0.03%
CO2 Tax	561.806	562.070	561.435	561.254	560.965	560.633	559.572	561.626	561.483	561.281	560.850
		0.05%	-0.07%	-0.10%	-0.15%	-0.21%	-0.40%	-0.03%	-0.06%	-0.09%	-0.17%

RECOMMENDATIONS

Under base sensitivity assumptions, the Comprehensive Plan provides a lower PVRR than scenario 1 with no DR or EE. Scenarios that double the investment in EE or exclude DR show better PVRR results than the base case. However, as indicated earlier, there are significant uncertainties surrounding the actual peak and energy impacts of the EE programs. The assumption used in the model assumes doubling EE

investment will double the peak and energy impacts. The probability that the impacts would be greater than double is quite small, while the probability of achieving less than double the benefits is considered fairly high.

Because of these uncertainties, KCP&L recommends that the DR and EE pilot programs as proposed in the Comprehensive Plan be approved. This recommendation allows KCP&L to enter into new DR and EE programs with proposed staffing levels and begin to monitor and evaluate the impacts and economics of numerous programs. As recommended, the DR and EE programs offer a 5-year pilot, with an assessment after the first 3 years to evaluate the effectiveness and performance of each of the programs based on actual results.

The sensitivity analysis around the size of KCP&L's participation is latan 2 indicate that reducing the 500 MW share under all scenarios returns a higher PVRR, even when investment in EE is doubled.

Doubling the funding of EE programs does not appear to result in the economic reduction in the proposed 500 MW share of latan 2. In all cases modeled, when KCP&L's share of latan 2 was reduced, both PVRR and ASR increased. This indicates that reducing the level of participation in latan 2 has an adverse affect on expected rates under any given level of funding for EE programs.

KCP&L's recommendation for DR and EE programs is to support the level of funding provided in the Comprehensive Plan.