Cost-Effective Energy Efficiency Opportunities in the Utah Economy

Energy Efficiency Overview

Utah has some 2 million residents and over 800,000 electricity customers. The total annual energy expenditures of these households, businesses, and industries exceed $3 billion. Over one-third of energy expenditures goes to purchasing 20,000 GWh of retail electric energy. In the last decade the population and economy of Utah have been growing faster than the national average. During this time our state's population has increased 29.6% (based on Census 2000) and economic output, as measured by gross state product, has risen 85%. Predictably, demand for electricity and other energy has also been keeping pace, increasing by 34%.

Utah electricity consumers have long been the beneficiaries of low-cost electricity supply, anchored in an abundance of local coal for power generation and transmission access to inexpensive hydroelectric resources from the Pacific Northwest and the desert Southwest. Still, strong increases in near-term wholesale power prices throughout 2000 and the winter of 2001 focused public attention on the need for a long-run energy efficiency and energy conservation policy.

Improving the efficiency of energy use can be viewed as one way to simultaneously address several important public policy issues. Improving efficiency saves money and increases disposable income of consumers. Utah businesses benefit from energy efficiency investments through increased economic productivity and competitiveness. The environment benefits by reduced air emissions, water and land use. Using energy efficiently can also extend the supply life of limited energy resources and reduce the need for expensive new electricity generation, transmission and distribution infrastructure.

A study commissioned by the Utah Public Service Commission's Energy Efficiency Advisory Group identified a significant level of energy efficiency potential in Utah's electricity sector. The report, prepared by the Tellus Institute, evaluated demand side management (DSM) potential and the benefit and costs ratios for various cost-effective DSM measures in Utah.[1]

For purposes of the study, three DSM alternatives were evaluated: energy efficiency, energy conservation and load management. Energy efficiency involves investment in technological measures or practices that reduce the use of energy yet deliver an equivalent or improved level of service. Energy efficiency measures slow overall load growth and the need to build new and expensive generating plants or purchase power on the wholesale market. Conservation, on the other hand, reduces the use of electricity but less service is provided. Conservation can be achieved through either public appeals via public service announcements or other types of persuasion to curtail usage voluntarily, or through price increases where consumers reduce usage to avoid higher expenditures on the service. For short-term load reduction, conservation is generally the better tool because it requires little or no lead-time to implement and achieve results.

Load management changes the timing of electricity consumption. There are three general types of load management: peak shaving, valley filling, and load shifting. Peak shaving reduces peak usage, while valley filling increases demand in off-peak periods. Load shifting moves usage from peak times to off-peak times.

In addition to the basic economic comparison – benefits vs. costs – the report evaluated the cumulative impact upon average electricity rates and estimated net reductions in air emissions from the measures included above.

Tellus Report Findings

The Tellus Institute study concluded that there exists a substantial, untapped potential for achieving cost-effective energy efficiency in the Utah economy.[2] Statewide projected electricity savings from the DSM measures were calculated for the period 2001 through 2019. Reductions in summer peak demand are projected to grow to 682 megawatts (MW) in 2006 and then decline very gradually thereafter. These results assume that the load management and combined heat and power (CHP) measures would continue in place indefinitely, while the energy efficiency measures would expire at the end of their normal lifetimes.[3] The demand reductions are a product of load management, energy efficiency, and CHP measures combined for each customer class.[4]

Annual energy savings are projected to increase to 2,309 gigawatthours (GWh) in 2006 then decline gradually. Cumulative projected energy savings through 2019 are 34,913 GWh. Projected savings from efficiency options installed during 2001-2006 would extend for several years after the period.

The cumulative present value of projected electricity savings was estimated to be $1.65 billion (2000 dollars). With total estimated resource costs of $367 million, the net projected benefit is $1.28 billion and the benefit-cost (B-C) ratio of all DSM measures was 3.9 to 1. Based on the assumptions used, the analysis showed that each DSM option was cost-effective, with B-C ratios ranging from 2.4 for commercial/institutional efficient cooling up to 10.1 for residential efficient cooling. In addition, all of the measures within each DSM option were found to be cost-effective, with B-C ratios ranging from 1.5 for industrial, premium efficient motors in lieu of rewinding to 40.0 for residential evaporative cooling in place of refrigerated central air conditioning.

The Tellus report also estimated the long-run impact of the DSM measures on average Utah electricity rates. And again, the results are positive. Taken as a whole, investment in the energy efficiency and load

[1] Demand side management (DSM) is the term commonly used when referring to energy efficiency or energy conservation.

[2] Projected resource value was measured by future electric energy and capacity costs that can be avoided through demand-side measures. Projected resource costs include the incremental technology cost of demand-side measures, the costs for administration of programs to increase the market penetration of measures, financial incentives used to induce customer participation in programs, and any additional resources used by the electric DSM measures (water or gas).

[3] In fact, energy-efficiency measures may be replaced with new measures of equal or higher efficiency, so the tapering off shown in the graphs may not occur in practice.

[4] Load management measures are specifically designed to provide incentives and enable electricity users to reduce their electricity use during periods of the highest electricity demand, including the time of maximum peak demand. Energy efficiency measures reduce electricity use throughout the periods of time when customers use the affected equipment. The contribution of efficiency measures to peak demand reductions is a by-product of their ongoing lower levels of electricity usage. The reduction in demand from the CHP measures arises from the fact that they are producing electricity for use in the host facilities instead of obtaining power through the electric grid. The CHP measures in the portfolio were sized to meet electricity needs in their host facilities and not sized to supply power to the electric grid.

management measures were estimated to reduce average electricity rates. The cumulative net reduction to rates, after utility DSM investment was accounted for was estimated at $110 million.[5] It must be emphasized that rate impact estimates are dependent upon assumptions utilized. Also, the estimates are based on cumulative present value. The year-to-year pattern of rate impacts will vary. DSM typically involves up front expenditures that are designed to produce a stream of savings over subsequent years. Under ordinary circumstances, this creates rate impacts that are less favorable in the early years than they are after the investment period. However, the effect of the extraordinarily high wholesale price levels in Western markets at the time of this report was not included in the Tellus analysis. Given the level of electricity prices experienced in Western wholesale markets in 2000-2001, the near-term savings from DSM investments could provide net benefits to rate levels in early years as well as later years.

Secondary Economic Impact of DSM Expenditures

Because cost-effective DSM should reduce total customer bills for electricity, it also tends to free up net disposable income for other uses. In studies of the impact of DSM on state economies and net employment, it has uniformly been found to be a net plus for the economy and employment. No study of these indirect economic effects was conducted for the Tellus report. But the existence of these indirect, economic "externality" benefits from the prior studies should be noted.

Several reports have shown that an investment in energy efficiency can have a significant positive impact on local per capita income, jobs, and total state earnings. A study prepared by the RAND Corporation (Bernstein et al. 2000) for the California Energy Commission showed energy efficiency investments in California since 1977 have provided economic benefits to the state economy equivalent to $875-$1,300 per capita (1998 dollars), and reduced the energy expenditure burden on low-income households. An economic analysis prepared by the Utah Office of Energy and Resource Planning assessing the impact of a $3 million investment in energy efficiency measures in state buildings found that the investment created 107 new jobs and increased total earnings in Utah's economy by $2.6 million.

Energy efficiency creates some additional direct benefits to business customers. For example, energy efficiency investments can be structured to create instant positive cash flow to the owner. This cash can be reinvested at the discretion of the business in pursuit of increased efficiency or increased output or increased profits. These investments tend to stay closer to the local economy than money spent purchasing energy from out of state suppliers.

The return on energy efficiency investments to a customer may be comparable to, or higher than, investments in a customer's core business opportunities. If higher, there is a greater net return that results in greater economic activity.

Environmental Benefits of DSM Investment

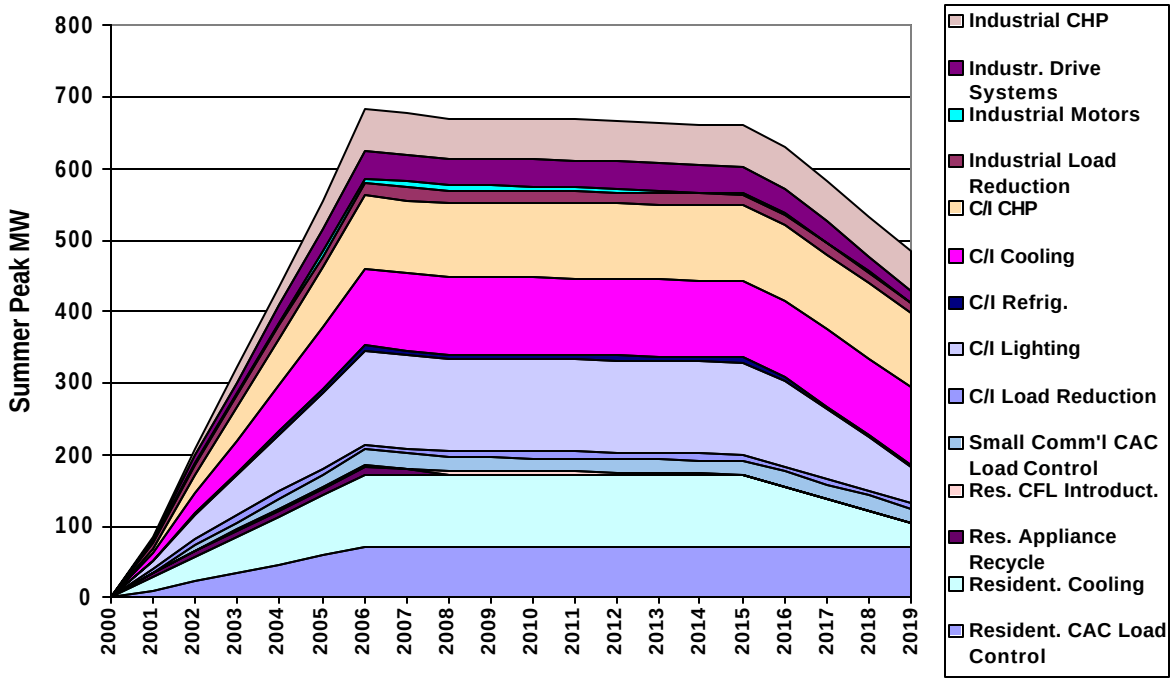
Energy efficiency options tend to reduce the amount of air pollutants emitted from power plants, including sulfur oxide (SOx) and nitrogen oxide (NOx) - emissions that are of particular concern from a health standpoint. The projected reductions are calculated relative to the new, efficient gas-fired generation units that are used as the basis of the study. Although the gas-fired CHP systems included in the portfolio would produce emissions of their own, there is a net reduction in emissions because the overall efficiency of electricity generation and on-site heating is increased through CHP. The total cumulative reductions in emissions from the DSM portfolio for the period through 2019 are estimated in the range of 428 to 670 tons of SOx and 12,500 – 19,600 tons of NOx.

In addition, the efficiency and CHP options would tend to yield net reductions in emissions of carbon dioxide (CO_2), the chief gas that is the subject of national and international discussions about how to avert climate change. Total cumulative portfolio reductions in CO_2 are estimated in the range of 13.9 – 21.8 million tons.

Emissions savings such as these are among the "externality" benefits of DSM that are not reflected in direct economic savings summarized above. Potential reductions in the impacts on land use and on water resources, due to electricity production and consumption, are among the other positive environmental externalities of DSM.

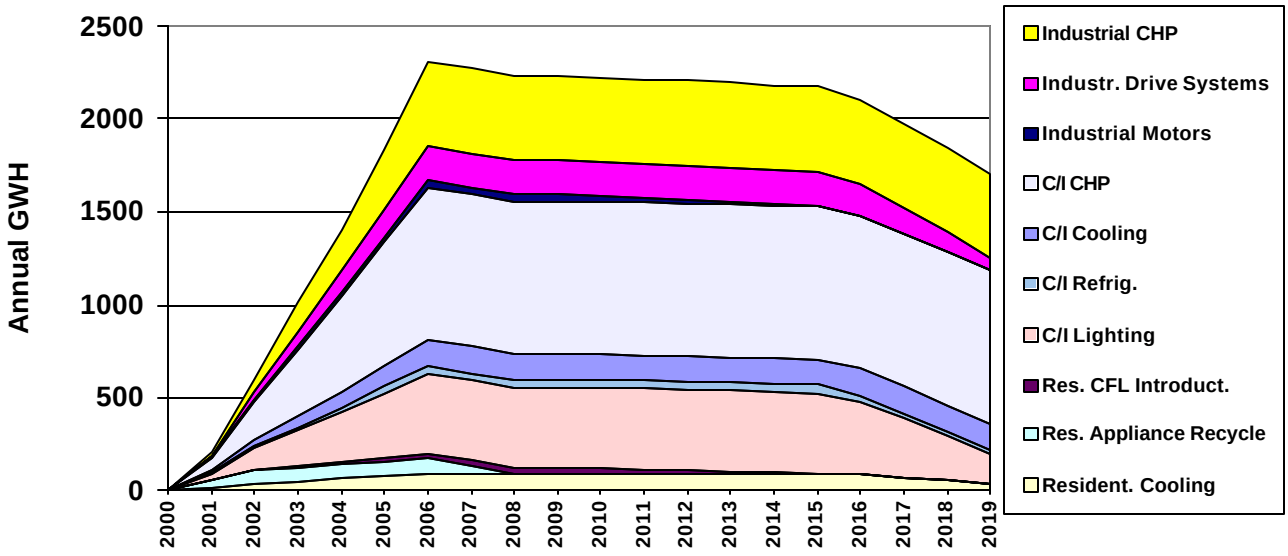
[5] The Tellus study predicted that two residential options, efficient lighting and appliance recycling, would tend to increase average rates due to the resulting reductions in electric utility revenues and the projected levels of market penetration. However, the residential options as a whole, inclusive of these two, are projected to reduce average rates. Other options that are projected to increase rates are commercial efficient refrigeration, efficient industrial motors, and commercial and institutional combined heat and power.

Figure 63
Peak Demand Savings for Illustrative Utah DSM Programs



Source: Tellus Institute

Figure 64
Energy Savings for Illustrative Utah DSM Programs



Source: Tellus Institute

Table 96
Demand Side Management (DSM) Measures by End-Use Sector

Residential Measures	Commercial/Institutional Measures	Industrial Measures
Load control of air conditioners	Load control of air conditioners	Load management
Efficient cooling equipment	Load management	Efficient motors
Residential lighting	Efficient cooling equipment and systems	Motor drive improvements (fans, pumps, compressed air)
Appliance recycling	Commercial lighting Efficient refrigeration Combined heat & power	Combined heat & power

Source: Tellus Institute

Table 97
Benefit-Cost Results for DSM Programs and Measures

RESIDENTIAL PROGRAMS

Programs	Major Measures	TRC B-C Ratio	RIM B-C Ratio
Load Control	Control of central air conditioners (CACs)	6.4	2.2
Efficient Cooling		10.1	2.6
	Efficient CACs	3	2.5
	Evaporative Cooling	40	2.7
Residential Lighting	CFLs	6.3	-1
Appliance Recycling	Refrigerator/freezer pickup	2.8	-0.2

COMMERCIAL/INSTITUTIONAL PROGRAMS

Programs	Major Measures	TRC B-C Ratio	RIM B-C Ratio
Load Control	Control of CACs	6.8	4.9
Load Management	Customer-specific Load Response	5.8	2.9
Efficient Cooling		2.4	2.5
	Medium Package AC System	5.7	5.3
	Large Chiller System	1.6	1.5
	Indirect/Direct Evaporative Cooling (IDDEC) – medium system	1.7	1.8
	IDDEC – medium/large system	3	3.2
	IDDEC – large system	1.6	1.8
Commercial Lighting		3.5	1.6
	Advanced Measures	3	1.3
	T8/Electronic Ballast & Similar	6.8	3
Efficient Refrigeration		4.6	-1.7
	Higher Cost Technologies	3.2	-1.2
	Lower Cost Technologies	6	-2.3
Combined Heat & Power		5.3	-10.7
(All CHP systems are gas-fired)	100 kW Diesel	6.1	-12
	30 kW Micro-Turbine	4.4	-11
	800 kW Diesel Replacing Electric Boiler	6.1	-11.9
	800 kW Diesel Replacing Gas Boiler	2.1	-5.7

INDUSTRIAL PROGRAMS

Programs	Major Measures	TRC B-C Ratio	RIM B-C Ratio
Load Management	Customer-specific Load Responses	5.8	2.9
Efficient Motors		4.4	4.5
	Motor Downsizing	8.2	7.4
	Premium Efficiency Motors in Lieu of Rewinding	1.5	1.5
	Premium Replacement Motors	5	5.1
Motor Drive Improvements		4.9	-0.1
	Compressed Air System Measures	10.6	-0.1
	Fan System Measures	10.6	-0.1
	Pump System Measures	3.6	0
Combined Heat & Power		2.5	3.1
(All CHP systems are gas-fired and	10 MW Combustion Turbine (CT)	2.8	2.9
assumed to replace natural gas boilers)	3 MW Diesel	2.4	3.5
	800 kW Diesel	2.1	3.2

Source: Tellus Institute