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NW Energy Coalition ~ Natural Resources Defense Council
Renewable Northwest Project ~ Advocates for the West

December 3, 2004

Jean Jewell, Commission Secretary
Idaho Public Utilities Commission
472 W. Washington St.
Boise, ID 83702-5983

Re: Comments on IPC-E-04-18 (Idaho Power's 2004 Integrated Resource Plan)

Dear Ms. Jewell:

The NW Energy Coalition, Natural Resources Defense Council, Renewable Northwest Project, and Advocates for the West (together, the "Clean Energy Advocates") submit these comments on Idaho Power Company's 2004 Integrated Resource Plan ("IRP").

While these comments include some criticisms of particular resource selections in the IRP, first and foremost we wish to emphasize that overall we believe the 2004 IRP marks a significant advance for Idaho Power Company. Idaho Power should be commended for its commitment to an open and robust public process (the Integrated Resource Plan Advisory Council) and to its demonstrated willingness to pursue new levels of DSM and renewable resources that we believe will lead to lower financial risks to the Company and its customers, as well as better protection of the environment. In our view, the Company met and exceeded the expectations of the Commission as reflected in Order 29189 (regarding the 2002 IRP).

We do believe, however, that the IRP action plan will not capture all cost-effective and practicably achievable demand-side management savings; and that exploration of all feasible alternatives must occur before the Company makes further investments in large-scale conventional coal-fired power plants.

We ask that the Commission take all of the following actions:

1. acknowledge and accept the IRP;
2. require Idaho Power to pursue all cost-effective energy efficiency resources;
3. caution against further investments in large-scale conventional coal-fired power plants prior to the 2006 IRP;
4. require Idaho Power to include advanced coal technologies, with carbon capture and storage, in the 2006 IRP analysis; and
5. encourage IPC to continue its open public process in developing the 2006 IRP.

ORIGINAL

Public Process

The Clean Energy Advocates are strongly supportive of the public process Idaho Power used in preparing the 2004 IRP.[1] Indicators of the IPRAC's success are easy to discern: a healthy cross-section of stakeholders were invited to the process; numerous meetings were held through every stage of IRP development; and the vast majority of invitees continued to participate throughout the process (even after the IRP had been filed with Commission). More importantly, we believe that the Company was genuinely interested in the IRPAC's input, and that the IRPAC's input is reflected in the IRP document itself.

The IRPAC process walked the difficult line between ensuring that IRP development is open to the spectrum of interests, yet also is sufficiently interactive and informed so as to add value to the highly technical and complex final product.

Energy Efficiency Investment

We commend Idaho Power for expanding its procurement of cost-effective energy efficiency and demand response programs in the IRP. Specifically, the selected portfolio calls for 48 MW of energy efficiency programs and 76 MW of demand response programs. The Clean Energy Advocates recognize the programs described in the IRP will represent an increase in demand-side investment, and believe the procurement of such resources should proceed on an expedited basis.

However, the Company's chosen portfolio still lags behind conservative estimates of feasible levels of cost-effective investment. The Company commissioned Quantum Consulting to analyze the potential for cost-effective energy efficiency investments in the residential and commercial sectors. The results of the Quantum report reveal that Idaho Power's selected portfolio ignores substantial cost-effective investments that would be feasible to acquire.

The first phase of the Quantum study looked primarily at peak load reductions. Some of these programs are the basis of the IRP's chosen investment level. The second phase was a more comprehensive evaluation that updated the phase one analysis and added baseload efficiency measure evaluation. We recognize that the second phase was completed after Idaho Power had completed the IRP. As a result, the second phase results were not included in the IRP analysis. The executive summary and some excerpted pages of the "Draft Final" Quantum report is attached to these comments. We hope and anticipate that the final report will be provided to the Commission as an addendum to the IRP.

The Quantum report found that under a "moderate" funding scenario, 72 MW of savings (on peak) could be achieved from energy efficiency programs over a 10 year forecast period; and

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[1] The Natural Resources Defense Council and Advocates for the West held seats on the Company's Integrated Resource Plan Advisory Council (IRPAC).

116 MW of savings could be achieved under a "high" funding scenario. Quantum report at 4-15, 16. The "maximum achievable" savings totaled 190 MW. Id.

Even the 72 MW of savings identified under a "moderate" funding scenario dwarfs the 48 MW of savings called for in the IRP's chosen portfolio. But these results from the Quantum report reflect an analysis of **only the residential and commercial sectors.** Thus, potential demand-side savings from the irrigation and industrial sectors would only broaden the gap between Idaho Power's chosen portfolio and the feasible level of cost-effective efficiency investment, as identified by the Company's consultant. Indeed, the IRP itself identifies 29 MW of peak savings from selected irrigation efficiency programs, and 12 MW from industrial efficiency programs. IRP at 57. Thus, adding the Quantum report's "moderate" scenario (72 MW from residential and commercial sectors) to the 41 MW of potential from irrigation and industrial sectors identified in the IRP, a total of 113 MW of efficiency savings should be pursued. Under the Quantum report's "High" funding scenario, together with the IRP's selected irrigation and industrial sector programs, a total of 157 MW of efficiency savings should be pursued.

While Idaho Power plans to increase its use of cost-effective energy efficiency resources, there are still large untapped cost-effective resources available. One frequently used metric to benchmark energy efficiency programs across utilities is the annual energy savings achieved by the programs as a percent of sales. To put Idaho Power's plans in perspective, consider that the annual savings from IPC's existing energy efficiency programs represent about 0.1% of annual load. With the additional investments called for in the IRP, IPC's savings will reach about 0.2% of sales.[2] The Northwest Power and Conservation Council's (NWPCC) recently-released draft "Fifth Plan" calls for Idaho Power to attain annual savings of about 0.5% of load.[3] Thus, IPC's current plans would reach less than *half* of the NWPCC goal. And in comparison, the California PUC recently set energy saving goals for the three major electric utilities at 1% of load, in order to capture 90% of the maximum achievable cost-effective savings.

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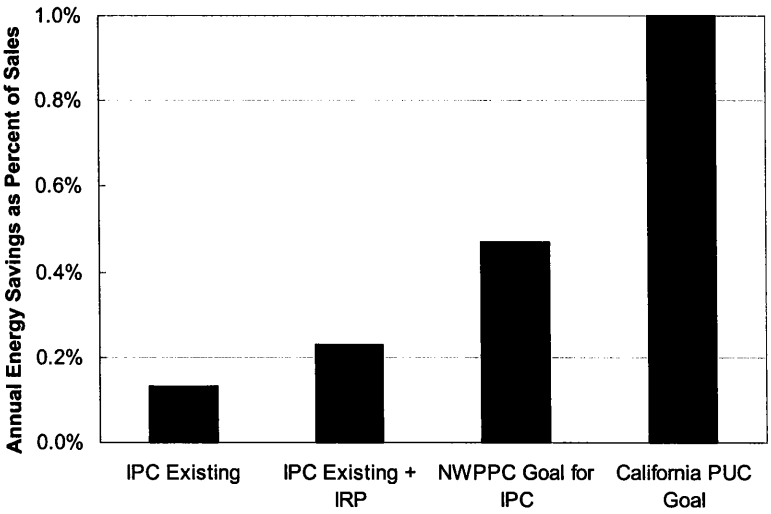
[2] Existing programs save up to 2.5 aMW per year; the IRP calls for an additional 1.8 aMW of savings per year, for a total of 4.3 aMW per year.

[3] The NWPPC's plan sets a savings goal of about 2500 aMW over twenty years for the region. This is achieved by increasing regional conservation acquisition from 130 aMW in the first year to 150 aMW in the fifth year. IPC assumes that it is 6.4% of the region's load; dividing the NWPPC's goal proportionately yields a near term goal of 8.3 aMW per year, and a mid-term goal of 9.6 aMW of savings per year. This would amount to annual savings of about 0.5% of load in both the near- and mid-term.

Benchmarking Idaho Power's Energy Efficiency Plans



The Clean Energy Advocates recognize that achievement of all cost-effective energy savings cannot happen overnight. We ask that the Commission continue to support Idaho Power's efforts to ramp up its demand-side programs, and require that the utility pursue all cost-effective and feasible energy savings identified in the Quantum report and meet the NWPCC goal.

In addition, we recognize that full achievement of these demand-side savings will manifest as significantly diminished profits for IdaCorp shareholders. NRDC, NW Energy Coalition, and Advocates for the West continue to work in the workshop process created in case number IPC-E-04-15 to eliminate this financial disincentive to demand-side investment.

Risk of Future Regulation of Carbon

The Clean Energy Advocates commend Idaho Power for recognizing the need to analyze and mitigate the financial risk associated with the potential future regulation of carbon dioxide emissions, in addition to the various other risks included in the IRP.

New information regarding climate change and the likelihood of related regulatory action supports extreme caution against further investments in fossil fuel-based resources – particularly large base-load resources such as coal.

The Arctic Council (composed of representatives of the 8 Arctic nations, including the United States) issued a report in November 2004 stating that temperatures in the Arctic are rising at approximately twice the rate of the rest of world, leading to the reduction of sea ice. The full primary and secondary impacts of such warming cannot be known at this time, but warming is surely occurring. The report can be downloaded at <http://amap.no/acia/>.

The West Coast Governors (for the states of California, Washington, and Oregon) recommended a series of steps to combat global warming on November 18, 2004. The Governors' action adds to the ongoing action by individual states around the country as summarized at pages 71-72 of the IRP.

International movement toward control of carbon emissions also recently leapt forward with Russia's approval of the Kyoto treaty. With Russia's ratification, the treaty will now enter into force in early 2005, requiring signatory countries to begin the process of reducing carbon emissions to 5% below 1990 emission levels.

In short, there is a strong and growing body of evidence that carbon regulation is a foreseeable eventuality. It is fully appropriate for Idaho Power and the Commission to evaluate the present and growing financial risks from future regulation of carbon.

Renewables

In general, we believe Idaho Power has given wind resources fair treatment alongside other resources, which is reflected in the draft IRP's call for acquisition of 350 MW of wind. Significant investment in clean energy is likely to be pursued across the Western United States in coming years. The Western Governor's Association (in their policy resolution 04-14) is calling for 30,000MW of clean energy in their region by 2015. (http://www.westgov.org/wga/policy/04/clean-energy.pdf)

Renewable resources have a fixed price over a 20 - 30 year period. The benefit of this cost certainty and future risk reduction should be balanced against the availability of gas at a long-term fixed price or a short-term contract with a long-term hedge. The recent volatility of gas prices underscores the value of resources with no fuel costs. In a recent study by Lawrence Berkeley National Laboratory, the authors estimated the fuel-price hedge value of wind resources at $0.40/MMBtu to $0.80/MMBtu, or 0.3 cents/kWh to 0.6cents/kWh.[4]

Specific to this IRP, the penetration level of wind into Idaho Power's full portfolio of resources will still be quite small, even with the acquisitions called for in the IRP. This fact indicates that integration costs (including the need for back up generation, if any) for these resources will also be small. This is particularly the case where there is no indication that the variability in output of wind (particularly given the low energy and capacity factors already assigned to wind)[5]

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[4] Mark Bolinger, Ryan Wiser and William Golove, *Account for Fuel Price Risk: Using Forward Natural Gas Prices Instead of Gas Price Forecasts to Compare Renewable to Natural Gas-Fired Generation*, August 2003, LBNL-53587, http://eetd.lbl.gov/ea/EMS/reports/53587.pdf

[5] IPC assigns wind an annual capacity factors of 35%; but only 5% during summer peak hours. We understand this is based on expected summer conditions at a hypothetical wind plant in southern Idaho. However, it is likely that actual wind projects will be located at several separate sites. This geographic dispersion is likely to increase the average energy and capacity factors for all wind contributions to the grid.

correlates with variation in load. Moreover, as forecasting for wind project output steadily improves, the need for shaping services will decline.

The Company's 2006 IRP should include a discussion of the appropriate discount rate to apply to renewable resources. We think that discounting the fuel costs for supply side resources at a discount rate of 7.2% (IRP at 68) is incorrect since it is assumed that fuel costs expenditures will be paid by customers on an annual basis through the Power Cost Adjustment mechanism. Because the Company intends to pass through fuel costs (and associated risks) to customers, the appropriate discount rate for fuel costs should not be based on the Company's weighted average cost of capital. Instead, it should be based on the lower, expected inflation rate. Moreover, the high discount rate severely disadvantages new renewable resources, such as wind, because renewables have high capital costs and no fuel costs. Basically, the high discount rate will skew the cost of gas plants to the detriment of renewables.

New Coal Investments

Idaho Power's IRP calls for investment in a new 500 MW conventional coal-fired power plant. Specifically, the Company's near-term action plan calls for the Company to identify a utility partner and issue an RFP for that coal plant prior to the completion of the 2006 IRP. The Clean Energy Advocates urge the Commission to caution Idaho Power against further investments in large-scale conventional coal-fired power plants prior to the 2006 IRP for several reasons.

First, the 500 MW coal plant is a lumpy capital investment, which could realistically be postponed for at least a year if the Company pursued a reasonable plan to capture all cost-effective energy efficiency savings as identified by the Company's own consultant (Quantum) and the Northwest Power Planning Council.

Second, the 2004 IRP did not analyze advanced coal technologies, such as integrated gasification combined cycle (IGCC) plants, which could provide both economic and environmental benefits relative to conventional coal technologies. Indeed, outputs of conventional pollutants and carbon from IGCC plants are substantially lower than those associated with conventional or even pulverized coal technology. Moreover, advanced coal technologies are more efficient than conventional technologies, and enable the use of cost-effective carbon capture and storage. These factors make IGCC a more prudent investment than conventional or pulverized coal when faced with the financial risk associated with greenhouse gas emissions.

The Commission should require Idaho Power to pursue all cost-effective energy efficiency resources and thereby postpone its consideration of a new coal-fired power plant until after the 2006 IRP. The Company should also require the Company to analyze advanced coal technologies, with carbon capture and storage, in the 2006 IRP analysis.

Conclusion

The 2004 IRP represents a leap forward in sound risk management and environmental stewardship. The Clean Energy Advocates ask the Commission to acknowledge and accept the IRP, but direct the Company in the following regards: (1) the Company should pursue investment in all cost-effective energy efficiency resources, at higher levels than called for in the IRP; (2) the IRP's plan for acquisition of renewable resources should be implemented over the next two years to help diversify the Company's energy portfolio; (3) in light of the further potential for investment in additional efficiency programs, the risks of future carbon regulation, and the prospects for renewable energy development in Idaho, additional fossil fuel-based resources should not solicited or acquired prior to approval of the 2006 IRP, and after all other alternatives have been exhausted; (4) the 2006 IRP should include an analysis of advanced coal technologies, with carbon capture and storage; (5) encourage IPC to continue its open public process in developing the 2006 IRP.

Thank you for the opportunity to comment on Idaho Power's 2004 IRP.

Sincerely,

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IDAHO POWER DEMAND-SIDE MANAGEMENT POTENTIAL STUDY

DRAFT FINAL

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October, 2004

EXECUTIVE SUMMARY

The Idaho Public Utilities Commission (IPUC) directed the Idaho Power Company (IPCo) to consult with their Energy Efficiency Advisory Group regarding the need to initiate a comprehensive DSM study of the Idaho Power service territory. In July 2002, the Customer Relations and Research Group at Idaho Power received recommendations from the Idaho Power Energy Efficiency Advisory Group and from Idaho Power management to proceed with a study of DSM opportunities. This study characterizes the potential for DSM resources through 2013 for the commercial and residential sectors.

This study was carried out in two phases. In the study's initial phase, the focus was on the potential for capacity reduction from demand-response (DR) programs and energy-efficiency (EE) opportunities based on assessment of measures that maximize peak reduction. For a second phase of the study, additional measures were added to the original EE portion of the analysis to produce estimates of DSM potential that include an emphasis on overall energy savings. Based on IPCo's resource planning needs, the potential for capacity reduction was the most important component of the study. As such, the results from the initial phase of the study were provided to IPCo's resource-planning department in late 2003 and early 2004 for incorporation into its 2004 Integrated Resource Plan (IRP).

The scope of this study also includes review and analysis of Idaho Power's summer peak load characteristics and identification of residential and commercial end-uses that have potential for demand reduction during the summer peak time. In addition, significant effort went into to development of baselines for residential and commercial customers in Idaho Power's service territory. This included estimation of end use energy and peak demand contribution; development of parameters such as electric equipment saturation, current efficiency measure saturation; incorporation of the impact of current codes and standards; analysis of Idaho Power forecasts and rate schedules; and review of Idaho Power's current DSM programs.

Inherent differences between EE and DR – with respect to both technologies and program types – called for distinct methodologies in assessing their respective potentials. The analysis of EE potential followed a measure-based methodology in which technology and market characteristics were combined to produce an estimate of the total technical potential of all measures under consideration. Using a forecast of avoided costs to remove all measures that were not cost effective from a total resource cost (TRC) perspective, the technical potential was reduced to produce an estimate of economic potential. Finally, the influence of market constraints given different program funding levels was modeled to reduce the economic potential to various estimates of achievable potential. A detailed description of these concepts and methodologies is presented in Chapter 2 of this report.

The DR portion of the study was based on an approach that merged professional judgment about DR participation levels with available Idaho Power data to assess potential peak demand reduction for a specific set of program offerings. Following an approach similar to that of the analysis of EE measures, the DR analysis first assessed the maximum amount of load to which DR programs could feasibly apply. This "applicable load" was then partitioned into "low, "partial," and "high" capability segments, which reflected the extent to which load is

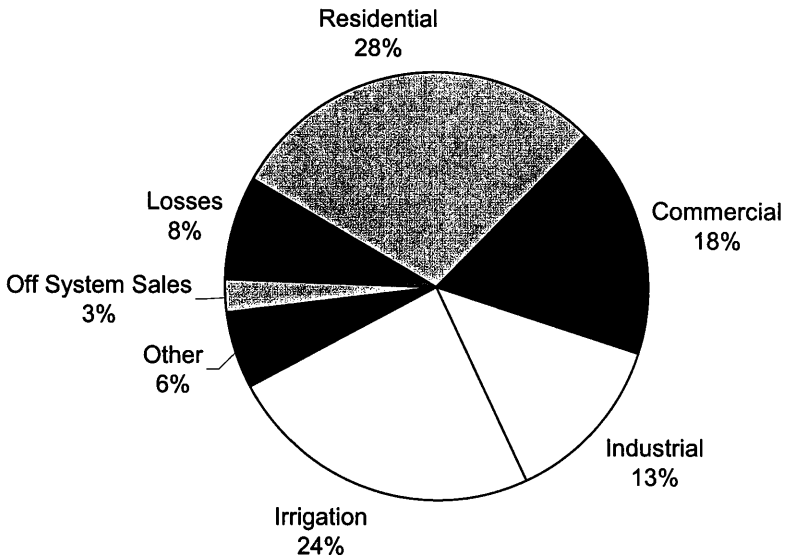
automated and/or centrally controlled. From this initial breakout of applicable load, achievable potential was estimated by modeling shifts in capability based on IPCo's program efforts and customer motivation given different incentive levels. The end result is a set of potential estimates by program concept and funding levels. Chapter 3 provides a comprehensive description of the methodology.

Finally, the results of the two analyses must stand on their own. Although EE and DR programs are not mutually exclusive, without accounting for the complex interactivity of the two, the individual results cannot be added to each other to produce a figure for the combined potential of both types of programs.

BASELINE ESTIMATES

In Exhibit ES-1 we show estimated summer peak demand and actual energy sales for Idaho Power for 2002. The residential sector is largest contributor to both summer peak demand and annual energy representing roughly 30 percent of each. The commercial sector is relatively small, representing roughly 20 percent of energy and 18 percent of peak demand. Seasonal irrigation contributes a very large and disproportionate amount to summer peak demand (representing 24 percent of summer peak demand but only 12 percent of annual energy). The industrial sector makes up 18 percent of annual energy usages but only 13 percent of summer peak, due to its higher than average load factor.

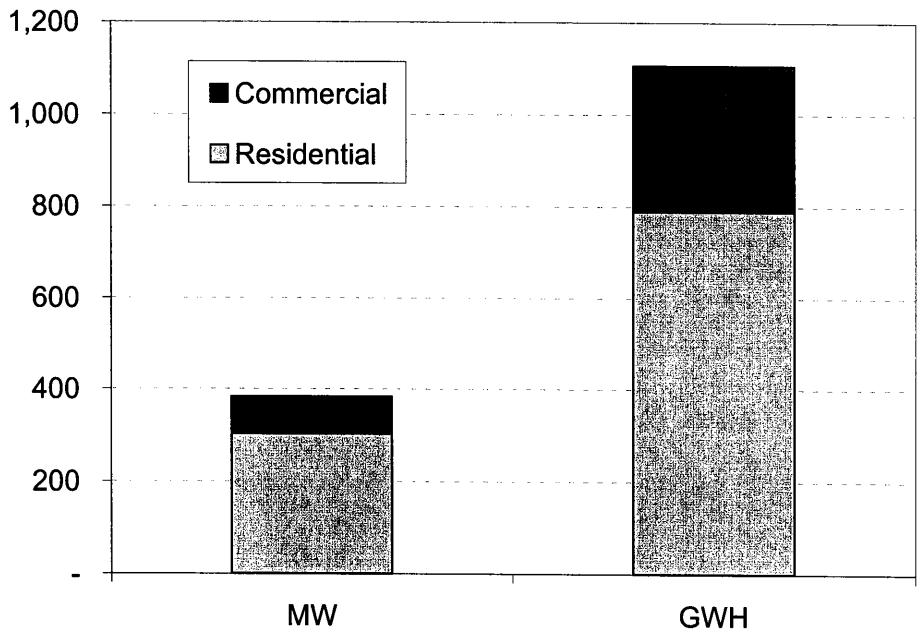
Exhibit ES-1
Estimated Breakdown of Summer Peak Demand by Sector for Idaho Power, 2002



ENERGY EFFICIENCY POTENTIAL

The study resulted in a total economic potential of 384 MW of peak demand reduction and 1,107 GWh of annual energy savings. These are displayed in Exhibit ES-2, broken out into residential and commercial sectors. This peak demand reduction represents nearly 23 percent of the combined residential and commercial peak demand forecast in 2013. For annual energy savings, the economic potential is about 12 percent of IPCo's 2013 energy forecast. Comprehensive results of technical and economic potential by sector, home or building type, and end use are presented in Chapter 4.

ES-2
Economic Potential (2013)
Peak Demand (MW) and Energy (GWh) Savings



Economic potential, which represents the savings possible if all cost-effective measures were installed in every application deemed physically feasible, is the point of departure from which more realistic assessments of the value of energy-efficiency programs are derived. To develop the estimates of achievable potential, the study modeled market penetration based on four different funding scenarios. These scenarios consisted of the following:

- A Low efficiency funding scenario with rebates covering 33% of incremental measure costs and base marketing funding levels;
- A Moderate efficiency funding scenario with rebates covering 50% of incremental measure costs and slightly higher marketing expenditures;

- A High efficiency funding scenario with rebates ramping up over time to 75% of incremental measure costs and significantly increased marketing expenditures; and

- A Maximum Achievable scenario with rebates ramping up over time to cover 100% of incremental measure costs and marketing expenditures sufficient to create maximum market awareness.

The achievable potential peak demand for the four scenarios as well as the estimated naturally occurring energy efficiency (which represent efficiency adoption in the absence of any programs) is displayed in Exhibit ES-3. For year 10 of the analysis, peak demand reductions range from 190 MW (around 11 percent of 2013 peak demand) for the maximum achievable scenario to 42 MW (less than 3% of 2013 peak demand) for the low funding scenario.

As shown in Exhibit ES-4, the achievable potential energy savings in 2013 were 681 GWh for the maximum achievable scenario, roughly 7.5 percent of IPCo's energy forecast for that year. The low-funding scenario showed 195 GWh for the same year, just over 2 percent of the forecast.

Based on the methodology used for this study, all of the measures that go into the assessment of achievable potential are estimated to be cost effective based on their incremental costs and incremental savings. For the achievable potential, however, marketing and administrative costs are added into the equation. After incorporating these costs, all four scenarios were still cost effective from the TRC perspective. In Exhibit ES-5, the present value of benefits is presented along with a breakout of the various costs components included in the TRC for all four scenarios.

Exhibit ES-3
Peak Demand Reduction Potential by Funding Scenario, 10-Year Forecast

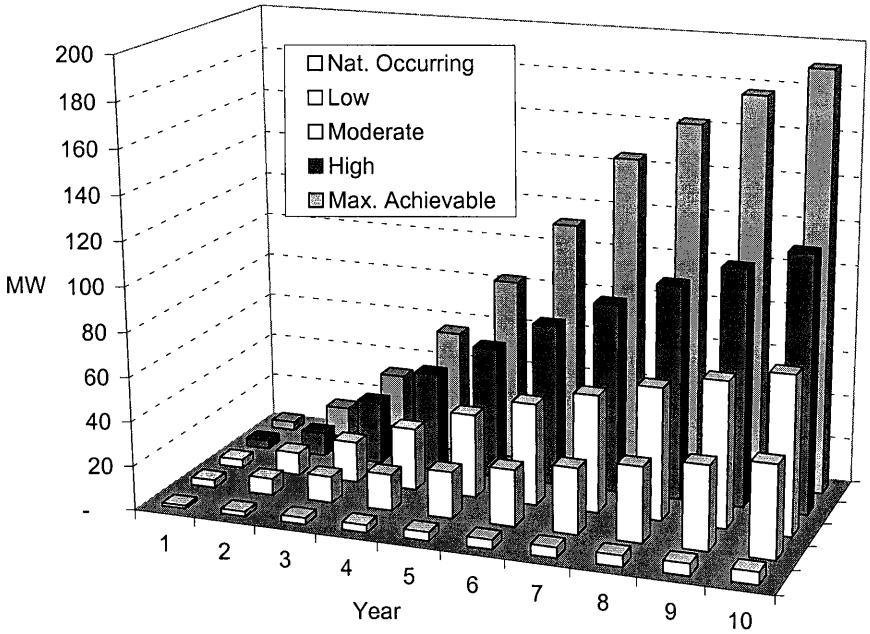


Exhibit ES-4
Energy Savings Potential by Funding Scenario, 10-Year Forecast

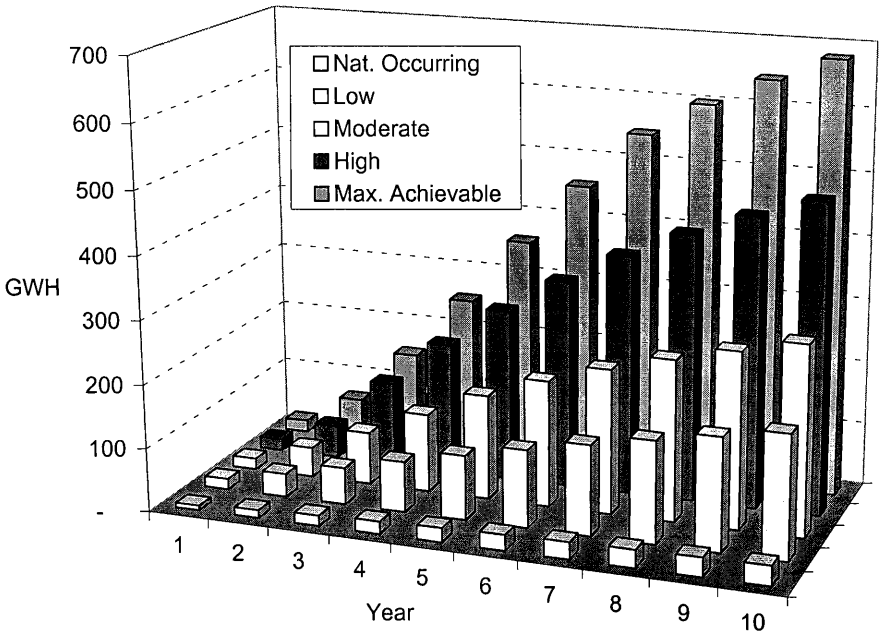
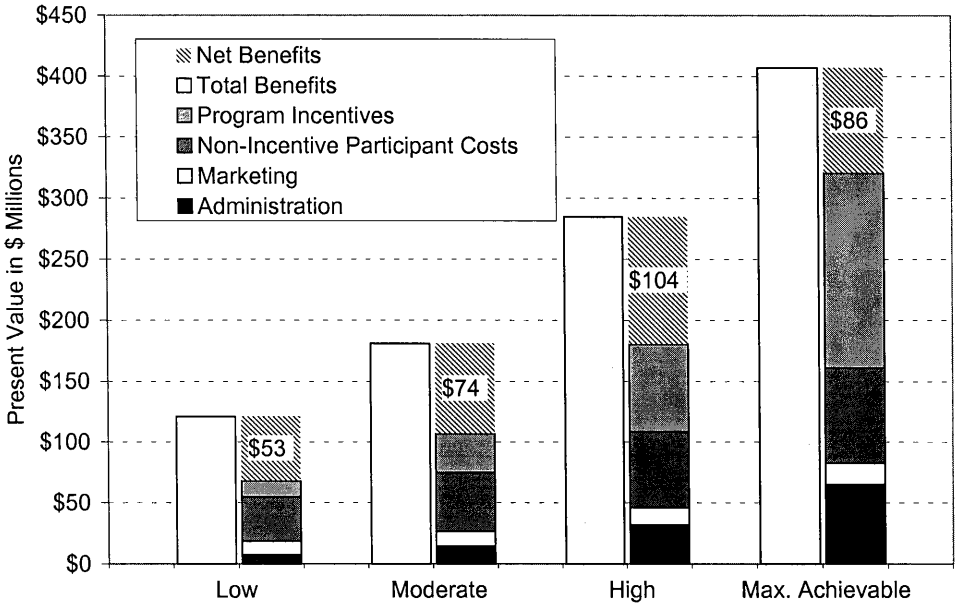


Exhibit ES-5

Present Value Costs and Benefits - Achievable Potential Scenarios



DEMAND RESPONSE POTENTIAL

As displayed in Exhibit ES-6, of IPCo's total peak demand in 2004, 469 MW (32 percent) were deemed to be applicable for peak demand reduction programs. Of this applicable load, 105 MW of potential savings were estimated to be economic. Of the total economic potential, AC load control programs for the residential sector accounted for nearly 60 MW, around 57 percent. The next largest contributors were the small- and large-commercial back-up generation programs, which combined for around 43 percent of the total economic potential.

Exhibit ES-6
Economic Potential for Residential and Commercial DR Programs

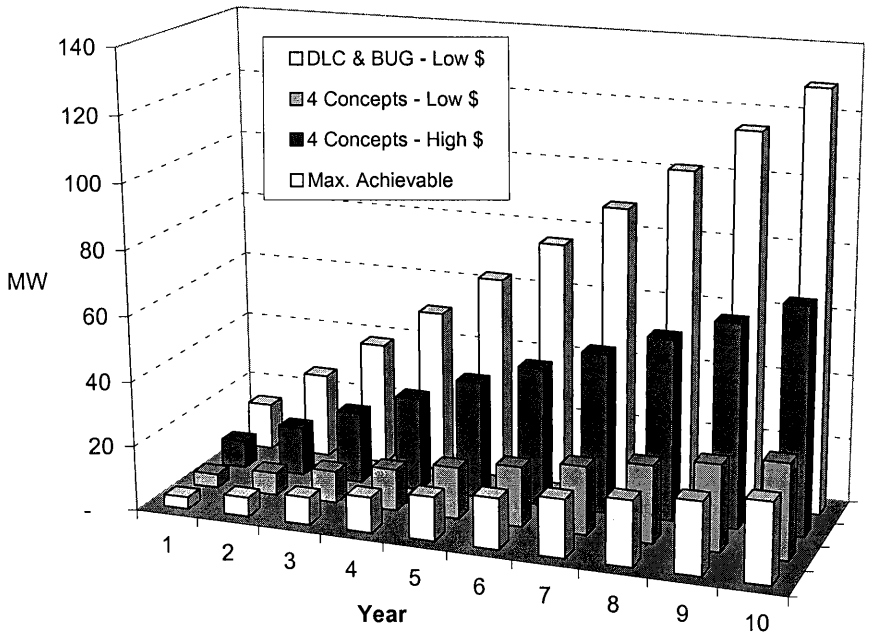
	MW in 2004	% Of Total Peak Demand
Total Peak Demand	1,478	
Estimated Applicable Demand for DR	469	32%
Economic Potential for DR	105	7%

The assessment of achievable DR potential was based on analysis of four program concepts - AC Load Control (DLC), Critical Peak Pricing (CPP), Voluntary Demand Response Incentives (DRP), and Back-up Generator Incentives (BUG) - bundled into four program strategies:

- DLC and BUG - Low Incentive Levels
- All 4 Concepts - Low Incentive Levels
- All 4 Concepts - High Incentive Levels
- "Maximum Achievable"

The forecast of annual estimated MW reduction that would occur during system peak conditions is shown in Exhibit ES-6 for each of the four strategies. The growth in the various scenarios represents a forecasted successful effort of IPCo to shift applicable load into higher capability segments as well as customer response to incentives. The maximum achievable scenario's 129 MW in 2013 amounts to more than 7.5 percent of the peak demand. The lowest potential is associated with the DLC and BUG program concepts with low funding, which has a potential of 25 MW in 2013, approximately 1.5 percent of peak demand. Chapter 5 presents complete results for the assessment of DR potential.

Exhibit ES-6
Comparison of Load Reduction Forecasts - Residential and Commercial Sectors



4. ENERGY EFFICIENCY PEAK DEMAND AND ENERGY SAVINGS POTENTIAL RESULTS

In this section we present summary results of the Idaho Power energy efficiency potential analysis for the residential and commercial sectors. First, economic and technical potential are discussed. Next, we present summary energy efficiency supply curves, which are an alternative method of presenting forecasted potentials. Finally, we present scenario forecasts for achievable energy efficiency potential. Definitions of the different types of energy efficiency potential and methods used to develop them are provided in Section 2 of this report. Section 2 also presents the baseline estimates used in our analyses.

At the outset of this study, the primary focus on was peak demand reduction and the scope was limited to measures with impacts on summer peak. In a later, second phase, the scope was expanded to look at all measures with the potential to provide cost-effective energy savings. Where possible, the figures in this section delineate the peak demand and energy savings associated with the two phases. In cases where there is no distinction, the figures represent the results of the second phase. Because the results of the first phase were provided to the resource-planning group at IPCo, identical graphs based only on the results of the initial phase are provided separately in Appendix G.

TECHNICAL AND ECONOMIC POTENTIAL

In Exhibits 4-1 and 4-2 we present our overall estimates of total technical and economic potential for peak demand and electrical energy in the residential and commercial sectors in the Idaho Power territory. **Technical potential** represents the sum of all savings achieved if all measures analyzed in this study were implemented in applications where they are deemed applicable and physically feasible. As described in Section 2, **economic potential** is based on efficiency measures that are cost-effective based on the total resource cost (TRC) test, a benefit-cost test used to compare the value of avoided energy production and power plant construction to the costs of energy-efficiency measures and program activities necessary to deliver them. The value of both energy savings and peak demand reductions are incorporated into the TRC test.

Overall and by Sector

If all measures analyzed in this study were implemented where technically feasible, we estimate that overall technical demand savings would be roughly 551 MW, about 33 percent of projected combined residential and commercial peak demand in 2013. If all measures that pass the TRC test were implemented, economic potential savings would be 384 MW, about 23 percent of total residential and commercial demand in 2013. Technical energy savings potential is estimated to be roughly 1,917 GWh, about 21 percent of total residential and commercial energy usage projected in 2013. Economic energy estimates savings are estimated at 1,107 GWh, about 12 percent of base residential and commercial usage. The technical and economic potential estimates are shown by sector and vintage (existing stock versus new construction) in Exhibits 4-3 through 4-5. The largest share of both technical and economic savings is in the residential existing stock.

Exhibit 4-1
Technical and Economic Potential (2013)
Peak Demand Savings – MW

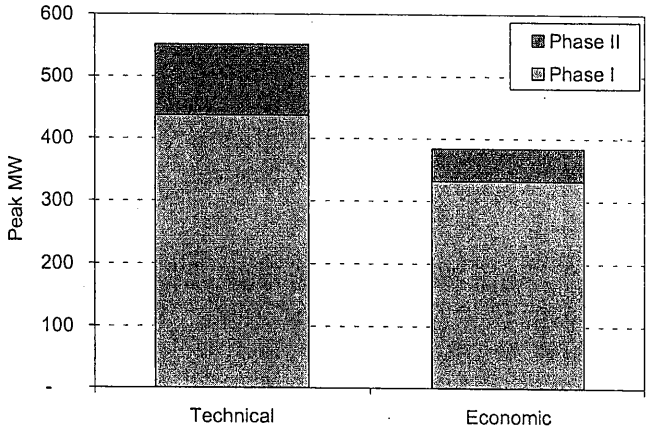


Exhibit 4-2
Technical and Economic Potential (2013)
Energy Savings – GWh per Year

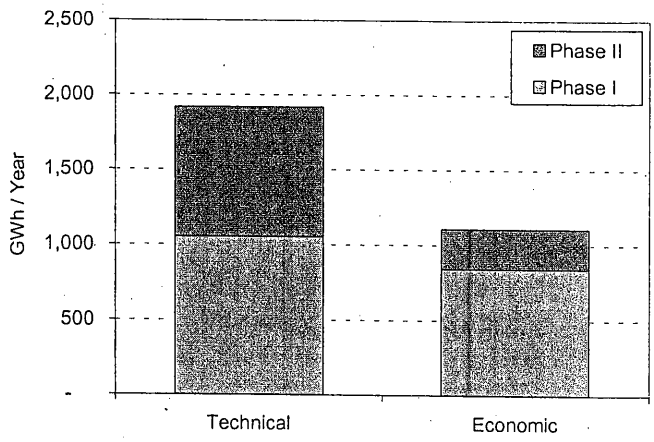


Exhibit 4-3
Technical and Economic Potential by Sector and Vintage, Peak Demand Savings (2013)

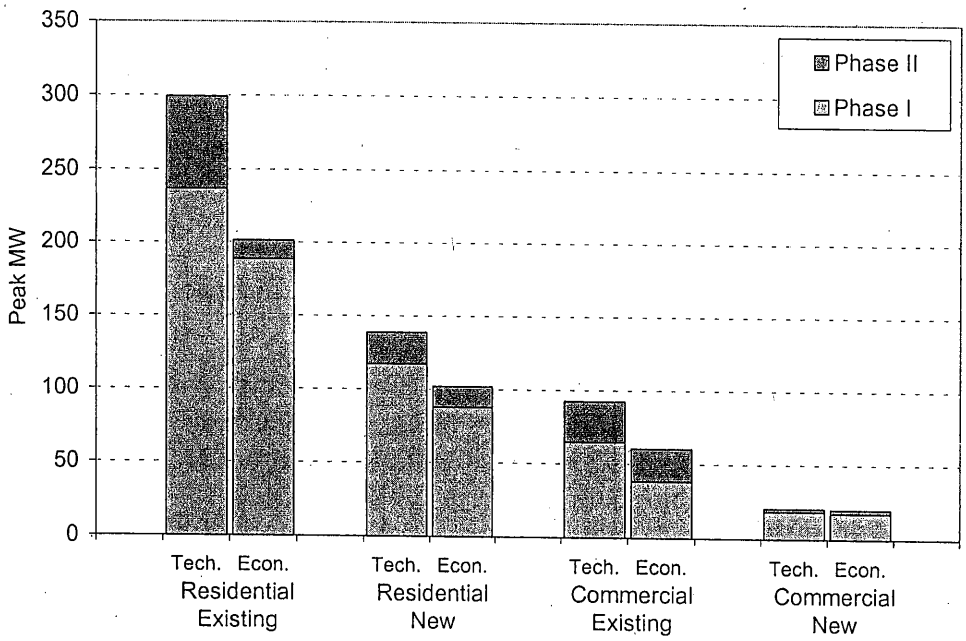


Exhibit 4-4
Technical and Economic Potential by Sector and Vintage, Energy Savings (2013)

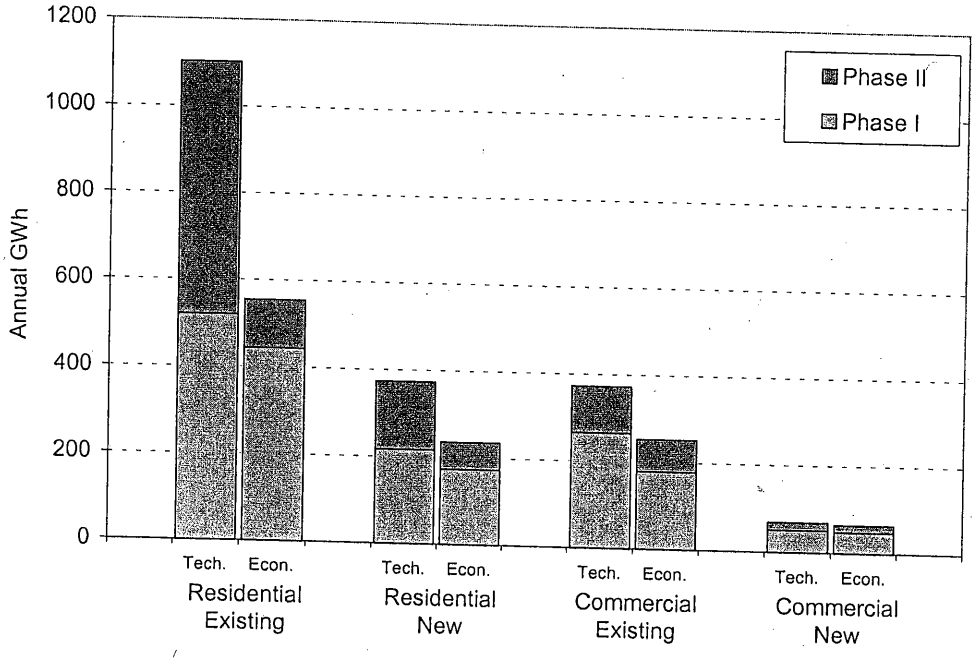


Exhibit 4-5a
Phase II Technical and Economic Potential Estimates

	MW		GWh	
Sector and Vintage	Technical	Economic	Technical	Economic
Residential – Existing	299	201	1,102	554
Residential – New	139	102	373	235
Commercial – Existing	92	60	373	252
Commercial - New	21	20	69	65
Total	551	384	1,917	1,107

Exhibit 4-5b
Phase I Technical and Economic Potential Estimates

	MW		GWh	
Sector and Vintage	Technical	Economic	Technical	Economic
Residential – Existing	237	189	520	444
Residential – New	117	88	216	173
Commercial – Existing	65	38	265	179
Commercial - New	23	22	59	55
Total	442	337	1,060	851

End Use Potential

Residential economic potential is presented by key end use in Exhibit 4-6. Lighting, cooling, and clothes washing dominate economic energy savings, while cooling makes up the vast majority of peak demand impacts. Exhibit 4-7 shows commercial sector economic potential estimates by end use. Lighting is the largest contributor in terms of both energy savings potential and peak demand savings potential, cooling is the second largest contributor to commercial economic peak demand savings.

Potential by Building Type

Exhibit 4-8 displays residential economic potential by building type. Single-family homes account for the vast majority of potential. Commercial sector economic potential is displayed by building type in Exhibit 4-9. The largest contributors to both GWh and peak MW potential are small offices, food stores, retail establishments, hospital/health care facilities, and "miscellaneous" buildings.

ENERGY EFFICIENCY SUPPLY CURVES

Energy efficiency supply curves for energy and peak demand savings are shown in Exhibits 4-10 and 4-11, respectively. The supply curves show the distribution of measure-level potentials by relative cost. Energy supply curve summary data are presented Exhibits 4-12 through 4-15 for the residential existing, residential new construction, commercial existing and commercial new construction vintages. Note that these values are aggregated across market segments and that individual segment results can vary significantly from the average values shown. In addition, it is important to recognize that cost-effectiveness, as defined by the TRC test, can not be determined exclusively from these curves because the value of both energy and demand savings must be integrated when comparing to supply side alternatives. Measure-level TRC estimates are provided in Appendix E.

Exhibit 4-6
Residential Economic Potential by End Use (2013)

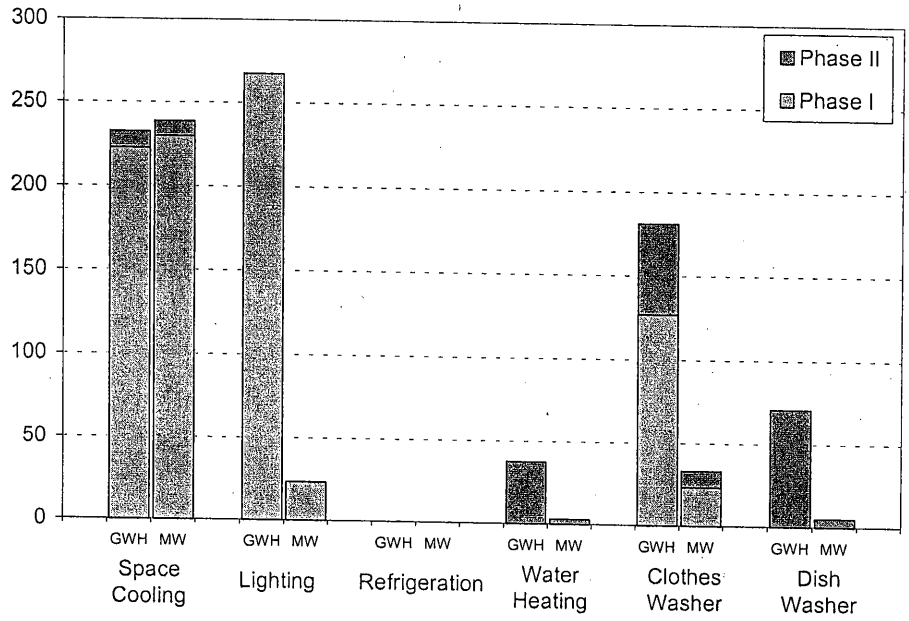


Exhibit 4-7
Commercial Economic Potential by End Use (2013)

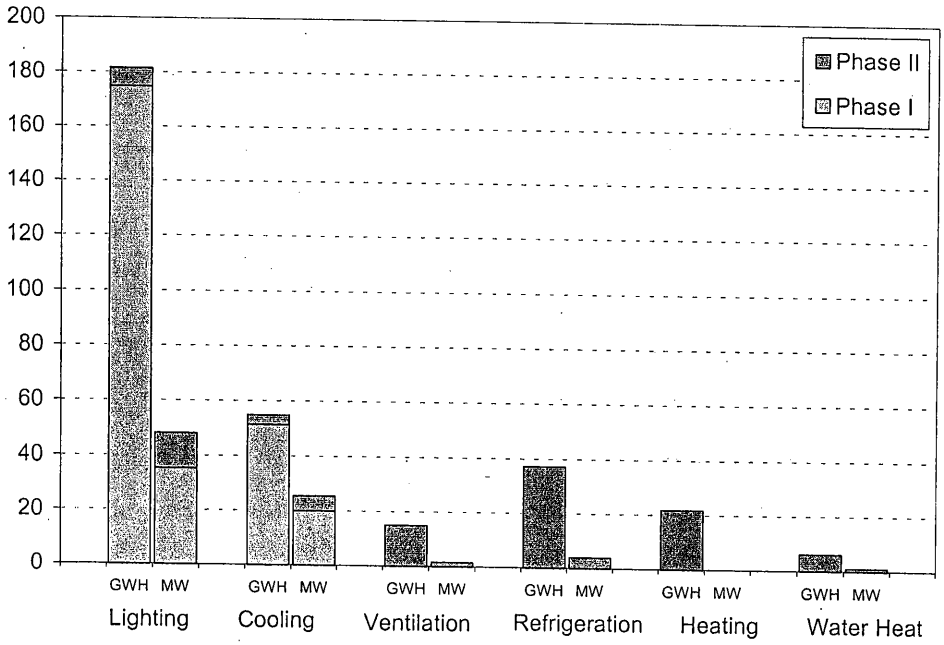


Exhibit 4-8
Residential Economic Potential by Building Type (2013)

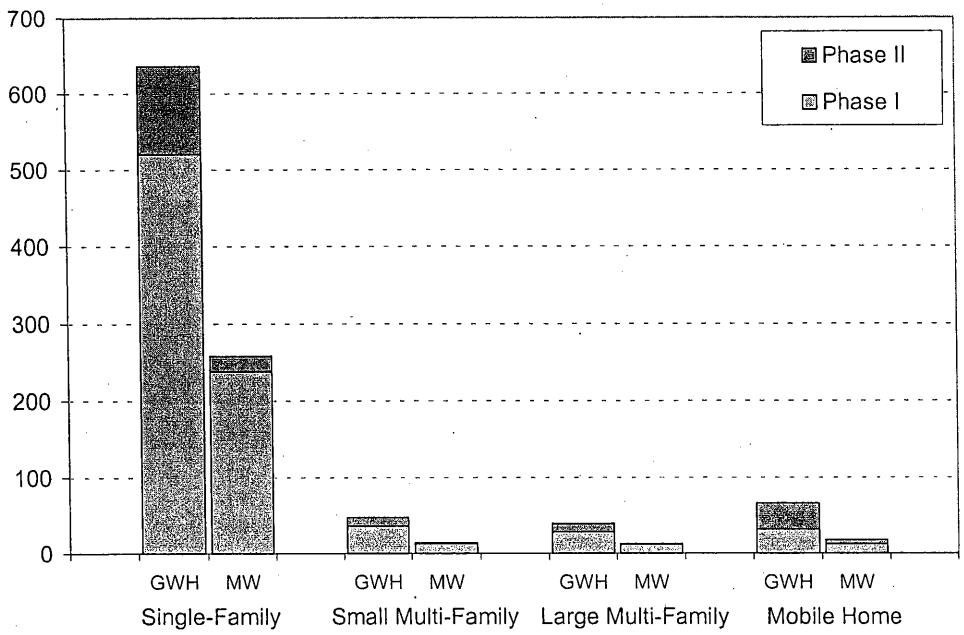


Exhibit 4-9
Commercial Economic Potential by Building Type (2013)

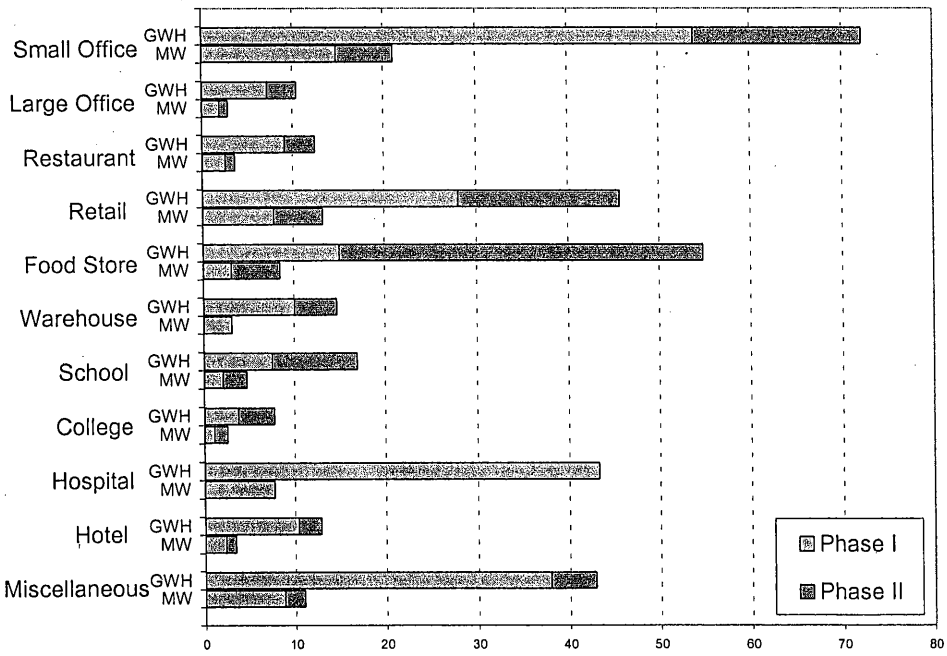


Exhibit 4-10
Residential and Commercial Energy Efficiency Supply Curve - Energy

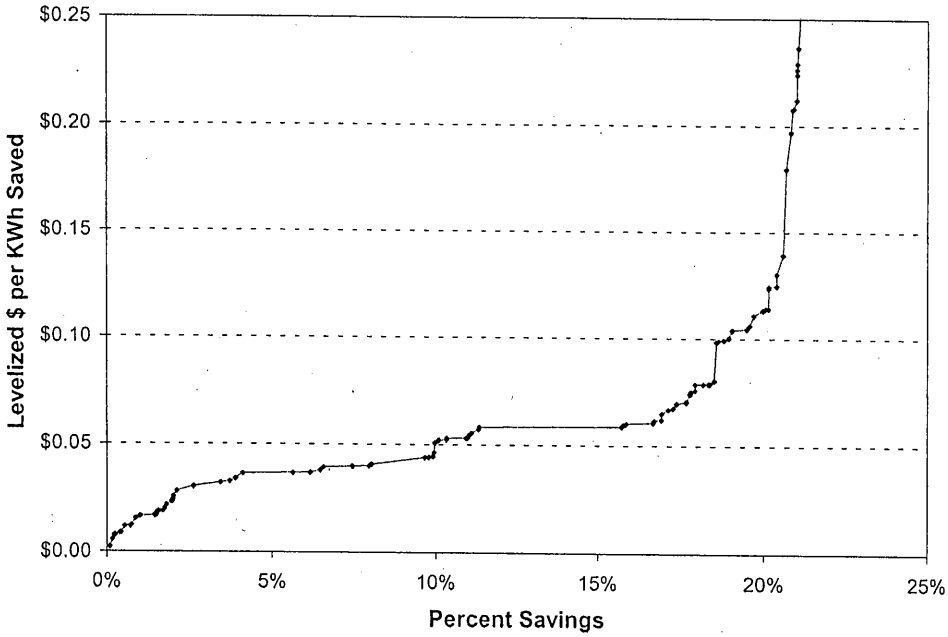


Exhibit 4-11
Residential and Commercial Energy Efficiency Supply Curve - Peak Demand

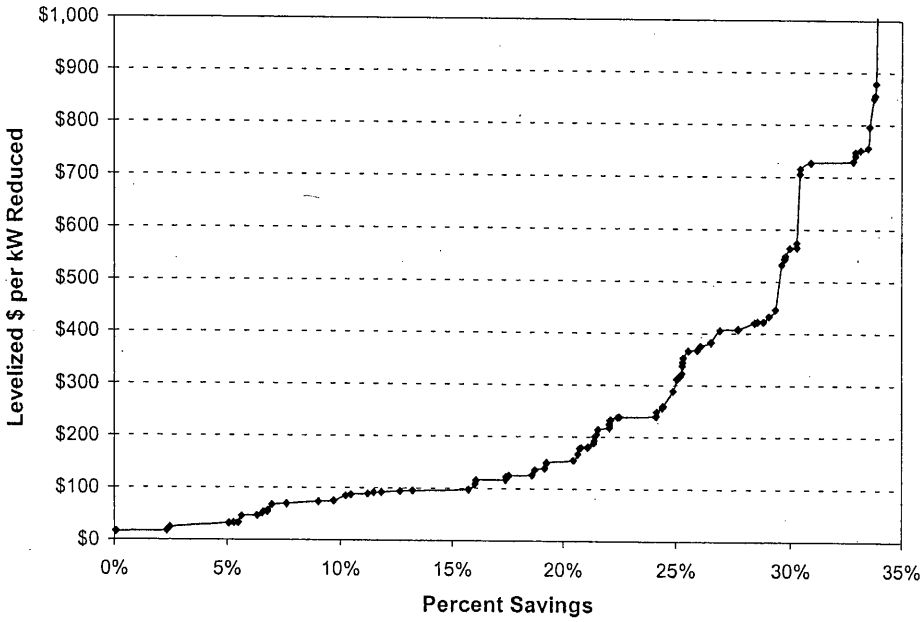


Exhibit 4-12
*Residential-Existing Energy Efficiency Supply Curve Data**

Measure	GWH Savings	Cumulative GWH Savings	Levelized Energy Cost $/kWh	Measure	MW Savings	Cumulative MW Savings	Levelized Capacity Cost $/kW
Low-Flow Showerheads	15	15	$0.012	Double Pane, Med Low-E Coating	55	55	$35
Tank Wrap	13	29	$0.016	Duct Insulation (.4)	4	59	$51
Hot Water Pipe Insulation	4	33	$0.019	Basic HVAC Diagnostic Testing And Repair	24	83	$74
Double Pane, Med Low-E Coating	58	91	$0.033	HE Room Air Conditioner - EER 10.5	12	95	$75
CFL	227	318	$0.040	Duct Repair (0.32)	14	109	$94
SEHA CW Tier 2 (MEF=2.20)	149	467	$0.044	10 to 12 SEER Split-System Air Conditioner	42	151	$98
Energy Star DW (EF=0.76)	55	522	$0.053	Wall 2x4 R-0 to Blow-In R-13 Insulation (0.14)	10	162	$98
Duct Insulation (.4)	4	526	$0.055	Direct Evaporative Cooler	22	184	$139
Heat Pump Water Heater (EF=2.4)	402	928	$0.059	Low-Flow Showerheads	1	185	$148
Basic HVAC Diagnostic Testing And Repair	22	950	$0.079	Tank Wrap	1	186	$205
ENERGY STAR or better Freezer	15	965	$0.079	SEHA CW Tier 2 (MEF=2.20)	27	213	$240
HE Room Air Conditioner - EER 10.5	11	975	$0.080	Hot Water Pipe Insulation	0	214	$241
Duct Repair (0.32)	13	989	$0.100	Attic Venting	10	223	$318
10 to 12 SEER Split-System Air Conditioner	40	1028	$0.105	10 to 13 SEER Split-System Air Conditioner	13	237	$408
ENERGY STAR or better Refrigerator	25	1053	$0.113	CFL	20	256	$452
Wall 2x4 R-0 to Blow-In R-13 Insulation (0.14)	8	1062	$0.122	ENERGY STAR or better Freezer	2	259	$544
Direct Evaporative Cooler	22	1083	$0.154	Heat Pump Water Heater (EF=2.4)	32	291	$730
Attic Venting	11	1094	$0.285	Ceiling R-19 to R-38 Insulation (.27)	3	294	$743
Whole House Fans	19	1113	$0.419	Energy Star DW (EF=0.76)	4	298	$751
10 to 13 SEER Split-System Air Conditioner	13	1126	$0.436	Whole House Fans	10	308	$799
Solar Water Heater	75	1200	$0.461	ENERGY STAR or better Refrigerator	3	311	$851
Ceiling R-19 to R-38 Insulation (.27)	4	1204	$0.577	Infiltration Reduction (0.4)	1	313	$870
Ceiling Fans	3	1208	$0.758	Ceiling Fans	2	314	$1,445
Infiltration Reduction (0.4)	1	1209	$1.094	10 to 14 SEER Split-System Air Conditioner	10	325	$1,648
10 to 14 SEER Split-System Air Conditioner	10	1219	$1.759	Solar Water Heater	6	331	$5,725

*Measures incremental to Phase II are highlighted.

*Exhibit 4-13**
Residential-New Construction Energy Efficiency Supply Curve Data – 10 Years

Measure	GWH Savings	Cumulative GWH Savings	Levelized Energy Cost $/kWh	Measure	MW Savings	Cumulative MW Savings	Levelized Capacity Cost $/kW
Low-Flow Showerheads	3	3	$0.012	Double Pane, Med Low-E Coating	39	39	$18
Double Pane, Med Low-E Coating	41	44	$0.017	Basic HVAC Diagnostic Testing And Repair	11	50	$70
Tank Wrap	4	48	$0.019	Duct Repair (0.32)	6	56	$92
Hot Water Pipe Insulation	1	49	$0.020	Direct Evaporative Cooler	10	65	$98
CFL	82	130	$0.040	HE Room Air Conditioner - EER 10.5	1	66	$116
SEHA CW Tier 2 (MEF=2.20)	47	177	$0.040	10 to 12 SEER Split-System Air Conditioner	23	89	$117
Energy Star DW (EF=0.76)	21	198	$0.052	Low-Flow Showerheads	0	89	$151
Heat Pump Water Heater (EF=2.4)	73	271	$0.061	Wall 2x4 R-13 to 2x6 R-13 Insulation (0.14)	4	93	$167
Basic HVAC Diagnostic Testing And Repair	10	281	$0.074	SEHA CW Tier 2 (MEF=2.20)	9	101	$218
ENERGY STAR or better Freezer	4	285	$0.079	Tank Wrap	0	101	$233
Duct Repair (0.32)	6	291	$0.098	Hot Water Pipe Insulation	0	102	$249
Direct Evaporative Cooler	10	300	$0.113	10 to 13 SEER Split-System Air Conditioner	8	109	$383
ENERGY STAR or better Refrigerator	8	308	$0.114	CFL	7	117	$455
HE Room Air Conditioner - EER 10.5	1	309	$0.124	ENERGY STAR or better Freezer	1	117	$544
10 to 12 SEER Split-System Air Conditioner	21	330	$0.125	Whole House Fans	5	122	$596
Wall 2x4 R-13 to 2x6 R-13 Insulation (0.14)	3	333	$0.209	Energy Star DW (EF=0.76)	1	124	$741
Whole House Fans	9	342	$0.312	Heat Pump Water Heater (EF=2.4)	6	129	$756
10 to 13 SEER Split-System Air Conditioner	7	350	$0.409	ENERGY STAR or better Refrigerator	1	130	$856
Solar Water Heater	15	365	$0.477	Ceiling Fans	1	132	$1,034
Ceiling Fans	2	367	$0.542	10 to 14 SEER Split-System Air Conditioner	6	138	$1,514
10 to 14 SEER Split-System Air Conditioner	6	373	$1.616	Solar Water Heater	1	139	$5,927

*Measures incremental to Phase II are highlighted.

Exhibit 4-14
*Commercial-Existing Energy Efficiency Supply Curve Data**

Measure	GWH Savings	Cumulative GWH Savings	Levelized Energy Cost $/kWh
Outdoor Lighting Controls (Photocell/Timeclock)	4.6	4.6	$0.017
Refrigeration	34.7	39.3	$0.026
Prog. Thermostat - DX	10.1	49.4	$0.028
T8/EB Replacement	56.8	106.3	$0.031
CFL Screw-in, Modular 18W	79.3	185.5	$0.040
Ventilation	16.5	202.0	$0.047
Occupancy Sensor	11.5	213.5	$0.059
High Pressure Sodium 250W Lamp	6.9	220.4	$0.056
DX Packaged System, EER=10.9, 10 tons	19.6	240.0	$0.057
DX Tune Up/ Advanced Diagnostics	13.1	253.2	$0.068
Heating	69.9	323.0	$0.068
Window Film (Standard)	7.4	330.4	$0.114
Water Heating	7.1	337.5	$0.117
Continuous Dimming	32.0	369.6	$0.233
Evaporative Pre-Cooler	7.3	376.9	$0.290

Measure	MW Savings	Cumulative MW Savings	Levelized Capacity Cost $/kW
DX Packaged System, EER=10.9, 10 tons	12.7	12.7	$88
T8/EB Replacement	15.2	27.9	$116
Prog. Thermostat - DX	2.1	30.0	$136
CFL Screw-in, Modular 18W	20.4	50.4	$155
Window Film (Standard)	4.7	55.0	$180
Refrigeration	3.8	58.9	$203
Occupancy Sensor	3.4	62.2	$200
DX Tune Up/ Advanced Diagnostics	2.8	65.1	$312
Evaporative Pre-Cooler	4.7	69.8	$446
Ventilation	1.6	71.4	$481
Continuous Dimming	15.8	87.2	$474
Water Heating	1.2	88.4	$691
High Pressure Sodium 250W Lamp	0.1	88.4	$6,733
Outdoor Lighting Controls (Photocell/Timeclock)	0.0	88.4	N/A
Heating	0.0	88.4	N/A

*Measures incremental to Phase II are highlighted.

*Exhibit 4-15**
Commercial-New Construction Energy Efficiency Supply Curve Data - 10 Years

Measure	GWH Savings	Cumulative GWH Savings	Levelized Energy Cost $/kWh
Low-e Windows	5.1	5.1	$0.022
10 % More Efficient Lighting Design	14.4	19.5	$0.023
Refrigeration	11.4	30.8	$0.026
20 % More Efficient Lighting Design	15.5	46.3	$0.034
Ventilation	4.9	51.3	$0.047
Water Heating	1.2	52.5	$0.058
DX Packaged System	6.9	59.4	$0.060
DX Tune Up/ Advanced Diagnostics	9.9	69.3	$0.070

Measure	MW Savings	Cumulative MW Savings	Levelized Capacity Cost $/kW
Low-e Windows	3.4	3.4	$33
10 % More Efficient Lighting Design	3.8	7.2	$87
DX Packaged System	4.5	11.7	$92
20 % More Efficient Lighting Design	4.9	16.6	$109
Refrigeration	1.2	17.8	$210
DX Tune Up/ Advanced Diagnostics	2.2	20.0	$318
Water Heating	0.2	20.2	$344
Ventilation	0.5	20.6	$481

*Measures incremental to Phase II are highlighted.

FORECASTS OF ACHIEVABLE PROGRAM POTENTIAL SCENARIOS

In this section we present our overall achievable potential forecasts. In contrast to technical and economic potential estimates, achievable potential estimates take into account market and other factors that affect adoption of efficiency measures. Our method of estimating measure adoption takes into account market barriers and reflects actual consumer and business implicit discount rates (see Section 2 for this methodology). **Achievable potential** refers to the amount of savings that would occur in response to one or more specific program interventions. *Net* savings associated with program potential are savings that are projected beyond those that would occur naturally in the absence of any market intervention. Because achievable potential will vary significantly as a function of the specific type and degree of intervention applied, we develop estimates for multiple scenarios. Peak demand and energy savings forecasts were developed for four possible program-funding scenarios. These scenarios were designed to address market changes to increasing incentive levels (as a percent of incremental measure cost) and marketing levels. The scenarios include:

1. A Low efficiency funding scenario with rebates covering 33% of incremental measure costs and base marketing levels;

2. A Moderate efficiency funding scenario with rebates covering 50% of incremental measure costs and slightly higher marketing expenditures;
3. A High efficiency funding scenario with rebates ramping up over time to 75% of incremental measure costs and significantly increased marketing expenditures; and
4. A Maximum Achievable scenario with rebates ramping up over time to cover 100% of incremental measure costs and marketing expenditures sufficient to create maximum market awareness. Maximum achievable efficiency potential is the amount of economic potential that could be achieved over time under the most aggressive program scenario possible.[17]

We forecasted program energy and peak demand savings under each achievable potential scenario for a 10-year period beginning in 2004. Our estimates of achievable potentials and their affect on forecasted demand and energy consumption are shown in Exhibits 4-15 through 4-17 for both Phase II and Phase I results.

As shown in Exhibit 4-15a, by 2013 *net*[18] peak demand savings are projected to be roughly 42 MW under Low, 72 MW under Moderate, 116 MW under High, and 190 MW under Maximum efficiency spending scenarios. In Exhibit 4-16a, we show projected net annual energy savings of 195 GWh under Low, 298 GWh under Moderate, 489 under High, and 681 GWh under Maximum efficiency futures.

Exhibit 17 provides a breakdown of Year-10 peak demand reduction potential by scenario, sector and vintage for both Phase II and Phase I results. As shown, the residential and commercial existing construction market segments account for most of the potential for the Low and Moderate scenarios. The residential existing segment accounts for an increasing share of potential impacts for the higher funding scenarios. Exhibits 4-18 and 4-19 summarize the total ten-year results for all funding scenarios for both phases of results. Exhibit 4-18 juxtaposes the total program benefits - based on the cumulative avoided costs associated with each scenario - with a breakout of the various cost components. Exhibit 4-19 provides the total ten-year program spending and forecasted achievable potential estimates by program scenario, sector and vintage. All of the funding scenarios are cost effective based on the TRC test. The TRC benefit-cost ratios are 1.7, 1.6, 1.5, and 1.4 for the Low, Moderate, High, Maximum Achievable scenarios, respectively.

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[17] Experience with efficiency programs shows that maximum achievable potential for voluntary programs will always be less than economic potential for two key reasons. First, even if 100 percent of the extra costs to customers of purchasing an energy-efficient product are paid for through program financial incentives such as rebates, not all customers will agree to install the efficient product. Second, delivering programs to customers requires additional expenditures for administration and marketing beyond the costs of the measures themselves. These added program costs reduce the amount of potential that it is economic to acquire. Policy makers should consider a combination of standards that follow behind strong voluntary programs as a more optimal efficiency acquisition strategy than trying to achieve maximum potential through voluntary programs only.

[18] Again, *net* refers throughout this chapter to savings beyond those estimated to be naturally occurring, that is, from customer adoptions that would occur in the absence of any programs or new standards.

Exhibit 4-15a
Phase II Net Peak Demand Reduction Potential by Funding Scenario, 10-Year Forecast

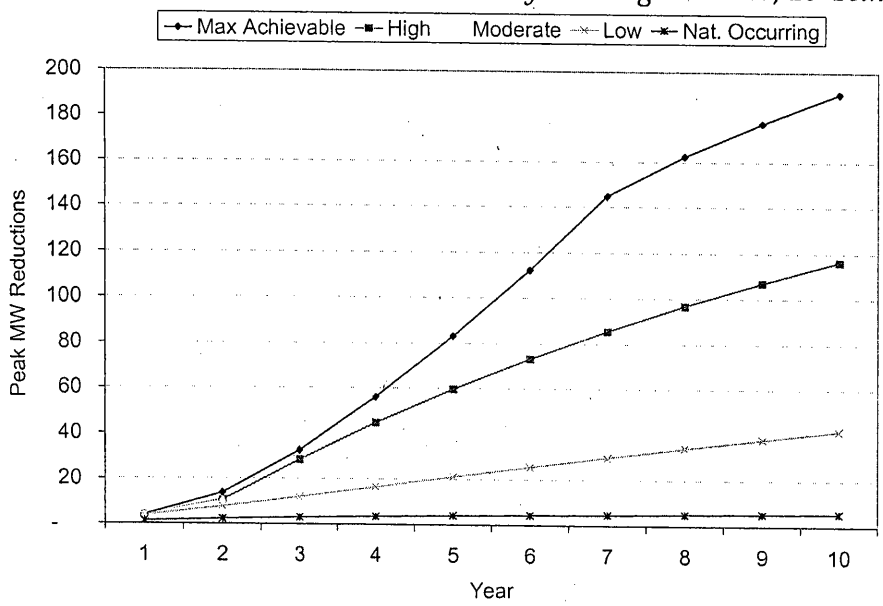

Exhibit 4-15b
Phase I Net Peak Demand Reduction Potential by Funding Scenario, 10-Year Forecast

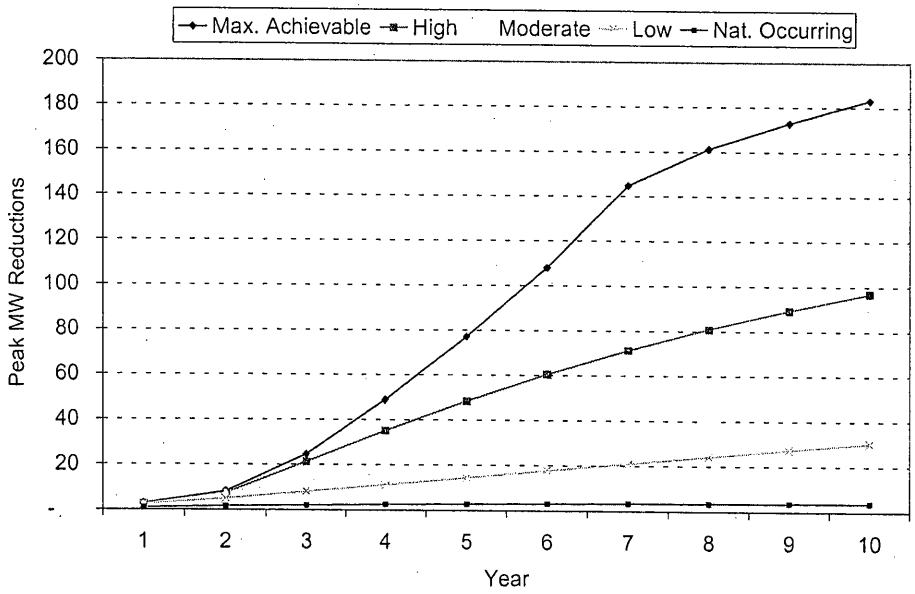

Exhibit 4-16a
Phase II Net Energy Savings Potential by Funding Scenario, 10-Year Forecast

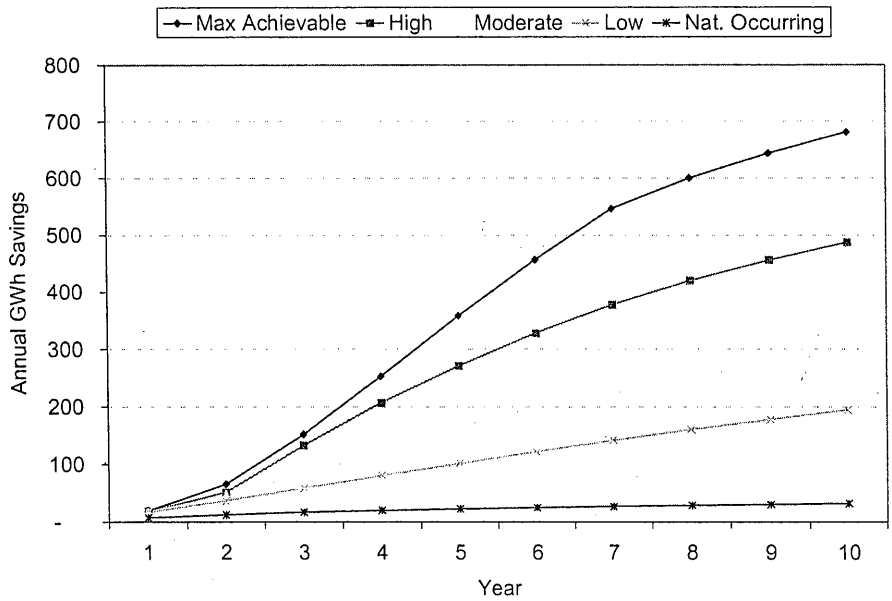

Exhibit 4-16
Phase II Net Energy Savings Potential by Funding Scenario, 10-Year Forecast

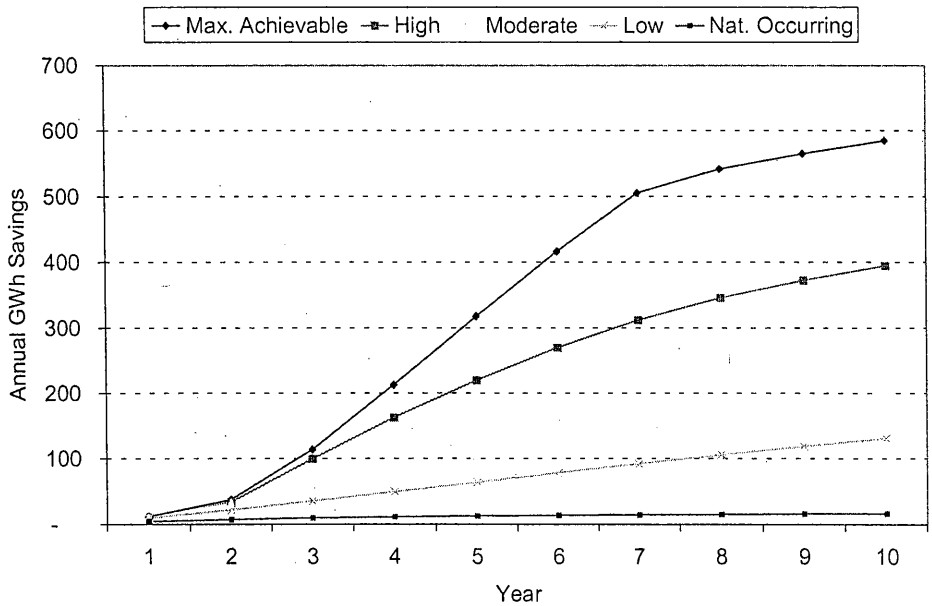

Exhibit 4-17
Phase II Net Peak Demand Reduction Potential by Funding Scenario and Segment - Year 10

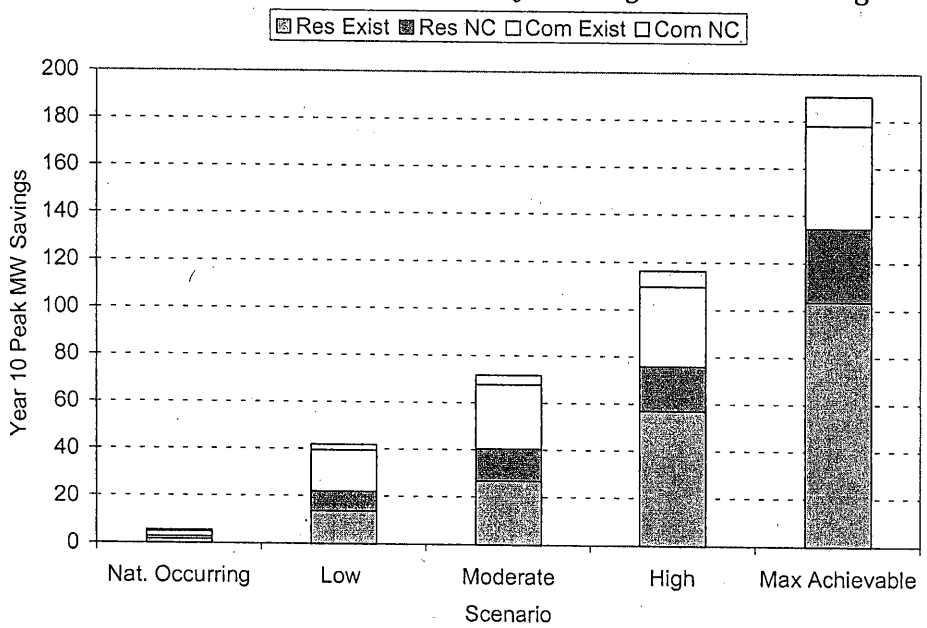

Exhibit 4-17b
Phase I Net Peak Demand Reduction Potential by Funding Scenario and Segment - Year 10

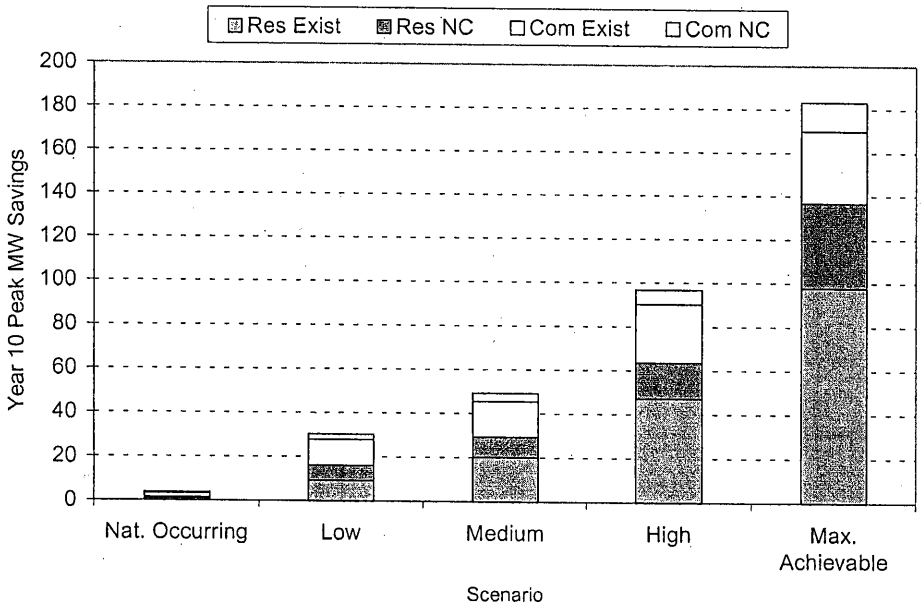

Exhibit 4-19a
Summary of Phase II Net Achievable Energy Efficiency Potential Forecasts – Year 10 (2013) Impacts

Sector/Vintage	Scenario	Cumulative 10-Year Program Costs ($ Milions)*	Net MW Reductions by 2013	Net Annual GWh Savings by 2013	Total Resource Cost Ratio
Residential Existing	Low	$16	14	82	1.6
	Moderate	$31	27	126	1.5
	High	$78	57	249	1.4
	Maximum	$148	103	348	1.3
Residential New Construction	Low	$6	8	23	2.0
	Moderate	$12	14	34	1.8
	High	$21	19	56	1.7
	Maximum	$38	31	89	1.6
Commercial Existing	Low	$15	17	83	1.7
	Moderate	$24	27	126	1.7
	High	$37	34	159	1.6
	Maximum	$60	43	202	1.5
Commercial New Construction	Low	$3	2	7	2.0
	Moderate	$6	4	12	1.7
	High	$12	7	23	1.5
	Maximum	$28	12	42	1.2
Total	Low	$39	42	195	1.8
	Moderate	$73	72	298	1.7
	High	$149	116	488	1.6
	Maximum	$274	190	681	1.3

*Program costs discounted for inflation at 3 percent per year.

Exhibit 4-19b
Summary of Phase I Net Achievable Energy Efficiency Potential Forecasts – Year 10 (2013) Impacts

Sector/Vintage	Scenario	Cumulative 10-Year Program Costs ($ Milions)*	Net MW Reductions by 2013	Net Annual GWh Savings by 2013	Total Resource Cost Ratio
Residential Existing	Low	$12	9	49	1.3
	Moderate	$25	20	86	1.3
	High	$68	47	200	1.3
	Maximum	$139	98	295	1.2
Residential New Construction	Low	$4	7	12	1.9
	Moderate	$6	9	17	1.9
	High	$14	16	33	1.7
	Maximum	$46	39	83	1.5
Commercial Existing	Low	$12	12	65	1.4
	Moderate	$18	16	88	1.4
	High	$36	27	144	1.4
	Maximum	$48	33	173	1.4
Commercial New Construction	Low	$3	2	6	1.7
	Moderate	$5	4	10	1.6
	High	$10	7	17	1.5
	Maximum	$21	13	34	1.4
Total	Low	$31	30	131	1.4
	Moderate	$54	49	201	1.4
	High	$128	97	395	1.4
	Maximum	$255	183	584	1.3

*Program costs discounted for inflation at 3 percent per year.