UTAH ENERGY EFFICIENCY STRATEGY: POLICY OPTIONS

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Utah Energy Efficiency Strategy: Policy Options

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Preface and Acknowledgements

The Utah Energy Efficiency Strategy was prepared be a team of researchers and analysts led by Howard Geller, Executive Director of the Southwest Energy Efficiency Project (SWEEP). The co-authors of the Strategy are Sara Baldwin, Kevin Emerson, and Sarah Wright of Utah Clean Energy, Therese Langer of the American Council for an Energy-Efficient Economy, and Patti Case of ETC Group, LLC. Editorial assistance was provided by Mark Ruzzin of SWEEP.

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Executive Summary

Governor Jon Huntsman announced on April 26, 2006 a goal of increasing energy efficiency in the state of Utah 20 percent by 2015. The goal covers all sectors and applies to all forms of energy use in the state, including electricity, natural gas, gasoline, and other petroleum products. It is intended to make Utah one of the nation's most energy-efficient states, thereby lowering energy bills paid by consumers, enhancing energy security and reliability, improving business profitability and competitiveness, and reducing air pollutants and greenhouse gas emissions.

In order to help the state achieve the energy efficiency goal, the Governor's Office invited the Southwest Energy Efficiency Project (SWEEP) and Utah Clean Energy (UCE) to prepare a Utah Energy Efficiency Strategy, in collaboration with state officials and other stakeholders. The primary objectives of the strategy are to examine the feasibility of achieving the goal for different forms of energy, develop and evaluate specific options for increasing energy efficiency in Utah, and estimate the economic and environmental impacts of achieving the goal.

The Utah Energy Efficiency Strategy contains 23 major policies, programs, or initiatives that could be implemented in order to accelerate energy efficiency improvements in the state and contribute to achieving the energy efficiency goal. The policies will save electricity, natural gas, motor vehicle fuels, and other petroleum products. These energy sources represent about 85 percent of primary energy use in the state (excluding energy used as an industrial feedstock). We do not consider options for increasing the efficiency of jet fuel use, LPG use, or coal used directly by industry.

Methodology

The methodology begins with a definition of a 20 percent improvement in energy efficiency by 2015. An increase in energy efficiency of 20 percent by 2015 is equivalent to a 16.7 percent (1 – 1/1.20) reduction in projected baseline energy use that year. A 20 percent increase in energy efficiency does not translate to a 20 percent reduction in energy use, in the same manner that a 100 percent increase in energy efficiency does not translate to a 100 percent reduction in energy use (a doubling of energy efficiency represents a 50 percent reduction in energy use).

The baseline scenario is a projection of energy use in the future given expected population and economic growth, but without assuming adoption of new energy efficiency measures and initiatives. Our baseline assumptions, derived from utility forecasts and other sources, include growth in electricity consumption of 3.2 percent per year, growth in natural gas consumption of 1.5 percent per year, and growth in gasoline and diesel consumption combined of 2.0 percent per year during 2006-2020.

We examine the potential of each option in the strategy, and the combination of options, to reduce baseline energy demand. We include the effects of current policies and programs, policies such as utility demand-side management programs and building energy codes, in estimating energy savings potential in order to give credit for ongoing energy efficiency initiatives. We also project energy use in the baseline scenario and the energy savings from each of our options through 2020. In some cases, the energy savings are moderate by 2015 but increase significantly between 2015 and 2020.

We have taken steps to avoid double counting of energy savings among the various options. This is achieved by reducing the savings potential attributed to certain options that are examined after other overlapping options have been assessed; e.g., we reduce the savings associated with building energy codes, tax credits, and education and training options due to their overlapping with utility demand-side management (DSM) options. In some cases, such as in the transportation area, adjustments are made when summing energy savings in order to avoid overstating energy savings potential.

For the economic analysis, all values are presented in 2006 dollars, with costs and benefits after 2006 discounted using a five percent annual discount rate. Energy prices are assumed to remain constant at their levels in 2006, other than increasing with inflation; i.e., energy prices are assumed to remain constant in real dollars. This is a conservative assumption given that energy prices are rising due to increasing fuel costs, increasing construction costs, and tightening environmental standards. Also, net economic benefits are considered over the lifetime of energy efficiency measures installed during 2006-2015; i.e., we include the full energy savings of measures installed in the latter part of this time period but with discounting the economic value of future savings.

For the environmental impacts analysis, we use the average emissions rates of “avoided” new fossil fuel power plants in the Rocky Mountain region in response to stepped-up energy efficiency efforts. These rates were calculated in another study that made use of the Energy Information Administration’s National Energy Modeling System (NEMS) model to determine future power plant emissions in reference and high-efficiency scenarios. Water savings from reduced operation of power plants is based on the average water consumption rates of new coal-fired and natural gas-fired power plants. This value is 0.5 gallons of water savings per kWh of avoided electricity generation.

Options

The energy efficiency strategy contains the following 23 options, grouped by category. The options are a mixture of educational, financing, incentive, and regulatory policies intended to stimulate additional cost-effective energy efficiency improvements on a large scale. For each option, we provide background discussion, a description of the specific proposal, estimated energy savings in 2015 and 2020, cost and cost effectiveness, estimated reductions in criteria pollutant and carbon dioxide emissions, other environmental and social impacts, and a discussion of political considerations. In addition, we include our recommended priority (high, medium, or low) for each option.

Utility Demand-Side Management and Pricing Policies

Option 1: Adopt Energy Savings Standards or Targets for Electric Utility Demand-Side Management Programs – savings standards or targets for Rocky Mountain Power, ramping up over four years to savings of approximately 1 percent of projected electricity sales from DSM programs each year.

Option 2: Adopt Decoupling and/or Shareholder Incentives to Stimulate Greater Utility Support for Energy Efficiency Improvements – either decoupling or performance-based incentives to encourage Rocky Mountain Power to maximize the amount of cost-effective energy savings it achieves.

Option 3: Adopt Innovative Electricity Rates in Order to Stimulate Greater Electricity Conservation and Peak Demand Reduction – critical peak pricing or real-time pricing for residential customers with central air conditioning.

Option 4: Expand Natural Gas Utility Energy Efficiency Programs and Establish Energy Savings Targets for these Programs – expansion of natural gas DSM programs implemented by Questar Gas Company in order to cut total gas sales at least 5 percent by 2015 and nearly 9 percent by 2020.

Buildings and Appliances Policies

Option 5: Upgrade Building Energy Codes and Provide Funding for Code Training and Enforcement Activities – upgrade of the statewide building energy code every three years, considering innovative features of energy codes adopted in other states; provision of training to builders, contractors, and local code officials.

Option 6: Adopt Residential Energy Conservation Ordinances (RECOs) to Upgrade the Energy Efficiency of Existing Homes – energy efficiency requirements at the time a home is sold, beginning with a RECO for rental property in Salt Lake City.

Option 7: Adopt Lamp and Appliance Efficiency Standards for Products Not Covered by Federal Standards – efficiency standards on general service lamps and four other products not covered by federal standards.

Option 8: Expand Low-Income Home Weatherization – state funding to double the number of low-income homes weatherized each year and distribution of 40,000 energy efficiency kits to low-income households.

Option 9: Adopt State Tax Credits for Highly-Efficient New Homes, Commercial Buildings, and Heating and Cooling Equipment – state tax credits for new homes, heating and cooling equipment, and commercial buildings that qualify for the federal energy efficiency tax credit, as well as for modern evaporative cooling systems.

Industrial Policies

Option 10: Undertake an Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions – an Industry Challenge and Recognition Program to encourage industrial firms to set voluntarily energy intensity reduction goals and to commit to implementing cost-effective energy efficiency projects at a higher rate than in the past.

Option 11: Remove Barriers and Provide Incentives to Stimulate Greater Adoption of Combined Heat and Power (CHP) Systems – appropriate environmental regulations, utility interconnection policies, and utility tariffs; promotion of fuels other than natural gas for fueling CHP systems; and reasonable financial incentives for high performance CHP systems.

Public Sector Policies

Option 12: Adopt Energy Savings Requirements for State Agencies – require state agencies, including state universities and colleges, to reduce energy use per unit of floor area at least 20 percent by 2015, and technical assistance to help agencies achieve the requirements.

Option 13: Energy Efficiency for Local Government and K-12 Schools, Including the Expansion of Utah's Revolving Loan Fund – expansion of the Revolving Loan Fund, promotion of performance contracting, and other efforts to reduce energy use per unit of floor in local government and K-12 schools at least 15 percent by 2015.

Option 14: Implement Energy Efficiency Education in K-12 Schools – incorporation of energy efficiency and conservation themes into curriculum and energy education blocks taught to K-12 students.

Transportation Policies

Option 15: Adopt Clean Car Standards for New Cars and Light Trucks – the greenhouse gas emissions standards for new cars and light trucks already adopted by eleven other states.

Option 16: Adopt Incentives to Stimulate Purchase of More Efficient Cars and Light Trucks – fees and rebates (a so-called feebate program) for new cars and light trucks based on the rated fuel consumption of each new vehicle.

Option 17: Adopt Pay-As-You-Drive (PAYD) Auto Insurance – payment of a portion of auto insurance based on the number of miles driven each year, starting with a three-year pilot program followed by mandatory phase-in until PAYD insurance is universal.

Option 18: Reduce the Rate of Growth in Vehicle-Miles Traveled – keep the percent growth in vehicle-miles traveled (VMT) to no more than the percent growth in population through a requirement in the State Transportation Improvement Plan.

Option 19: Improve Enforcement of Highway Speed Limits – better enforce highway speed limits through increased use of radar, lasers, and speed cameras, as well as education.

Option 20: Improve the Efficiency of Heavy-Duty Trucks and the Goods Movement System – low-interest loans to promote the purchase of new trucks or the retrofit of existing trucks with energy efficiency technologies and electrification of truck stops.

Option 21: Replacement Tire Efficiency Standards – require that replacement tires have a rolling resistance no greater than that of tires used on new vehicles.

Cross-Cutting Policies

Option 22: Undertake a Broad-Based Energy Efficiency Public Education Campaign – educate the public regarding energy efficiency and conservation measures through a mass media campaign and other messaging techniques.

Option 23: Increase Energy Efficiency Expertise through Training and Certification – training and certification of energy efficiency professionals through community college, vocational, and other types of courses.

Results

Table ES-1 shows the electricity savings results by option. The options that offer the largest savings potential are expanded electricity DSM programs, enhanced and better enforced building energy codes, state lamp and appliance efficiency standards, and the industrial challenge and recognition program. The total electricity savings potential in 2015, 6,189 GWh per year, represents an 18.0 percent reduction from projected baseline

Table ES-1 – Total Electricity Savings Potential

	Savings Potential (GWh/yr)		
Option	**2010**	**2015**	**2020**
Electricity DSM expansion	894	2,375	4,108
Building code upgrades	214	674	1,391
Lamp and appliance standards	137	1,334	2,137
Industrial challenge	130	615	1,183
Public sector initiatives	169	421	604
Public education	226	393	420
Other	202	377	476
TOTAL	**1,972**	**6,189**	**10,319**

electricity consumption that year. Thus the electricity saving options meet Governor Huntsman's energy efficiency goal. Furthermore, the electricity savings continues to grow rapidly after 2015, reaching 25.7 percent of projected electricity demand in 2020 in the baseline scenario. In addition to the substantial electricity savings, implementing these options would also greatly reduce peak power demand.

Figure ES-1 shows the growth in electricity use during 2005-2020 in the baseline and high efficiency scenarios; i.e., assuming implementation of all electricity savings options. In the baseline scenario, electricity demand grows 3.2 percent per year on average. In the high efficiency scenario, electricity demand growth is limited to 1.2 percent per year on average during 2005-2020. Thus, implementing all of the electricity savings options would not entirely eliminate load growth, but it would reduce it by over 60 percent.

Figure ES-1 – Electricity Consumption by Scenario

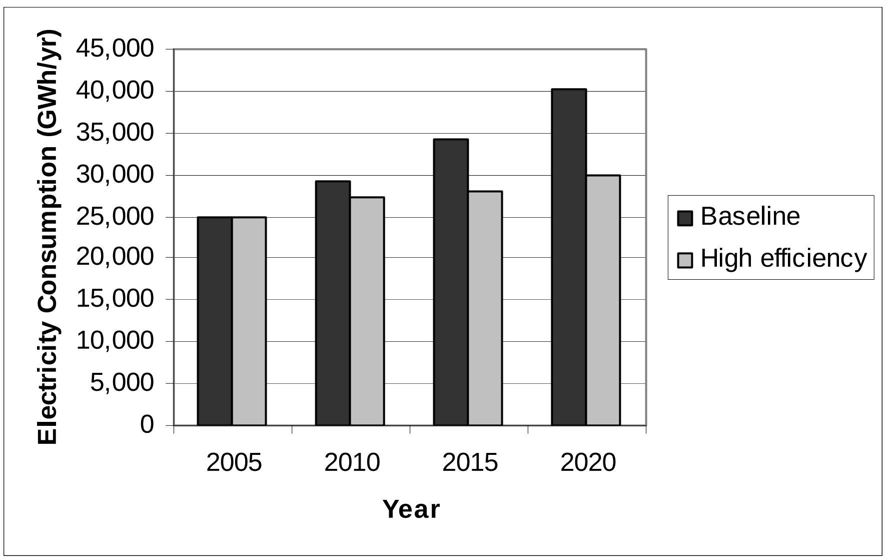


Table ES-2 shows the natural gas savings by option. The options that offer the largest gas savings potential include gas utility DSM programs, building energy codes, and the industrial challenge and recognition program. The total gas savings potential in 2015, 22.2 million decatherms, is equivalent to 14 percent of projected baseline gas consumption for that year. Thus, the natural gas options are not adequate to meet the Governor's goal. However, the gas savings potential continues to grow significantly after 2015, reaching over 22 percent of projected natural gas demand in 2020 in the baseline scenario. The gas savings potential is limited in part by the fact that natural gas use has declined somewhat in recent years due to high gas prices and other factors, meaning that significant efficiency improvements have already occurred.

Table ES-2 – Total Natural Gas Savings Potential

Option	Savings Potential (million decatherms per year)		
	2010	**2015**	**2020**
Gas DSM program expansion	2.33	8.27	14.94
Building code upgrades	1.25	3.74	7.48
Conservation ordinances	0.40	1.20	1.60
Low-income weatherization	0.48	1.28	1.84
Industrial challenge	0.78	3.71	7.25
Public sector initiatives	0.86	2.10	2.96
Public education	1.09	1.75	1.69
Other	0.04	0.14	0.21
TOTAL	**7.23**	**22.19**	**37.97**

Figure ES-2 shows the growth in natural gas use during 2005-2020 in the baseline and high efficiency scenarios. The scenarios do not include natural gas use for electricity generation in the electric utility sector. In the baseline scenario, natural gas consumption increases 1.5 percent per year on average. In the high efficiency scenario, gas demand increases slightly in the early years but then declines in absolute terms. By 2020, total natural gas consumption is slightly below that in 2005. Thus, we estimate that the energy efficiency options are adequate to eliminate growth in natural gas consumption over the medium-term in Utah.

Figure ES-2 – Natural Gas Consumption by Scenario

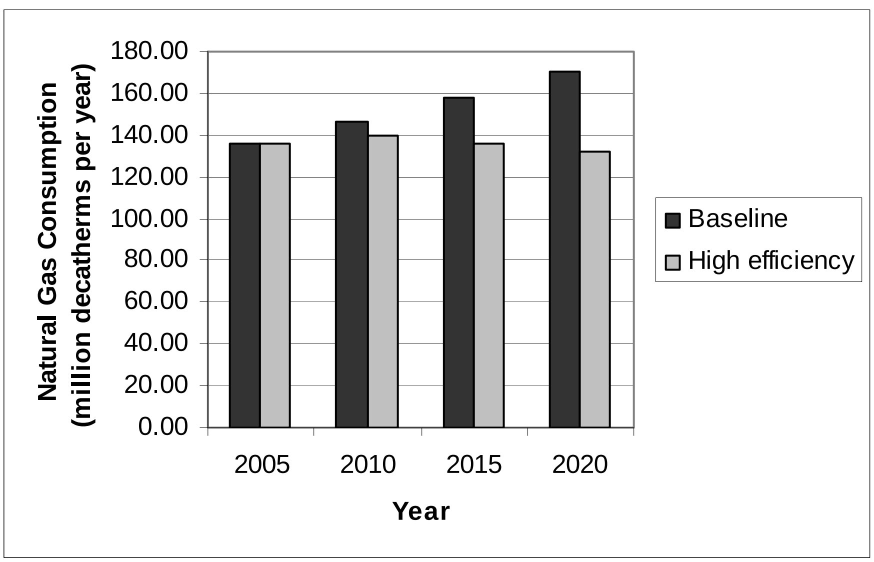


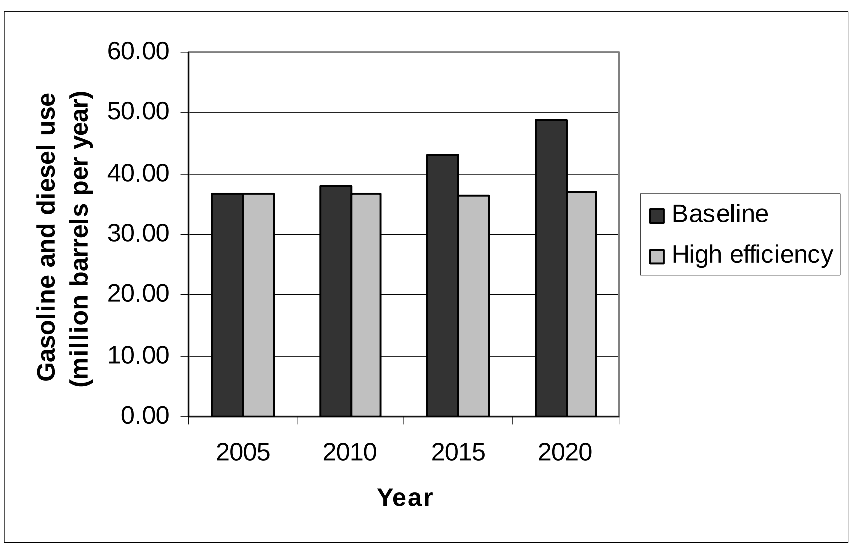
Table ES-3 shows the potential savings of gasoline and diesel fuel. In Chapter VI, each transportation option is analyzed independent of the other options. However, adjustments are made here to consider the gasoline and diesel savings options in combination and avoid double counting of energy savings. The options that offer the largest potential gasoline savings are the clean car standards and pay-as-you-drive insurance. The gasoline savings potential in 2015 represents 18.3 percent of projected gasoline consumption that year in the baseline scenario. Thus, the gasoline savings options in combination surpass the Governor's energy efficiency improvement goal. However, the diesel fuel savings in 2015 represent only about 9 percent of projected diesel fuel use for that year, in the absence of new efficiency initiatives. Taken together, the gasoline and diesel fuel savings in 2015 represent 15.6 percent of projected fuel consumption that year in the baseline scenario. These energy savings values are conservative in that they do not include the upstream savings in petroleum refining and transport.

Table ES-3 – Total Gasoline and Diesel Savings Potential

	Savings Potential (million barrels per year)		
Option	**2010**	**2015**	**2020**
Clean car standards	0.238	2.076	4.586
Feebates	0.164	0.984	1.784
PAYD insurance	0.030	1.503	3.299
Reduce VMT growth	0.110	0.714	1.423
Enforce speed limits	0.621	0.702	0.796
Truck efficiency measures	0.248	0.992	1.439
Replacement tire standards	0.205	0.676	0.742
TOTAL[1]	**1.518**	**6.718**	**11.803**

[1] The totals do not equal the sum of the values in the columns.

Figure ES-3 – Gasoline and Diesel Fuel Use by Scenario



The gasoline and diesel fuel savings continue to grow significantly after 2015, reaching 11.8 million barrels per year in 2020. This savings potential represents over 24 percent of projected gasoline and diesel use that year in the absence of the efficiency initiatives. Figure ES-3 shows the growth in gasoline and diesel fuel use during 2005-2020 in the baseline and high efficiency scenarios. In the baseline scenario, demand for these fuels increases close to two percent per year on average given expected growth in driving and assumptions about vehicle efficiency. In the high-efficiency scenario, demand for these transportation fuels increases only about 0.3 percent per year on average during 2005-2020. Gasoline consumption actually falls but diesel fuel use still rises.

We also examine the overall energy savings from all fuels and options combined by converting fuels and electricity to primary energy units (Table ES-4). In doing so, we account for energy losses in electricity production and delivery. The primary energy values cover only those fuel types considered in this study; i.e., we do not include other forms of energy such as jet fuel or coal consumed by industry. The options combined lead to 128 trillion Btu of primary savings in 2015, a 16.8 percent reduction relative to primary energy use in the baseline scenario. Thus, the 23 options in combination achieve Governor Huntsman's energy efficiency goal at least for the major forms of energy considered in this study. Furthermore, the primary energy savings reach over 217 trillion Btu in 2020, a 25 percent reduction relative to primary energy use in the baseline scenario.

Table ES-4 – Primary Energy Savings Potential

	Primary Energy Consumption or Savings (trillion Btu per year)			
	2005	2010	2015	2020
Baseline Scenario	598.5	669.3	762.0	868.7
High Efficiency Scenario	598.5	631.4	634.0	651.3
Energy use per capita – Baseline Scenario [1]	237.8	236.3	241.1	249.2
Energy use per capita – High Efficiency Scenario [1]	237.8	222.9	200.6	186.8
Savings in High Efficiency Scenario	0.0	37.9	128.0	217.4
Savings as percent of baseline energy use	0.0	5.7	16.8	25.0

[1] The unit is million Btu per capita.

Figure ES-4 shows projected primary energy per capita over time in each scenario. In the baseline scenario, energy use per capita is projected to increase slightly during 2005-2020. But energy use per capita is projected to decrease over 21 percent between 2005 and 2020 in the high efficiency scenario.

Figure ES-4 – Energy Use per Capita by Scenario

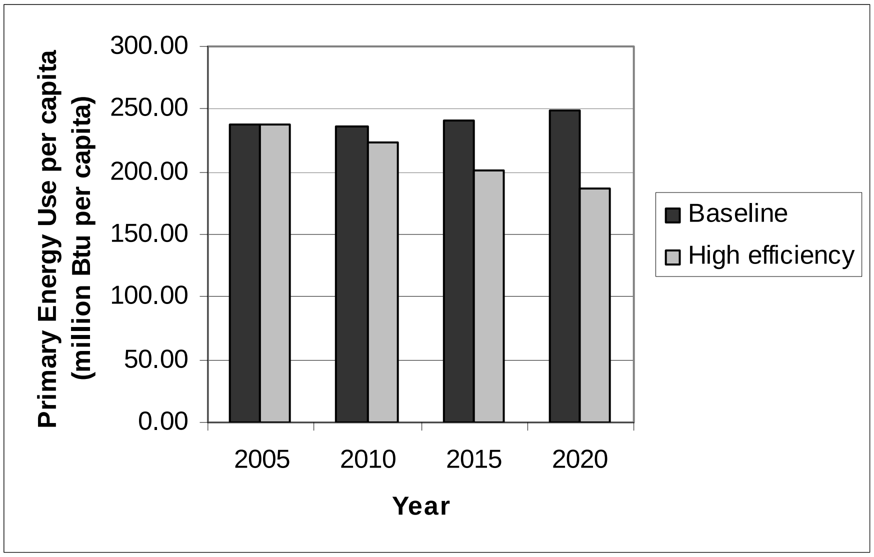
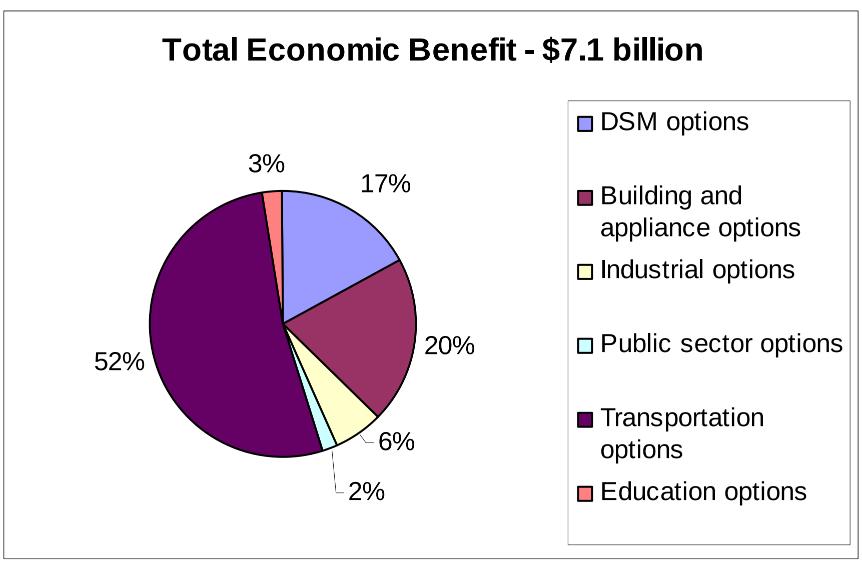


Figure ES-5 shows the estimated net economic benefits of the options where net economic benefits have been quantified. The net economic benefits are the net present value of benefits minus costs for efficiency measures installed during 2006-2015. In total, the estimated net economic benefits of about $7.1 billion is equivalent to saving about $6,700 per household on average, based on the number of households projected in 2015. And again this estimate is conservative in that it assumes energy prices do not rise (in real dollars). In addition, it does not include valuation of non-energy benefits, which in some cases could be substantial.

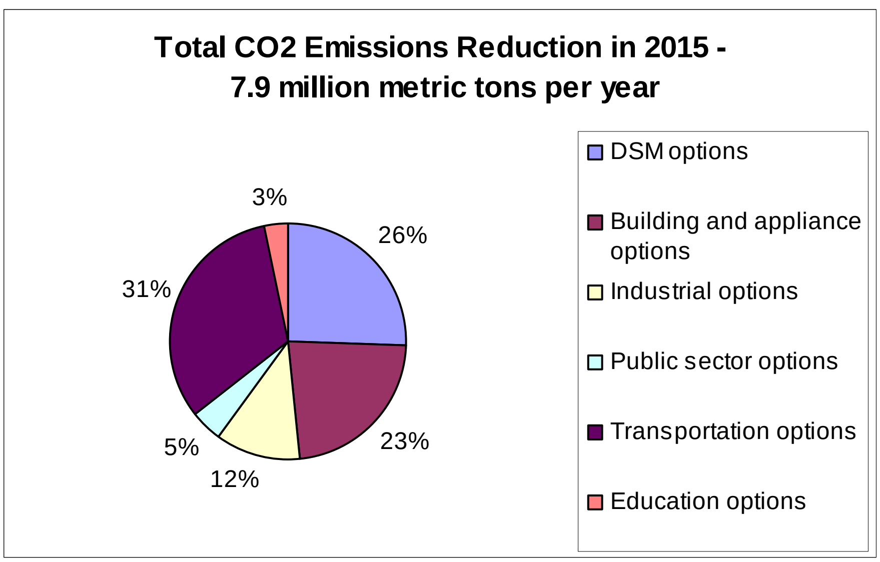
Figure ES-5 – Net Economic Benefit of Energy Efficiency Options



Regarding the potential costs and benefits to Utah's state government, upgrading energy efficiency in state buildings and facilities is the most costly option but also results in a significant net economic benefit to state government. With an investment of about $14 million per year in efficiency measures in state facilities, we estimate net economic benefits of $88 million over the lifetime of efficiency measures implemented during 2007-2015, on a net present value basis. This is more than adequate for offsetting the cost to state government of all the other options combined. These costs to the state are estimated to equal about $9 million per year on average during 2008-2015. The largest item, representing nearly half the total, is the additional state contribution to low-income home weatherization.

Implementing the energy efficiency options would provide substantial environmental benefits within and beyond the state of Utah. Carbon dioxide (CO_2) emissions, the main pollutant contributing to global warming, would be reduced as a result of decreased fossil fuel consumption for power generation, vehicle operation, space heating, and other purposes. Figure ES-6 shows the estimated CO_2 emissions reductions in 2015 by option cluster. Of the total of 7.9 million metric tons of avoided CO_2 emissions that year, transportation options provide about 31 percent, DSM options about 26 percent, and building and appliance options about 23 percent.

Figure ES-6 – Carbon Dioxide Emissions Reductions in 2015 from Implementation of the Energy Efficiency Options



In addition to reduced CO_2 emissions, the options will reduce emissions of other pollutants, including NOx, SO_2, hydrocarbons, and mercury. With respect to options that save electricity, the reduction in these criteria pollutants is somewhat limited by the fact that future electricity savings obviates the need for new power plants—plants that are relatively clean due to the emissions standards on new power plants. With respect to cars and light trucks, increasing energy efficiency through policies such as the clean car standards and feebates should lead to lower tailpipe pollutant emissions. Although it is difficult to quantify these impacts, the energy efficiency options will help to improve air quality in the Salt Lake City basin in particular.

There also will be significant water savings, particularly from options that result in reduced operation of fossil-fuel based power plants, which consume a significant amount of water in their cooling systems. We estimate that the options taken together will lower water consumption in power plants by approximately 3.4 billion gallons per year in 2015 and 5.6 billion gallons per year in 2020. The latter is equivalent to the annual water use of 36,600 average Salt Lake City households.[1] Furthermore, there will be additional water savings from promotion and increased adoption of energy and water-conserving devices such as resource-efficient clothes washers and dishwashers.

Priority

Among the 23 options developed in this report, we suggest that the following 11 options be viewed as high priority by the Governor, the Legislature, the Public Service Commission, and other key decision makers. These options provide the greatest energy savings and consequently the bulk of the economic and environmental benefits.

- Energy Savings Standards or Targets for Electric Utility Demand-Side Management Programs
- Expanded Natural Gas Utility Energy Efficiency Programs and Energy Savings Targets for These Programs
- Upgraded Building Energy Codes and Funding for Code Training and Enforcement
- Lamp and Appliance Efficiency Standards for Products Not Covered by Federal Standards
- Expand Low-income Home Weatherization
- Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions
- Energy Savings Targets for State Agencies
- Clean Car Standards for New Cars and Light Trucks
- Pay-As-You-Drive Auto Insurance

[1] Residential water consumption in Salt Lake City averages about 140 gallons per day per capita, or 153,000 gallons per year per household. See *Water Conservation Master Plan 2004*. Salt Lake City Department of Public Utilities. Salt Lake City, UT.

- Reduce the Rate of Growth in Vehicle-Miles Traveled

- Broad-Based Public Education Campaign

In conclusion, Utah would save a large amount of energy if it adopted the high priority energy efficiency policy options, and possibly other options, described and analyzed in this study. By 2015, electricity use could be reduced by 18 percent, natural gas use by nearly 14 percent, and gasoline use by 18 percent, all in comparison to otherwise forecasted levels of energy use that year. By implementing all of the options, the ambitious energy efficiency goal set by Governor Huntsman could be achieved, at least for the forms of energy considered in this study. Furthermore, the energy savings would continue to grow rapidly during 2016-2020, reaching 25 percent primary energy savings by 2020.

Substantial benefits would result from achieving these levels of energy savings. Consumers and businesses in Utah could save over $7 billion net during the lifetime of efficiency measures implemented through 2015. Water savings would reach at least three billion gallons per year by 2015 and over five billion gallons per year by 2020. Pollutant emissions would be cut as well. Most notably, Utah would significantly reduce its carbon dioxide emissions, thereby contributing to the worldwide effort to limit global warming impacts, and would do so very cost effectively. Local air quality would also improve. Aggressively pursuing greater energy efficiency is truly a winning opportunity for Utah’s citizens, businesses, government, and environment.

Chapter I – Introduction

Energy efficiency is a high priority resource for Utah. Governor Jon Huntsman announced on April 26, 2006 a goal of increasing energy efficiency in the state of Utah 20 percent by 2015. This goal was officially established in Executive Order 2006-0004, issued by Governor Huntsman on May 30, 2006.[2] The goal applies to all forms of energy use in the state, including electricity, natural gas, gasoline, and other petroleum products. It is intended to make Utah one of the nation's most energy-efficient states, thereby lowering energy bills paid by consumers, enhancing energy security and reliability, improving business profitability and competitiveness, and reducing air pollutants and greenhouse gas emissions.[3]

Following the announcement of the goal, an ad hoc group of state officials and other interested parties began to work on the metrics for measuring progress towards achieving the goal. The Working Group reviewed the status of energy efficiency efforts in Utah and made recommendations for further initiatives to advance energy efficiency in the state. Moreover, inspired by the leadership of Governor Huntsman, energy efficiency has received strong support over the past year within the Governor's Office, state government more broadly, and from the major electric and gas utilities operating in Utah.

In order to help the state examine options for achieving the energy efficiency goal, the Governor's Office invited the Southwest Energy Efficiency Project (SWEEP) and Utah Clean Energy (UCE) to prepare a state energy efficiency strategy. The primary objectives of the strategy are to explore what could be done to achieve the Governor's goal, examine the feasibility of achieving the goal for different types of energy, and estimate what the economic and environmental impacts of achieving (or approaching) the goal would be.

The Utah Energy Efficiency Strategy contains 23 major policies, programs, or initiatives that could be implemented in order to accelerate energy efficiency improvements in the state and achieve the goal where possible. The policies will save electricity, natural gas, motor vehicle fuels, and other petroleum products. These energy sources represent a large majority of overall energy use in the state (excluding energy used as an industrial feedstock). However, we do not consider options for increasing the efficiency of a few forms of energy, including jet fuel, liquefied petroleum gas (LPG), or coal used directly by industry.

For each option in the strategy, we first provide a background discussion that discusses precedents for the policy in both Utah and in other states. Then we describe the specific policy proposal, estimate the energy savings that would result by 2015 and 2020 from implementing the policy, analyze cost and cost effectiveness, estimate reductions in

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[2] Governor's Executive Order 2006-0004: Improving Energy Efficiency. www.rules.utah.gov/execdocs/2006/ExecDoc113478.htm

[3] *Energy Efficiency: Utah's High-Priority Resource*. EPA 430-F-07-003. U.S. Environmental Protection Agency, Clean Energy-Environment State Partnership Program. 2007.

criteria pollutant and carbon dioxide emissions, review other environmental and social impacts, and discuss political feasibility. In addition, we include our recommended priority (high, medium, or low) for each option.

Current Energy Use

Before considering options for increasing energy efficiency, it is helpful to review how energy is currently used in Utah. The State Energy Program has compiled energy consumption information for 2005 based on data collected by the Energy Information Administration of the U.S. Department of Energy. Figure 1 shows the breakdown of primary energy consumption by energy type. In this evaluation electricity is considered in terms of fuel input for electricity production (source Btus). Consequently, consumption of coal, natural gas, and other fuels excludes energy used for electricity generation. On this basis electricity accounts for over 44 percent, all petroleum products 34 percent, and natural gas 19 percent of total primary energy consumption. This figure includes fuel feedstocks, fuels used to produce electricity that then is exported, as well as true in-state energy consumption. With respect to electricity production, coal-fired power plants account for over 95 percent of electricity generation in the state.

Figure 1 – Utah Primary Energy Use in 2005

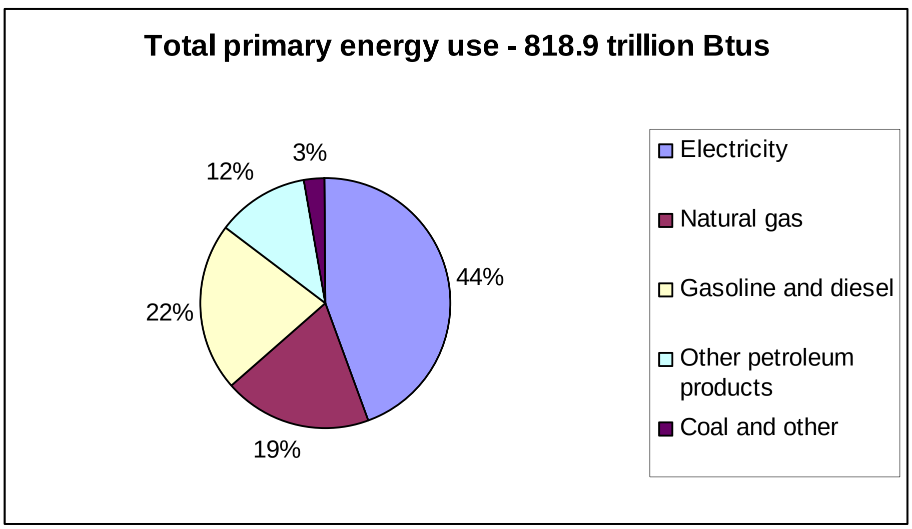
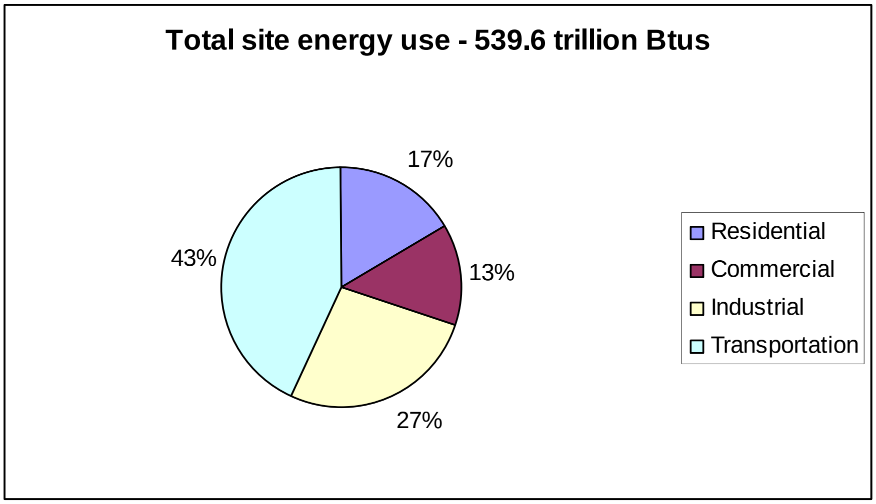


Figure 2 shows secondary energy consumption by sector. In this case, electricity is counted in terms of its direct energy content (site Btus). On this basis the transportation sector is most significant, followed by the industrial, residential, and commercial sectors. The main energy sources of concern in this study—electricity, natural gas, gasoline, and diesel fuel—account for 85 percent of total energy consumption in the state on a primary basis and 76 percent of total energy consumption on a secondary (site) basis.

Figure 2 – Utah Site Energy Use in 2005



Methodology

The methodology begins with our definition of a 20 percent improvement in energy efficiency by 2015. An increase in energy efficiency of 20 percent by 2015 is equivalent to a 16.7 percent (1 – 1/1.20) reduction in projected baseline energy use that year. A 20 percent increase in energy efficiency does not translate to a 20 percent reduction in energy use, in the same manner that a 100 increase in energy efficiency does not translate to a 100 percent reduction in energy use (a doubling of energy efficiency represents a 50 percent reduction in energy use).

The baseline scenario is a projection of energy use in the future given expected population and economic growth, but without new energy efficiency measures and initiatives taken into account. Our baseline assumptions, derived from utility forecasts and other sources, include growth in electricity consumption of 3.2 percent per year, growth in natural gas consumption of 1.5 percent per year, and growth in gasoline and diesel consumption (combined) of 2.0 percent per year during 2006-2020.

We then examine the potential of each option in the strategy, and the combination of options, to reduce this baseline energy demand projection. Energy efficiency programs or initiatives begun in 2006 are included in our policy scenario since this is the year the Governor announced the energy efficiency goal. As will be shown in the strategy, our policies reduce the otherwise anticipated growth in energy demand in Utah significantly. However, they do not result in an absolute reduction in energy use from current levels, except in the case of natural gas.

We include the effects of current policies and programs, (e.g. utility demand-side management programs and building energy codes), in estimating energy savings potential in order to give credit for ongoing energy efficiency initiatives. In particular we count savings from efficiency measures installed in 2006 and thereafter since the Governor adopted the efficiency goal that year. We also project energy use in the baseline scenario and the energy savings from each of our options through 2020. In some cases, the energy savings are moderate by 2015 but increase significantly between 2015 and 2020.

We have taken steps to avoid double counting of energy savings among the various options. This is done by reducing the savings potential attributed to certain options that are examined after other overlapping options have been assessed; e.g., we reduce the savings associated with building energy codes and education and training options due to their overlapping with utility demand-side management (DSM) options. In some cases, such as in the transportation area, adjustments are made when summing energy savings in order to avoid double counting and overstating overall energy savings potential.

For the economic analysis, all values are presented in 2006 dollars with costs and benefits after 2006 discounted using a five percent annual discount rate. Energy prices are assumed to remain constant at their levels in 2006, other than increasing with inflation; i.e., energy prices are assumed to remain constant in real dollars. This is a conservative assumption given that energy prices are rising due to increasing fuel costs, increasing construction costs, and tightening environmental standards. Also, net economic benefits are considered over the lifetime of energy efficiency measures installed during 2006-2015; i.e., we include the full energy savings of measures installed in the latter part of this time period but with discounting of future savings.

For the environmental impacts analysis, we use the average emissions rates of "avoided" new fossil fuel power plants in the Rocky Mountain region in response to stepped-up energy efficiency efforts. These rates were calculated in another study that made use of the Energy Information Administration's National Energy Modeling System (NEMS) model to determine future power plant emissions in reference and high efficiency scenarios. The difference in emissions, based on avoiding a mix of new coal-fired and natural gas-fired power plants, provides average emissions rates for "avoided" new power plant capacity in the region.[4] The specific emissions coefficients we use are: 671 metric tons of CO_2 per GWh saved, 0.045 short tons of SO_2 per GWh saved, 0.28 short tons of NOx per GWh saved, and 0.004 pounds of mercury per GWh saved. The emissions coefficients for SO_2 and NOx are relatively low due to the stringent emissions standards on new power plants. Emissions coefficients for natural gas and petroleum products are based on their direct energy content; i.e., the CO_2 emitted when these fuels are burned.

Water savings from decreased operation of power plants is based on the average water consumption rates of new coal-fired and natural gas-fired power plants, as estimated in the previously-referenced study. Assuming an equal amount of avoided operation of each type of power plant and conventional wet cooling systems, this value is 0.5 gallons of water savings per kWh of avoided electricity generation.

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[4] *The New Mother Lode: The Potential for More Efficient Electricity Use in the Southwest.* Boulder, CO: Southwest Energy Efficiency Project, Nov. 2002. http://www.swenergy.org/nml/index.html

Chapter II – Utility Demand-Side Management and Pricing Policies

Option 1: Adopt Energy Savings Standards or Targets for Electric Utility Demand-Side Management Programs

Background

Rocky Mountain Power (RMP), a subsidiary of PacifiCorp previously known as Utah Power, is responsible for 80 percent of electricity sold in Utah and is the only investor-owned utility in the state. RMP has implemented demand-side management (DSM) programs for its residential and business customers in Utah for over 20 years. But these programs declined significantly during the late 1990's. The revitalization of these programs grew out of a stakeholder advisory group set up as part of a 1999 general rate case. The advisory group prepared a report for the Utah Public Service Commission (PSC) in 2001 that showed large potential for cost-effective electricity savings.[5] This report in turn led to the expansion of DSM programs by RMP. DSM programs grew from a budget of about $5 million in 2001 to $12 million in 2003 and then to about $25 million in 2006. Spending on DSM programs as of 2006 was equivalent to about 2.1 percent of RMP's retail sales revenues in Utah. In addition, Utah ranked 18th in the nation in electricity energy efficiency program spending per capita as of 2006.[6]

The operation of utility DSM programs in Utah is related to the preparation of utility Integrated Resource Plans (IRPs) and consideration of energy efficiency resources within these plans. In addition, legislation was adopted in 2002 allowing a tariff rider charge on customers' bills to pay for utility DSM programs. A settlement agreement to put in place a tariff rider mechanism for Rocky Mountain Power's DSM programs was approved by the PSC in 2003. This facilitated DSM program cost recovery and contributed to the ramp up of Rocky Mountain Power's DSM programs in recent years.

RMP's DSM programs have been relatively successful in providing cost-effective electricity savings and peak load reductions. The programs in 2006 alone provided about 29 MW of peak reduction and 120 GWh per year of electricity savings from efficiency measures installed that year alone. In addition, RMP had 86 MW of peak load reduction capability as of 2006 through installation of air conditioner cycling controls. The electricity savings from DSM programs and efficiency measures installed in 2006 was equivalent to about 0.58 percent of the company's total retail electricity sales.

Regarding the cost effectiveness of RMP's DSM programs, RMP estimates that its primary commercial and industrial DSM programs (FinAnswer and FinAnswer Express)

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[5] D. Nichols and D. von Hippel. *An Economic Analysis of Achievable New Demand-Side Management Opportunities in Utah*. Report prepared for the Systems Benefits Charge Stakeholder Advisory Group to the Utah Public Service Commission. Boston, MA: Tellus Institute. March 2001.

[6] See *U.S. Energy Efficiency Programs: A $2.6 Billion Industry.* Boston, MA: Consortium for Energy Efficiency. 2007. http://www.cee1.org/ee-pe/cee_budget_report.pdf.

have a benefit-cost ratio of 2.1-3.0 from a total resource cost (TRC) perspective, with the range due to varying assumptions about future avoided energy supply costs.[7] The programs are even more cost effective from the utility cost and rate impact test perspectives. Regarding residential programs, recent analyses show that the high efficiency air conditioning and evaporative cooling program (known as the Cool Cash program) has a benefit-cost ratio of about 3.4-3.8, the refrigerator recycling program has a benefit-cost ratio of 2.3-3.2, and the home energy savings (retrofit measures) program has a benefit-cost ratio of about 1.2-1.5 when using the TRC test.

RMP is still ramping up its DSM programs in Utah and admits that there is room for further growth both through expanding existing programs and introducing new programs. A new program providing rebates for popular residential energy savings measures began in the second half of 2006. Overall, RMP plans to spend about $33 million or around 2.5 percent of revenues on DSM programs in 2007.[8] In addition, municipal utilities in Utah acknowledge they could do much more to stimulate more efficient electricity use.

RMP's parent company PacifiCorp completed a system-wide DSM potential study in July 2007.[9] The report estimates that it is technically and economically feasible to reduce projected electricity use in 2027 (20 years) by about 13 percent but that only 7 percent savings is achievable through DSM programs. However, the report contains a number of conservative assumptions that limit the achievable potential. Also, the report does not explicitly address the savings potential in ten or 15 years.

According to the Energy Efficiency Task Force convened by the Western Governors' Association, leading electric utilities in the country are investing 2-3 percent of their revenues on DSM programs and these programs in turn are saving the equivalent of around 0.8-1.0 percent of electricity sales each year.[10] For example, investor-owned utilities in California and Connecticut, as well as the municipal utility in Austin, TX, are achieving this level of energy savings.[11] This means that their DSM programs cut electricity use approximately 4-5 percent after five years of effort, 8-10 percent after ten years of effort, etc. More recently, Sierra Pacific Power Co. in Nevada proposed

[7] Memorandum from Brian Hedman, Quantec LLC to Don Jones, Jr., PacifiCorp, Feb. 2, 2007. The TRC test compares the full cost of the efficiency measures to the utility's avoided energy supply costs as a result of the adoption of the efficiency measures, on a net present value basis.
[8] Presentation of Jeff Bumgarner, PacifiCorp to the Demand-Side Management Advisory Group, Feb. 6, 2007.
[9] *Assessment of Long-Term, System-Wide Potential for Demand-Side and Other Supplemental Resources*. Report prepared by Quantec, Summit Blue Consulting, and Nexant, Inc. for PacifiCorp, Portland, OR, July 11, 2007.
[10] Energy Efficiency Task Force Report, Western Governors' Association, Denver, CO, p. 55. http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf.
[11] *National Action Plan on Energy Efficiency*. Washington, DC: U.S. Department of Energy and the Environmental Protection Agency, July 2006. pp. 6-8 – 6-9. http://www.epa.gov/cleanrgy/pdf/napee/napee_report.pdf.

expanding its DSM programs to the level of saving 1.0 percent of retail electricity sales per year during 2008-2010.[12]

Electric utility DSM programs typically save electricity at a total cost of $0.02-0.03 per kWh (utility plus participant costs), meaning improving end-use efficiency is the least-cost electricity resource.[13] Also, many of these programs reduce peak power demand more than they reduce electricity consumption in percentage terms, meaning the programs also improve the overall load factor for the utility system.

One way to stimulate the expansion of DSM programs is to adopt energy savings standards requiring a minimum level of energy savings. This policy has been adopted in a number of states either as stand-alone efficiency standards or combined energy efficiency and renewable energy standards. For example, Texas adopted legislation in 2002 that requires investor-owned utilities to operate energy efficiency programs sufficient to save 10 percent of forecasted energy demand growth. This led the utilities in Texas to increase DSM program funding to the level of about $85 million per year as of 2004, resulting in electricity savings of 370 GWh per year.[14] In 2007, the legislation was amended to require that utilities save 20 percent of forecasted load growth through DSM efforts.

Nevada has incorporated energy savings from DSM programs into the state's renewable energy standards, now renamed as clean energy standards. Utilities are allowed to use energy savings from DSM programs to meet up to 25 percent of their clean energy standard each year. This has resulted in the main utility (Nevada Power Co.) more than doubling its DSM expenditures and energy savings.

<u>Specific Energy Efficiency Proposal</u>

This policy would establish energy savings targets or standards for the DSM programs implemented by RMP. In addition, energy savings targets or standards would be established for the larger municipal utilities and rural electric co-ops in the state. The standards could be expressed in terms of energy savings only, or could also include peak demand reductions.

We suggest that the targets or standards ramp up over a four-year period (2008-2011) to the level of saving approximately 1 percent of projected electricity sales from DSM programs each year. This should be adequate time for both RMP (which already has extensive DSM programs) and the major municipal utilities and rural co-ops to achieve the targets or standards. We suggest that standards or targets apply to municipal utilities and co-ops with 10,000 or more customers, which means that seven municipal utilities and co-ops would be covered, the largest being the utilities operated by the cities of Provo and St. George. The roughly 40 smaller municipal utilities and co-ops would not

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[12] *2007 Integrated Resource Plan, Volume IV Load Forecast and Market Fundamentals and Volume V Demand Side Plan*. Sierra Pacific Power Company, Reno, NV. June 2007.
[13] See Reference 11, p. 6-5. Also, see Reference 10, pp. 55-56.
[14] S. Nadel. 2006. *Energy Efficiency Resource Standards: Experience and Recommendations.* Washington, DC: American Council for an Energy-Efficient Economy, March. http://aceee.org/pubs/e063.pdf

be covered. RMP along with the covered municipal utilities and rural co-ops account for about 92 percent of electricity use in the state.

In order to meet the energy savings targets or standards, the utilities could implement a comprehensive set of DSM programs, including:

- free or deeply-discounted electricity savings measures for low-income households,
- rebates for consumers that purchase ENERGY STAR products or undertake home retrofits,
- incentives for high-efficiency evaporative coolers and air conditioners, air conditioner tune-ups, and proper air conditioner sizing and installation,
- audits for and rebates to businesses that upgrade the efficiency of their heating, cooling, and lighting equipment as well as their building envelope,
- technical and financial assistance to industries that are interested in improving the energy efficiency of their processes as well as an industrial self-direction program (as RMP is currently implementing),
- grants to pay a portion of the cost for energy savings projects, including daylighting projects, in local government buildings and schools,
- training, certification, and outreach to increase the skills of builders, contractors, and energy efficiency service providers in Utah,
- advertising and incentives to increase the availability and purchase of innovative energy-efficiency measures such as modern evaporative cooling systems or super-efficient windows,
- home energy usage display and feedback devices,
- promotion of low-cost conservation measures such as enabling the power management capability of computer monitors,
- installation of load control devices, smart thermostats, and more sophisticated energy meters to facilitate pricing-related DSM initiatives, and
- design assistance and incentives to builders and/or owners that construct highly energy-efficient new homes and commercial buildings.

Some of these programs are in place now but could be expanded; others would be new programs. All of the programs should pass the Total Resource Cost (TRC) test in order to provide economic benefits for consumers and businesses in addition to energy savings. In order to facilitate achievement of the targets or standards on the part of RMP, we recommend consideration of performance-based financial incentives for utility shareholders in conjunction with adoption of the standards (see Option 2). In addition, the state could provide some technical assistance to help affected municipal utilities and co-ops plan and analyze potential DSM program options, particularly those utilities with limited DSM experience.

The energy savings standards or targets suggested above are admittedly ambitious. Achieving them will require a very concerted effort on the part of utilities as well as strong support from key parties such as the Governor’s office and state utility regulatory commission. Effectively implementing some of the options described below, such as tax credits for innovative energy efficiency technologies and public education, will help utilities achieve the goals presented above. In addition, the development and commercialization of some new energy efficiency technologies in coming years should help utilities to achieve the standards or targets. While it is impossible to know in advance which new technologies will become available, the pace of technological advance is rapid and numerous new energy efficiency measures are likely to reach the marketplace during the next 13 years.

Energy Savings

In order to estimate energy savings and peak load reduction potential, it is first necessary to project future electricity use in the absence of utility DSM programs implemented in 2006 and beyond. In its 2007 Integrated Resource Plan, PacifiCorp estimated that its Utah service area will experience energy demand growth of 2.7 percent per year on average during 2007-2016, while peak demand will grow even faster.[15] These projections include the impacts of planned DSM programs which reduce energy growth by about 0.5 percent per year on average. So without DSM programs, it is reasonable to assume energy load growth of about 3.2 percent per year. This growth rate is applied statewide through 2020 to produce a "baseline" (no new efficiency efforts case) energy forecast for this study. Note that DSM programs implemented prior to 2006 are included in the baseline scenario and not in the policy scenario.

In projecting energy savings, we assume that utilities achieve electricity savings equivalent to 0.5 percent of sales in 2006 (RMP achieves slightly more than this, the affected municipal utilities and rural co-ops less), 0.6 percent in 2007, 0.7 percent in 2008, 0.8 percent in 2009, 0.9 percent in 2010, and 1.0 percent of sales in 2011 and thereafter. In order to estimate summer peak demand reduction, we use a coefficient of 0.33 MW of peak reduction per 1 GWh/yr of electricity savings from DSM programs. This coefficient is similar to what RMP as well as utilities in California, Nevada, and Colorado have achieved in the past. It implies that there is some emphasis on peak demand reduction within a comprehensive set of energy efficiency programs.

To project DSM budgets, we assume an initial energy savings to DSM program budget ratio of 5 kWh/yr of savings per DSM program dollar. This is approximately the value achieved by RMP in 2005-06. We assume this value decreases slightly over time to a minimum level of 4.3 kWh/yr of savings per DSM program dollar as "low hanging fruit" is exhausted and savings become more difficult and costly to achieve. Also, we assume that the energy savings measures persist throughout the evaluation period. Most energy efficiency measures have a 15-year or longer lifetime. Those with less than a 15-year lifetime would likely be replaced with additional efficiency measures at the end of their useful life.

Table 1 shows the projected DSM program budgets and resulting levels of energy savings during 2006-2020, given the assumptions listed above. Once again, these values apply to RMP along with the seven largest municipal utilities and rural electric co-ops, together accounting for 92 percent of electricity use in the state. Starting with DSM

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[15] *2007 Integrated Resource Plan*. Portland, OR: PacifiCorp. May 2007.

programs in 2006, cumulative DSM efforts would yield about 894 GWh/yr of electricity savings by 2010, 2,375 GWh/yr by 2015, and 4,108 GWh/yr of savings by 2020. The peak demand reductions (not shown in the table) reach 295 MW by 2010, 784 MW by 2015, and about 1,356 MW by 2020. Savings from DSM programs implemented before 2006 are not included in these estimates since these programs occurred prior to the announcement of Governor Huntsman's energy efficiency goal.

Overall, this DSM effort would save about 6.9 percent of Utah's projected electricity use in 2015 in the absence of DSM programs, and 10.2 percent of projected electricity use in the state in 2020. The energy savings targets or standards would not eliminate all load growth, but they would reduce load growth to a more manageable level; i.e., from about 3.2 percent to 2.2 percent per year once the programs ramp up. Furthermore, the peak demand reduction would be greater than the reduction in energy use in percentage terms, thereby helping utilities increase their average system load factor.

Table 1 – Projected Electricity Savings and Corresponding DSM Budget Levels for Proposed Energy Savings Standards or Targets

Year	DSM funding level (million 2006 $)	Electricity Savings from Programs each Year (GWh/yr)	Electricity Savings from Cumulative Programs (GWh/yr)	Savings from Cumulative Programs as a Fraction of Sales (%)
2006	23.7	118.7	118.7	0.46
2007	30.0	147.0	265.7	1.00
2008	36.9	177.0	442.6	1.61
2009	44.4	208.7	651.3	2.30
2010	**52.7**	**242.3**	**893.6**	**3.05**
2011	61.7	277.8	1,171	3.88
2012	63.7	286.7	1,458	4.68
2013	65.8	295.9	1,754	5.45
2014	69.4	305.4	2,060	6.20
2015	**71.6**	**315.2**	**2,375**	**6.93**
2016	73.9	325.2	2,700	7.64
2017	78.1	335.6	3,036	8.32
2018	80.6	346.4	3,382	8.98
2019	83.1	357.5	3,739	9.62
2020	**85.8**	**368.9**	**4,108**	**10.25**

Cost and Cost Effectiveness

Implementing this policy would cost the state government little or no money since the PSC is already involved in approving and monitoring RMP's DSM programs. The state could benefit from expansion of DSM programs, including those targeted to commercial buildings, through additional technical assistance and/or incentive dollars.

Note that this does not include the cost of DSM programs which will be recovered from all customers including public sector customers.

Table 1 includes the estimated DSM program funding levels in order to meet the proposed energy savings targets or standards. DSM funding ramps up from about $24 million per year in 2006 to about $53 million per year by 2010, $72 million by 2015, and over $80 million per year in the final years of the analysis period (in 2006 dollars). At the $72 million annual funding level, utilities would be spending about 3.5 percent of their projected retail sales revenues on DSM programs. The proposed DSM spending level of about $22.00 per capita as of 2015 would place Utah among the top states in the nation in terms of DSM program spending per capita.[16]

These are significant expenditures of what ultimately is customers' money, but the increase in DSM funding is justified by the benefits. DSM programs enable utilities to purchase less fuel (and/or electricity) and reduce their investment in new power plants as well as transmission and delivery facilities over the lifetime of the efficiency measures. The projected electricity savings by 2020 is equivalent to the electricity output of approximately 600 MW of baseload power capacity. These avoided costs are substantial and should exceed the cost of the efficiency measures and the programs by a wide margin. Based on the experience of RMP and the work of the Energy Efficiency Task Force of the Western Governors' Association, we assume that future DSM programs in Utah have a benefit-cost ratio of 2.4 on average using the Total Resource Cost (TRC) test.[17]

Based on these assumptions, the proposed level of DSM program activity during 2006-2015 would stimulate about $796 million of investment in energy efficiency measures (discounted net present value). With an overall benefit-cost ratio of 2.4, the efficiency measures would produce $1.91 billion in gross economic benefits and $1.12 billion in net economic benefits over their lifetime. To put the net economic benefit figure in perspective, it is equivalent to about $1,140 for every household served by RMP and the seven municipal utilities and rural co-ops covered by the proposal. Even greater economic benefits result from efficiency measures installed during the 2016-2020 time period.

Environmental and Social Benefits

The DSM programs would lead to reduced operation of coal-fired and natural gas-fired power plants. This in turn will reduce water use and pollutant emissions by power plants. Assuming the avoided electricity generation comes from a mix of coal- and natural gas-fired plants, the water savings in Utah would be about 0.5 gallons per kWh of avoided power generation.[18] Thus the savings standards suggested above would save approximately 1.2 billion gallons of water per year by 2015 and 2.1 billion gallons of

[16] Five states, California, Massachusetts, Rhode Island, Connecticut and Vermont, were at or above this funding level in 2006. See *U.S. Energy Efficiency Programs: A $2.6 Billion Industry.* Boston, MA: Consortium for Energy Efficiency. 2007. http://www.cee1.org/ee-pe/cee_budget_report.pdf.
[17] See Reference 10, p. 52.
[18] See Reference 4, pp. 3-23 – 3-24.

water per year by 2020. A total of about 14.6 billion gallons of water would be saved during 2008-2020.

The energy savings targets or standards would also reduce SO_2, NOx, mercury, and CO_2 emissions by power plants. We estimate these impacts based on the regional electricity conservation potential study that SWEEP completed in 2002.[19] Table 2 shows the estimated emissions reductions in 2015 and 2020 assuming the electricity savings displace the operation of a combination of gas-fired and new coal-fired power plants. The SO_2 and NOx emissions reductions are relatively limited because these newer power plants are cleaner than older power plants. However, the reduction in CO_2 emissions is very large because CO_2 is not a regulated or controlled pollutant at the present time. CO_2 emissions are of growing concern because they are the primary cause of the greenhouse effect and global warming. The estimated reduction in mercury emissions is relatively small in physical terms, but mercury is a highly toxic substance.

Table 2 – Estimated Emissions Reduction from the Proposed Energy Savings Standards or Targets

Pollutant	Avoided Emissions in 2010	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric tons)	600	1,595	2,757
SO_2 (short tons)	40	107	185
NOx (short tons)	250	665	1,150
Mercury (pounds)	3.6	9.5	16.4

The energy savings targets or standards will also provide social benefits. First, robust DSM programs will improve the quality of the housing and commercial building stock in Utah and lead to homes and work places that are more comfortable. For example, sealing leaky HVAC ducts will improve cooling ability and reduce hot zones within a building. Likewise, sealing the building envelope will reduce drafts.

Second, improving the energy efficiency of low-income housing will help occupants stretch their disposable income and will make it easier for them to pay their utility bills. This in turn will result in less utility arrearages, less bad debt, and fewer consumer shut-offs, thereby benefiting both utilities and low-income households.

Third, energy efficiency improvements such as better lighting, better ventilation, or better controls for HVAC systems can result in productivity improvements in the workplace, including reductions in worker absenteeism and increased output per worker.[20] In addition, energy efficiency improvements in schools, particularly increased

[19] See Reference 4, pp. 3-18 – 3-21.
[20] J.J. Romm. 1999. *Cool Companies: How the Best Businesses Boost Profits and Productivity by Cutting Greenhouse Gas Emissions*. Washington, DC: Island Press. Also, K. Imbierowicz and L.A. Skumatz. 2004.

use of daylighting, enhances the learning environment and has been shown to produce better student performance on standardized tests.[21] Likewise, there is good evidence that use of daylighting helps to increase sales in the retail sector.[22]

Fourth, achieving the energy savings standards or targets will lead to a net increase in employment in Utah. Selling and installing energy efficiency measures is relatively labor-intensive, while producing fossil fuels and electricity is not. In addition, consumers and businesses will re-spend their energy bill savings after efficiency measures are installed in ways that support more jobs in the local economy. For example, households will purchase a little more food, clothing, housing, entertainment, etc. on average, and these expenditures support more jobs than do electricity purchases. We estimate that the proposed savings standards would result in a net increase of 1,315 jobs in the state by 2015 and 2,260 jobs by 2020[23].

Political and Other Considerations

There has been broad support for RMP's DSM programs in recent years. The PSC has approved all of RMP's requests for new or modified DSM programs after demonstration that such programs are likely to be cost-effective. There has been minimal opposition to growth in funding for cost-effective DSM programs from stakeholders such as low-income advocates or industrial consumer representatives. Thus, there is not likely to be major opposition to continued growth in RMP's DSM programs as long as the programs are effective, well-managed, and producing clear benefits for the utility and its customers. Demonstrating that the programs provide economic benefits that are greater than the cost of the programs is critical for achieving this consensus.

Establishing energy savings targets or standards for RMP at the levels suggested above is likely to be more controversial. In particular, RMP could object to this policy. It may be more acceptable to adopt the targets or standards but include the caveat that the targets or standards would be relaxed if there are insufficient cost-effective programs and measures for meeting them.

Establishing energy savings targets or standards for municipal utilities and rural electric co-ops also would be controversial. Municipal utilities are currently not regulated by the PSC. However, the PSC does have the authority to adopt regulations other than those pertaining to rates or charges for electric co-ops. It might be politically feasible to

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"The Most Volatile Non-Energy Benefits: New Research Results 'Honing In' on Environmental and Economic Impacts." *Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy.

[21] L. Heschong and R. Wright. 2002. "Daylighting and Human Performance: Latest Findings." *Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy.

[22] R. Peet, L. Heschong, R. Wright, D. Aumann. 2004. "Daylighting and Productivity in the Retail Sector." *Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy.

[23] These estimates are derived from a previous study that includes analysis of employment impacts from increasing the efficiency of electricity use in Utah. See Reference 4, pp. 4-1 – 4-18.

establish energy savings targets for the municipal utilities and co-ops, but leave the implementation (and hence compliance) up to each individual utility. This means there would not be enforcement of the targets in the case of the municipal utilities and co-ops. A number of municipal utilities in western states including utilities in Austin, Seattle, Sacramento, and Fort Collins are implementing exemplary energy efficiency programs, without state regulation. Adopting energy savings targets for larger municipal utilities and co-ops in Utah should have a positive effect even if there is no PSC oversight or enforcement.

Measurement and verification of energy savings will be an important issue if energy savings targets or standards are adopted. In particular, it will be important not to overstate energy savings from utility DSM programs. For example, the utilities should evaluate the net impacts of their programs taking into account both "free riders" and the spillover effect. The utilities should undertake thorough energy savings analyses of their DSM programs using well-established procedures such as the International Performance Measurement and Verification Protocol.[24]

Priority

This policy would yield large electricity savings as well as substantial economic, environmental, and social benefits. The energy savings targets or standards we suggest are ambitious but are not unprecedented considering DSM experience nationwide. We recommend that this option be viewed by the Governor, Legislature, and PSC as a **high priority.**

Case Study 1:

Energy Efficiency Retrofit at a Turkey Processing Plant: Moroni Feed Company, Moroni

Moroni Feed Company is a fully integrated turkey producing and processing cooperative. Five million commercially grown turkeys are raised by 64 independent members of the cooperative every year. The turkeys are processed at Moroni's central plant. Moroni Feed Company utilized Rocky Mountain Power's Energy FinAnswer program to facilitate upgrading the energy efficiency of condensers and compressors at the plant. Participation in this program cut the cost of the retrofit in half, resulting in an acceptable payback period.

The project involved replacing a less efficient shell-and-tube condenser with a high efficiency evaporative condenser and variable speed fan controls. A computer control system was also installed for the processing plant's refrigeration system. The facility previously used manually operated compressors and condensers. The new control system was installed in order to automatically sequence and unload compressors to optimize energy efficiency.

[24] See www.ipmvp.org.

Quick Facts

Total Project Cost: $464,000 ($232,000 after the utility incentive)
Annual Energy Savings: $78,940 (2.1 million kWh/year)
Equipment: High efficiency condensers, compressors and automated control system.
Simple Payback: 2.9 yrs (5.9 yrs before incentive)
Benefits:

- reduced electricity use
- increased equipment longevity
- increased process reliability
- reduced equipment downtime
- shorter compressor operating hours
- lower peak summer condensing pressures
- better access to system data

Source: Rocky Mountain Power, 2006

Case Study 2:

Lighting Retrofit:
Utah Indoor Soccer, Woods Cross

Utah Indoor Soccer keeps the lights on for 9 to 15 hours a day, seven days a week at its 20,000 square foot indoor soccer facility. With funding from Rocky Mountain Power's Energy FinAnswer Express DSM program, Utah Indoor Soccer replaced older high bay metal halide light fixtures with energy-efficient T5 high output fluorescent light fixtures. The new fixtures improved lighting on the soccer fields and cut electricity use by more than 50 percent.

Regarding the utility incentive program, the lighting contractor responsible for implementing this project had this to say, "You can't beat it. It was the difference between doing and not doing this project." And in addition to the electricity savings, the new lamps last longer meaning reduced maintenance costs.

Quick Facts

Efficiency measures: T5 high output fluorescent light fixtures
Total project cost: $15,060 ($10,025 after the utility incentive)
Annual energy bill savings: $6,070 (88, 700 kWh/year)
Simple payback period: 1.7 years (2.5 years before incentive)
Benefits:

- reduced electricity use
- better lighting quality
- better light control
- longer lamp life and less maintenance

Source: Rocky Mountain Power, 2004

Option 2: Adopt Decoupling and/or Shareholder Incentives to Stimulate Greater Utility Support for Energy Efficiency Improvements

Background

Currently Rocky Mountain Power (RMP) receives dollar-for-dollar cost recovery for its DSM programs through a tariff rider mechanism. A number of states, including California, Idaho, Maryland, and Oregon, have adopted decoupling policies that break the link between electric or natural gas utility sales and recovery of fixed costs.[25] The amount of allowed fixed cost recovery is determined ahead of time in a rate case, and a true-up mechanism is used to ensure the utility received no more (or no less) than the determined amount. This removes the financial incentive that utilities traditionally have of promoting more energy consumption (and ineffective conservation programs) in-between rate cases. It also removes the disincentive that utilities have for supporting adoption of combined heat and power systems by their customers.

In 2006, the Utah Public Service Commission (PSC) approved a three-year pilot decoupling mechanism for Questar Gas Company (QGC), in conjunction with initiating natural gas DSM programs.[26] This policy, known as the Conservation Enabling Tariff, addresses the issue of declining natural gas usage per customer while removing the disincentive for QGC to implement effective natural gas DSM programs. The basic approach is to determine allowable non-gas revenue per customer and use a balancing account with periodic true-ups to meet pre-established fixed cost recovery requirements. Shortly after this policy was adopted, QGC developed and received approval from the PSC to implement five natural gas DSM programs starting in 2007 (see Option 4 below).

Other states including Arizona, Connecticut, Massachusetts, Minnesota, and Nevada have adopted performance incentives (also known as shareholder incentives) to reward utilities for implementing effective DSM programs and overcome their historical reluctance for doing so. Various approaches to performance incentives exist, including allowing utilities to earn a higher-than-normal rate of return on some or all DSM expenditures, allowing utilities to earn a bonus if they meet certain energy savings targets, or allowing utilities to keep a portion of the net economic benefits resulting from their DSM programs. The incentive is usually limited to a small fraction of the net economic benefits produced by the DSM programs. Performance incentives can be relatively easy to implement, and consequently more states have adopted this approach than decoupling, at least for electric utilities.[27]

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[25] M. Kushler, D. York, and P. Witte. 2006. *Aligning Utility Interests with Energy Efficiency Objectives: A Review of Recent Efforts at Decoupling and Performance Incentives.* Washington, DC: American Council for an Energy-Efficient Economy, October. In March 2007, the Idaho Public Utilities Commission adopted decoupling for Idaho Power Co. on a three-year pilot basis.

[26] Order Approving Settlement Stipulation: In the Matter of the Approval of the Conservation Enabling Tariff Adjustment Option and Accounting Orders. Public Service Commission of Utah, Salt Lake City, UT. October 5, 2006.

[27] See Reference 25.

Specific Energy Efficiency Proposal

This policy would either: 1) extend decoupling to RMP, the one investor-owned electricity distribution utility in the state, 2) adopt performance-based incentives to encourage RMP (and possibly QGC) to maximize the amounts of cost-effective energy savings they achieve, or 3) do both. There is no redundancy in adopting both decoupling and performance incentives; in fact, the two policies are complementary in that decoupling removes disincentives to promoting more efficient energy use while incentives reward utilities for doing a good job.

One performance-based incentive option would be to allow RMP to get a bonus as it meets and surpasses a minimum threshold of energy savings. For example, the utility could be given a bonus of up to 10 percent of its expenditures for achieving energy savings in excess of 100 GWh per year (savings in recent years have ranged from 100-120 GWh per year). The bonus, which would be added to the DSM tariff rider collected each year, could increase on a sliding scale as the utility achieves more energy savings, and could be limited to no more than 20 percent of the net economic benefits provided by DSM programs in any one year, thereby ensuring that customers realize the majority of the benefits.

Another option would be to allow RMP to capitalize and earn a rate of return on its DSM expenditures, rather than treating them as an expense. In order to provide a performance incentive, the rate of return for DSM expenditures could be increased in proportion to the energy savings and peak demand reduction achieved, as well as program cost effectiveness. Once again, the value of the additional rate of return could be capped at 20 percent of the annual net economic benefits provided by the DSM programs. This approach, proposed recently by SWEEP in Nevada, would ensure that customers maintain the majority of the economic benefits while giving the utility a financial incentive to maximize energy savings and economic benefits.[28]

Energy Savings

Adopting decoupling or shareholder incentives would support the expansion of DSM programs in Utah and achievement of the goals spelled out in Option 1. But it is difficult to estimate what impact adopting decoupling or shareholder incentives alone would have on either DSM funding or energy savings. Furthermore, it would be unreasonable (double counting) to add savings from this policy to those attributed to Option 1. Therefore we consider this option as helping to facilitate the savings attributed to Option 1, but not providing additional savings.

Cost and Cost Effectiveness

There would be a very modest cost to establish and implement decoupling or shareholder incentives for RMP in terms of the regulatory cost; i.e., time and expense for

[28] For a copy of the Nevada proposal, see www.swenergy.org/news/SWEEP_Nevada_Comments_022007.pdf.

the PSC. This cost might be on the order of $100,000 per year. It is unclear if the PSC would need additional funding or could implement this policy within its current budget.

There could be much greater costs and benefits to society if this policy leads to an expansion of utility DSM programs, with the benefits exceeding the costs assuming the additional DSM programs are cost effective. However, it is not possible to estimate the magnitude of such costs and benefits.

Political and Other Considerations

Decoupling can be a controversial policy as it is perceived by some as shifting risk from utility shareholders to consumers. This argument was made by the Committee for Consumer Services, for example, when natural gas decoupling was debated in Utah. Likewise, shareholder incentives for expanded DSM programs can be perceived as an excessive reward for utilities, accompanied by the argument that utilities should be implementing well-funded and effective DSM programs as part of their normal course of business without any type of shareholder incentive.

The arguments against decoupling and shareholder incentives can be mitigated if not eliminated by including certain features when the policies are crafted. These include: 1) making any shareholder incentives performance-based and including financial penalties for poor performance as well as rewards for superior performance; and 2) capping any financial incentive and limiting it to a small portion of the net economic benefits provided by the DSM programs. Regarding decoupling, it is possible to design a decoupling policy that is narrower in scope than full decoupling of utility sales and revenues. For example, Oregon has adopted partial decoupling for its main natural gas utility. This mechanism applies to weather-normalized gas consumption, meaning any weather-related variation in gas use is not addressed by the decoupling mechanism.[29]

Priority

We believe that this policy could be valuable for stimulating further expansion of electricity DSM programs in Utah. However, we acknowledge that it would be controversial. Therefore, we recommend that it be viewed by policymakers including the PSC as a **medium priority.**

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[29] *Energy Efficiency Policy Toolkit*. Gardiner, ME: Regulatory Assistance Project. July 2006, p. 26. http://www.raponline.org/Pubs/Efficiency%20Policy%20Toolkit%201%2004%2007.pdf.

Option 3: Adopt Innovative Electricity Rates in Order to Stimulate Greater Electricity Conservation and Peak Demand Reduction

Background

There are a number of ways to use electricity rates to stimulate electricity conservation and peak demand reduction. One way is to adopt time-of-use (TOU) rates that have higher kWh charges during peak demand periods compared to off-peak periods. Another strategy, already in effect in Utah to some degree, is to adopt inverted block rates, whereby the price per kWh increases as electricity consumption increases. A third way is to adopt some sort of demand response pricing strategy such as real-time pricing or critical peak pricing.[30]

The WGA Energy Efficiency Task Force report notes that a number of western states, including Utah, have adopted inverted block rates (also known as tiered rates) for residential customers. Under inverted block or tiered rates, the price per kWh increases as electricity consumption increases. In California, for example, basic residential tariffs are split into five tiers, with the highest consumption tier nearly twice as expensive per kWh as the lowest tier. As the Task Force report stated, "…this provides a strong incentive for conservation and efficiency investments, complementing other energy efficiency initiatives such as utility DSM programs and building energy codes."[31]

Critical peak pricing is a type of demand response program that allows the utility to increase the price of electricity during times of maximum power demand and/or cost. It is targeted to households with central air conditioning, generally households with above average electricity consumption. Households can be equipped with enabling technology that automatically reduces AC use (or the use of other high-demand devices) during critical peak periods. Customers are also notified by phone or email when these critical events occur.

In a pilot program in California known as the Automated Demand Response System (ADRS), a sampling of households with central air conditioning were placed on TOU rates as well as critical peak rates that were about three times the normal on-peak rates during a limited number of "critical peak" periods. The customers were able to program controls to change their air conditioner thermostat setting or curtail other loads during these periods. The ADRS pilot program found a significant reduction in peak demand by participating high-consumption households with automated controls, about 1.4-1.8 kW (43-51 percent) on average. In addition, participants reduced their total electricity use during summer months by about five percent on average.[32] The California pilot program also found that critical peak pricing had a much greater impact on summer peak demand than TOU rates.

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[30] *National Action Plan for Energy Efficiency.* Washington, DC: U.S. Department of Energy and the Environmental Protection Agency. July 2006. http://www.epa.gov/cleanenergy/pdf/napee/napee_report.pdf.
[31] See Reference 10, p. 34.
[32] *Automated Demand Response System Pilot. Final Report, Volume 1.* Boulder, CO: Rocky Mountain Institute, March 31, 2006. Also, J. Swisher, K. Wang, and S. Stewart. "Evaluation of automated residential

In another demand response pilot program known as the Energy Smart Pricing Program (ESPP), voluntary real-time pricing was implemented for 1,400 households with air conditioning in Chicago. Prices were communicated to customers on a day-ahead basis via a toll-free phone number or by visiting a web site. The ESPP resulted in peak demand reductions of about 20 percent and an overall reduction in summer electricity use of about three to four percent on average.[33]

Specific Energy Efficiency Proposal

This policy would implement critical peak pricing or real-time pricing for residential customers in Utah with central air conditioning. A pilot program should first be conducted to determine the impacts and the cost effectiveness of different approaches. A key issue is whether or not the value of the peak demand reduction and energy savings more than offsets the cost for new meters as well as any additional in-house control technologies. If one or more of the pilot programs prove to be cost effective, we recommend scaling up the effort to all customers with air conditioning or possibly just those AC customers with above average electricity use.

In order for any pricing policy to be effective in promoting energy efficiency and conservation, education should be carried out to inform customers about opportunities to reduce electricity use during peak demand periods. This could be done in conjunction with other public education efforts (see Option 21).

Energy Savings

Regarding critical peak pricing or real-time pricing along the lines implemented in California and Chicago, we assume such rate designs and associated enabling technologies result in 4 percent energy savings on average during the four summer months. About 54 percent of RMP's residential customers had central air conditioning as of 2005 and this fraction is on the rise.[34] For the sake of this analysis we assume that 65 percent of households use central air conditioning by 2015. Given these assumptions, the estimated energy savings is 208 kWh per year per participating household on average. In addition to the energy savings, there should be a substantial reduction in peak power demand.

Assuming the number of households in the state grows to 1.06 million by 2015, the aggregate electricity savings potential from residential demand response pricing is about 143 GWh/yr by 2015. By 2020, the savings potential could grow to an estimated 160 GWh/yr. These energy savings levels are relatively modest, about 1.5 percent of total projected electricity consumption by residential customers. However, the peak demand reduction potential could be much more significant, on the order of 300-600 MW by

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demand response with flat and dynamic pricing." *Proceedings of the ECEEE 2005 Summer Study*. Boulder, CO: Rocky Mountain Institute.

[33] A. Star, L. Kotewa, M. Isaacson, and M. Ozog. 2006. "Real-Time Pricing is the Real Deal: An Analysis of the Energy Impacts of Residential Real-Time Pricing." *Proceedings of the 2006 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy. pp. 5-316 – 5-327.

[34] Personal communication with Jeff Bumgarner, PacifiCorp, Portland, OR, February 19, 2007.

2015. Once again, this assumes that all households with central air conditioning participate either voluntarily or due to a change in the basic residential tariff.

Cost and Cost Effectiveness

Analysis of the California ADRS pilot program found that the cost effectiveness is very sensitive to issues such as the scale of the program, the assumed avoided costs, and the level of peak demand reduction.[35] Targeting high-consumption households and possibly households in areas of high avoided costs was recommended as one strategy for improving cost effectiveness. In addition, the technologies for residential demand response are changing rapidly. For these reasons, it is very difficult to estimate the potential cost and cost effectiveness of such programs in Utah. This should be done through careful design and analysis of a pilot program or programs.

Environmental and Social Benefits

Given that the energy savings is relatively modest, this option is not likely to have a large impact on pollutant emissions from power plants. However, the significant reduction in power demand during peak load periods could reduce emissions on very hot days, thereby helping Utah meet air quality standards and improve public health.

Adopting critical peak pricing could benefit low-income households since these households tend to have below average electricity use in general and less electric air conditioning in particular. These households would benefit both from the lower rates during non-critical periods and from the reduced investment in new power plants and/or distribution system upgrades as a result of attenuating peak load growth.

Political and Other Considerations

Residential critical peak pricing needs to be demonstrated and evaluated in Utah. If a pilot program turns out to be cost effective, then a full scale program should be implemented. In doing so, a key decision will be whether to implement the strategy on a voluntary or mandatory basis. A voluntary critical peak pricing option will be less controversial but also will have less impact. It may be preferable to start with a voluntary option and then consider making critical peak pricing or real-time pricing mandatory after a high level of consumer awareness and acceptance is obtained.

Priority

It does not appear that these innovative electricity pricing options would result in a significant amount of incremental energy savings. However, critical peak pricing or real-time pricing could result in a significant peak demand reduction based on experience in other states. Therefore we recommend initiation of a pilot program in this area as a **medium priority.**

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[35] *Residential Automated Demand Response System (ADRS) Pilot Economic Analysis Report.* Boulder, CO: Rocky Mountain Institute, March 2005.

Option 4: Expand Natural Gas Utility Energy Efficiency Programs and Establish Energy Savings Targets for these Programs

Background

A study regarding natural gas energy efficiency potential was completed by the consulting firm GDS Associates, Inc. for the Utah Natural Gas Demand Side Management (DSM) Advisory Group in 2004.[36] The study concludes that a comprehensive and well-funded 10-year DSM effort could reduce the natural gas use of residential and commercial customers by 20 percent at the end of the 10-year period. The estimated benefit-cost ratio for this overall effort is 2.39 using the Total Resource Cost (TRC) test.

Numerous gas utilities are implementing cost-effective DSM programs that are helping their customers reduce their gas consumption and gas bills. SWEEP carried out a survey of gas DSM programs offered by 10 utilities with comprehensive DSM programs.[37] This survey found that as of 2004, the leading gas utilities were spending 1.0-1.6 percent of their retail revenues on DSM programs and were reducing gas sales by 0.5-1.0 percent per year. This is the amount of gas savings from programs implemented in 2004 alone. Furthermore, the benefit-cost ratio for these programs as a whole ranged from 1.6 to 5.6, and in most cases exceeded 2.0.

In addition, California adopted new energy savings requirements for both gas and electric utilities in 2004.[38] The gas requirements will provide customers relief from rising natural gas bills by tripling annual gas savings after a 10-year effort, saving 44 million decatherms per year by 2013, equivalent to the gas consumption of one million households on average. Gas utilities in California began ramping up their DSM programs in 2006.

Questar Gas Company (QGC) developed a set of natural gas efficiency programs for its customers in consultation with a stakeholder advisory group during 2006, following the adoption of gas sales/revenue decoupling on a pilot basis. These programs were submitted to the PSC and approved for implementation in early 2007.[39] QGC is anticipating it will spend $7.0 million per year initially on gas DSM programs for both residential and commercial (general service) customers. The DSM programs are expected to reduce gas use by 133,000 decatherms per year, which is equivalent to about 0.14 percent of gas sales to these customers. The proposed DSM budget is equivalent to about 0.8 percent of QGC's retail sales revenues from its general service customers. QGC is committed to implementing gas DSM programs on a pilot basis for three years.

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[36] *The Maximum Achievable Cost Effective Potential for Gas DSM in Utah for the Questar Gas Company Service Area*. Final Report prepared by GDS Associates for the Utah Natural Gas DSM Advisory Group, June 2004. http://www.swenergy.org/news/Natural_Gas_DSM_Potential_in_Utah.pdf.
[37] S. Tegen and H. Geller, *Natural Gas Demand-Side Management Programs: A National Survey*. Boulder, CO: Southwest Energy Efficiency Project, January 2006. http://www.swenergy.org/pubs/Natural_Gas_DSM_Programs_A_National_Survey.pdf
[38] California Public Utilities Commission. Decision D.04-09-060, September 2004.
[39] Order. Docket No. 05-057-T01. Public Service Commission of Utah. January 16, 2007.

Specific Energy Efficiency Proposal

This policy would maintain and expand natural gas DSM programs in Utah. Funding of programs for residential and commercial customers would be ramped up to about 1.5 percent of sales revenues by 2010, and remain at this level through 2020. Additional funding would be used to expand program marketing as well as add new efficiency measures, such as high-efficiency boilers, energy efficiency retrofits for multi-family buildings, and high-efficiency commercial food service equipment, to the DSM portfolio QGC initiated in 2007. In addition, we propose initiating gas DSM programs for industrial customers but limiting the budget for such programs to 0.75 percent of natural gas costs (both commodity and transportation) for these customers. This will enable QGC to increase its gas savings while limiting the impact of DSM programs on the rates paid by industrial customers.

We also suggest setting gas savings targets, namely to save 2 percent of total gas sales in the state by 2011 and 5 percent of sales by 2015, from DSM programs implemented starting in 2007. The objective is to stimulate "best practice" natural gas DSM programs in the state, in addition to best practice electricity DSM programs. In order to facilitate achievement of the gas savings targets, we assume that decoupling of sales and fixed cost recovery is maintained.

Energy Savings

In projecting energy savings, we assume that QGC increases the effectiveness of its programs over time and by 2010 is able to save 63,000 decatherms per million dollars spent on DSM programs. This is the median savings value achieved by the ten utilities surveyed by SWEEP.[40] Also, we assume that the energy savings measures persist throughout the evaluation period. Many gas saving measures, such as home insulation or high-efficiency furnaces, have lifetimes of 15 years or more. Those with less than a 15-year lifetime would likely be replaced with additional efficiency measures at the end of their useful life.

Table 3 shows the projected DSM program budgets and resulting levels of energy savings during 2007-2020, given the assumptions listed above. These values apply to DSM programs for all customers – residential, commercial, and industrial. Starting with DSM programs in 2007, cumulative DSM efforts would yield about 2.4 million decatherms per year of gas savings by 2010, 8.3 million decatherms per year by 2015, and 15.0 million decatherms per year by 2020. Overall, this DSM effort would save about 5.2 percent of Utah's projected natural gas use in 2015 in the absence of DSM programs, and nearly 9 percent of projected gas use in the state in 2020. In making these estimates, we only consider gas use for energy purposes. Natural gas feedstocks used by the petrochemical industry, for example, are excluded.

[40] See Reference 37.

Cost and Cost Effectiveness

Table 3 includes the estimated DSM program funding levels in order to meet the proposed energy savings standards. DSM funding ramps up from about $7 million per year in 2007 to nearly $20 million per year by 2015 (in 2006 dollars). The proposed DSM spending level of about $6.00 per capita as of 2015 is less than what is being spent on gas DSM in leading states (Wisconsin and Iowa) as of 2006.[41]

Table 3 – Projected Gas Savings and Corresponding DSM Budget Levels for Gas DSM Programs

Year	DSM funding level (million 2006 $)	Natural Gas Savings from Programs each Year (million decatherms/yr)	Natural Gas Savings from Cumulative Programs (million decatherms/yr)	Savings from Cumulative Programs as a Fraction of Sales (%)
2006	0.0	0.0	0.0	0.0
2007	7.0	0.14	0.14	0.12
2008	11.2	0.38	0.52	0.38
2009	14.3	0.70	1.22	0.86
2010	**17.5**	**1.11**	**2.33**	**1.60**
2011	18.0	1.13	3.46	2.34
2012	18.4	1.16	4.62	3.07
2013	18.8	1.19	5.81	3.80
2014	19.3	1.22	7.02	4.52
2015	**19.7**	**1.24**	**8.27**	**5.24**
2016	20.2	1.27	9.54	5.96
2017	20.7	1.30	10.84	6.67
2018	21.2	1.33	12.18	7.39
2019	21.6	1.36	13.54	8.09
2020	**22.2**	**1.40**	**14.94**	**8.80**

We assume that DSM programs pay for half of the cost of natural gas efficiency measures on average, leading to a total investment of $221 million in efficiency measures during 2007-2015 (discounted net present value). Based on the experience of other gas utilities with comprehensive gas DSM programs as well as the Utah gas DSM potential study, we assume that gas DSM programs in Utah have a benefit-cost ratio of 2.4 on average using the TRC test, once such programs are well-established.[42] This is considerably greater than the estimated benefit-cost ratio of 1.3 for the DSM programs

[41] See *U.S. Energy Efficiency Programs: A $2.6 Billion Industry*. Boston, MA: Consortium for Energy Efficiency. 2007. http://www.cee1.org/ee-pe/cee_budget_report.pdf.
[42] See References 36 and 37.

that QGC is implementing in 2007. However, 2007 is the first year of DSM programs with start-up costs and limited energy savings.

Based on these assumptions, the efficiency measures installed during 2007-2015 would produce $530 million in gross economic benefits and $309 million in net economic benefits over their lifetime (discounted net present value). To put the net economic benefit figure in perspective, general service customers paid about $880 million for natural gas and industrial customers paid about $370 million as of 2006. Even greater economic benefits result if the gas DSM programs implemented in the 2016-2020 time period are included.

Environmental and Social Benefits

Stimulating more efficient gas use through gas DSM programs will provide other benefits besides the direct gas and energy bill savings. Some gas conservation measures such as energy-efficient clothes washers and dishwashers also save water and/or electricity. Some measures such as home retrofits and duct sealing will improve occupant comfort and reduce health problems such as mold formation. Other measures such as furnace tune-ups and replacement will enhance consumer safety as well.

Gas conservation efforts in low-income households will help these households stretch their disposable income. It also will make it easier for these households to keep up with utility bill payments, meaning fewer shut-offs, fewer bill arrearages, and less bad debt for gas utilities. Natural gas conservation also puts downward pressure on wholesale natural gas prices and helps businesses increase their productivity. In addition, conserving natural gas will result in reduced pollutant emissions and other environmental benefits due to decreased gas combustion.

Regarding environmental benefits, this policy would lead to a significant reduction in CO_2 emissions from reduced burning of natural gas. We estimate annual CO_2 emissions would decline by about 440,000 metric tons in 2015 and 794,000 tons in 2020.

Political and Other Considerations

Gas utilities in Utah (and elsewhere) have been experiencing declining gas sales per customer due to factors such as national appliance efficiency standards, building energy codes, and conservation efforts stimulated by rising gas prices. In order to get gas utilities to support and operate well-funded and effective energy efficiency programs, it is critical to remove the financial disincentive they have towards promoting less gas consumption by their customers. Consequently, it is important to adopt sales and revenue decoupling as has been done on a pilot basis in Utah. In our view, continuing decoupling will be valuable if not essential for realizing the gas savings targets proposed above.

Priority

This policy would yield large natural gas savings as well as substantial economic and environmental and social benefits. We recommend that it by viewed by the Governor, Legislature, and PSC as a **high priority.**

Chapter III – Buildings and Appliances Policies

Option 5: Upgrade Building Energy Codes and Provide Funding for Code Training and Enforcement Activities

Background

Utah is a high-growth state which will see approximately 235,000 new housing units built over the next 10 years. Likewise, a large amount of commercial sector new construction will occur in the state. It is important to maximize the energy efficiency of new homes as well as new commercial buildings given the high growth in the state and the fact that it is much easier to implement energy efficiency measures when a new home or commercial building is constructed than to try to retrofit energy efficiency measures into an existing building.

Building energy codes specify minimum energy efficiency requirements for new buildings or existing buildings undergoing a major renovation. Building energy codes are important because of the "split incentive" that exists for most new buildings. Builders typically bear the capital cost of energy efficiency improvements but do not pay the energy bills after the building is occupied. Consequently, a new home or commercial building is rarely designed to minimize the lifecycle cost.

Utah has had a mandatory statewide energy code for many years. The state adopted the *2006 International Energy Conservation Code* (IECC) for both new residential and new commercial buildings, effective January 1, 2007. Thus, Utah has an up-to-date energy code "on the books." Utah also has a network of home energy raters and inspectors. However, it unclear to what degree the energy code is enforced by local building inspectors. There is some evidence that enforcement and compliance is spotty and that it varies considerably across jurisdictions in the state.[43]

According to the Energy Efficiency Task Force convened by the Western Governors' Association, building energy codes are very cost-effective. The extra first cost for complying with energy codes is usually paid back through energy savings in seven years or less.[44] Furthermore, building energy codes are saving large amounts of energy and money in aggregate in states with well-implemented state-of-the-art energy codes.[45]

Specific Energy Efficiency Proposal

This policy would first ensure that statewide building energy codes continue to be updated every three years. We recommend that the state go beyond the minimum requirements of the IECC when updating its energy codes, including innovative features of

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[43] Personal communication with Dave Wilson, Utah Energy Conservation Coalition, Oct. 2006.
[44] See Reference 10, p. 42.
[45] *Clean Energy-Environment Guide to Action*. Washington, DC: U.S. Environmental Protection Agency, April 2006. pp. 4-29 – 4-31.

codes adopted in other states if such features are shown to be cost-effective for building owners in Utah. For example, California has adopted additional energy efficiency requirements for both new homes and new commercial buildings as part of its Title 24 statewide building energy code, including requirements pertaining to lighting in new homes, duct testing and sealing, and roofing reflectivity. These code requirements should be considered for adoption in the future in Utah.

This policy would also provide funding for training of builders, contractors, and local code officials by the State Energy Program, as well as grants to local jurisdictions to co-fund energy-related inspections and better enforce energy codes. We suggest providing on the order of $200,000 per year, with approximately half of this used for training and half provided to local jurisdictions to improve code enforcement. Such efforts have had a high payoff in terms of energy savings per dollar of expenditure elsewhere, and we believe similar results could be achieved in Utah.[46] It should be possible for the state to obtain co-funding for these activities from the U.S. Department of Energy and/or from utilities. In fact, RMP and QGC included a total of $90,000 in their 2007 DSM program budgets for building code-related training provided in partnership with the State Energy Program. Training for builders and local code officials took place during the summer of 2007.

In addition, the State Energy Program and utilities should continue to encourage construction of highly-efficient new homes and commercial buildings that go well beyond the minimum code requirements. Both RMP and QGC are implementing incentive programs for builders of new homes that meet or exceed the ENERGY STAR new homes program criteria. These efforts are starting to pay off, with the number of ENERGY STAR-certified homes in the state increasing by nearly a factor of 10 between 2004 and 2006.[47] Also, the utilities provide incentives for certain energy efficiency measures installed in new commercial buildings. Energy savings from these efforts are counted separately under the utility DSM options.

Energy Savings

We estimate the energy savings and peak demand reduction from upgrading and better enforcing building energy codes by making assumptions about the construction rates in the state during 2006-2020, the fraction of new homes and commercial buildings that would be affected by new energy codes, and the energy savings per home and per unit of floor area in commercial buildings in the homes and commercial buildings impacted by the codes. In particular, we assume construction of 23,500 new housing units and 30 million square feet of new or renovated commercial building floor area per year on average during 2007-2020.[48]

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[46] L. Kinney, H. Geller and M. Ruzzin 2003. *Increasing Energy Efficiency in New Buildings in the Southwest*. Boulder, CO: Southwest Energy Efficiency Project, pp. 4-2 – 4-3. http://www.swenergy.org/ieenb/codes_report.pdf.

[47] There were 3,554 ENERGY STAR-certified homes built in Utah in 2006, a 16% market share. Data provided by the ENERGY STAR new homes program, U.S. EPA, Washington, DC, July 2007.

[48] See Reference 46, pp. 3-11 and 3-31. Also, Governor's Office of Planning and Budget, 2005 Baseline Projections.

Regarding energy savings, we assume that the 2006 IECC leads to 5 percent electricity savings and 10 percent natural gas savings in new homes, and 10 percent electricity and natural gas savings in new commercial buildings, relative to standard construction practices in the absence of the new code. We also assume that stepped up training and code enforcement results in 95 percent of new buildings complying with the code requirements. In addition we assume that the energy code is upgraded every three years and that 5 percent additional electricity and natural gas savings are realized each time the code is upgraded.[49]

As part of this analysis, we give credit for energy savings resulting from the adoption of the 2006 version of the IECC because this code was enacted and put into effect after Governor Huntsman adopted the statewide energy efficiency goal. Our assumptions about energy savings from building energy codes are modest in part to avoid double counting savings with utility DSM programs. These programs are promoting beyond-code new construction. Energy savings associated with new homes or commercial buildings that go well beyond code requirement (e.g., ENERGY STAR new homes) are counted under the utility DSM policy options.

Table 4 shows the resulting electricity and natural gas savings in 2010, 2015, and 2020 based on these and other assumptions. The total electricity savings are estimated to reach 674 GWh by 2015 and 1,391 GWh by 2020. Natural gas savings reach about 3.7 million decatherms by 2015 and 7.5 million decatherms by 2020. About 70 percent of the electricity savings comes from commercial buildings while nearly two-thirds of the natural gas savings comes from new residential buildings. To put these savings estimates in perspective, the estimated electricity savings in 2015 is equivalent to about 2 percent of projected statewide electricity consumption without efficiency initiatives, while the estimated natural gas savings in 2015 is equivalent to about 3 percent of projected statewide gas consumption without efficiency initiatives.

Table 4 – Projected Electricity and Natural Gas Savings from Updated and Well-Enforced Building Energy Codes

	Electricity Savings (GWh per year)			Natural Gas Savings (million decatherms per year)		
Sector	**2010**	**2015**	**2020**	**2010**	**2015**	**2020**
Residential	54	193	429	0.82	2.47	4.94
Commercial	160	481	962	0.42	1.27	2.54
All	214	674	1,391	1.25	3.74	7.48

[49] These assumptions were derived primarily from the Energy Efficiency Task Force report issued by the Western Governors' Association, see Reference 11. We include savings from the 2006 IECC since it was adopted and put into effect after Gov. Huntsman announced the statewide energy efficiency goal.

Cost and Cost Effectiveness

Regarding the cost to the state of Utah, we are suggesting a budget of $200,000 per year for building code-related training as well as support for building inspections and code enforcement efforts at the local level. It should be possible to obtain a portion of this funding from other sources besides the state budget, such as from the utilities.

Regarding cost to the private sector, upgrading the energy efficiency of new homes and commercial buildings is cost effective. We estimate that upgrading the energy efficiency of a new home in order to comply with the 2006 IECC code will cost about $825 on average but will result in about $120 in annual energy bill savings, meaning a simple payback of around seven years. A seven-year simple payback period was assumed for building energy codes in the WGA Energy Efficiency Task Force report.

In aggregate, we estimate that adopting new energy codes as suggested above will lead to about $440 million in investment in energy efficiency measures during 2006-2015 (discounted net present value). The resulting energy bill savings over the lifetime of these measures would equal about $966 million on a present value basis, meaning a net economic benefit of about $526 million (2006 dollars). Additional net benefits result from more efficient new homes and commercial buildings constructed during 2016-2020.

Environmental and Social Benefits

By reducing the amount of electricity consumed, up-to-date building energy codes would reduce water consumption and the pollutant emissions from operating coal- and gas-fired power plants. We estimate that upgrading and better enforcing building energy codes along the lines proposed here would reduce water consumption in the state approximately 4.2 billion gallons during 2007-2020. Furthermore, we estimate the codes would reduce CO_2 emissions by approximately 651,000 metric tons per year by 2015 and 1.33 million metric tons per year by 2020. These emissions reductions result from both lowering fossil fuel use for electricity generation and from reduced direct natural gas consumption.

Well-designed energy-efficient new buildings provide a number of other benefits besides energy bill savings. These non-energy benefits include greater comfort, residents that are more satisfied with their new homes, workers in commercial buildings that are more productive, fewer health problems due to indoor air pollutants and potential mold buildup, and less litigation over building defects.[50]

Political and Other Considerations

As noted above, Utah has done a good job in adopting up-to-date model energy codes in recent years. The challenge is to train builders, contractors, and local code officials as to what is required and cost-effective ways to comply with codes, and to ensure that all or close to all new homes and commercial buildings meet or exceed the

[50] See Reference 10, pp. 58-59.

codes that are on the books. Code enforcement is the responsibility of local governments (cities and counties). Providing modest funding to local jurisdictions could go a long way to improving energy code enforcement, especially if a city or county is required to demonstrate that they are meeting energy code enforcement standards in return for receiving state funding.

Priority

This policy would yield substantial electricity and natural gas savings as well as economic, environmental, and social benefits. Put simply, it makes sense to "build buildings right" rather than to try to retrofit them with energy efficiency measures later. We recommend that this policy be viewed by the Governor and Legislature as a **high priority.**

Case Study 3:

Energy-Efficient New Homes and Commercial Buildings: Kennecott Daybreak community, South Jordan

Kennecott Land is working with South Jordan to plan a large-scale mixed-use development on 4,126 acres. The plan provides for nearly 14,000 residential units as well as commercial development, making the Daybreak community the largest master-planned community in the history of Utah. Kennecott Land is the only land developer in the nation to be certified with the ISO 14001 Environmental Management System.

ENERGY STAR® Homes
Kennecott is requiring that all homes built in the Daybreak Community be Energy Star® certified. These homes incorporate reduce air leakage, low thermal conductivity windows, improved insulation, and high efficiency heating and cooling systems.

Quick Facts

- **Homeowner Savings:** $200-$400 in annual utility bill savings.
- **Environmental Benefits:** 14,000 Energy Star® housing units will yield around 30,000 tons of avoided carbon dioxide emissions each year, or nearly 1 million tons over 30 years. This is equivalent to taking about 6,700 passenger cars off the road.

Community Center and Elementary School

- LEED Silver certification in 2006
- Features energy-efficient design, natural lighting, and reduced water consumption
- Ground-source heat pump saves Daybreak Elementary School $0.25 per square foot in heating costs compared to what other schools in the Jordan School District pay.

Option 6: Adopt Residential Energy Conservation Ordinances to Upgrade the Energy Efficiency of Existing Homes

Background

Approximately 44,000 existing homes are sold each year in Utah, compared to construction of about 20,000 new homes. A number of jurisdictions in the United States have adopted and successfully implemented residential energy conservation ordinances (RECOs) for the purpose of upgrading the energy efficiency of existing housing. RECOs require homeowners and landlords to implement specific energy efficiency measures, if necessary, at the time a house or rental property is sold or renovated. RECOs are designed to bring the existing housing stock up to a minimum level of energy efficiency. In some cases, the emphasis is on multi-family or rental housing.

RECOs are in place and operating reasonably well in San Francisco, Berkeley, and other communities in California. In California, RECOs pertain to all types of housing. The cities of Burlington, VT and Ann Arbor, MI, and the state of Wisconsin have adopted RECOs that apply only to rental property. In some cases, there is a cost ceiling on how much a property owner has to spend because of the RECO. San Francisco, for example, limits the expenditure to 1 percent of the sales price.[51]

RECOs usually list required energy efficiency measures such as a minimum level of attic insulation, duct sealing and insulation, water heater tank and pipe insulation wrap, and water saving measures. The city or state inspects and certifies that homes or rental units meet the requirements. The City of Berkeley contracts with a community-based non-profit organization to do the inspections.

The Wisconsin statewide program for rental property gives the buyer up to one year to meet the standards. Inspections are done by either a state or private inspector. The state has four people administering the program and recovers the entire cost of the program through modest fees charged to parties responsible for complying with the standards. Nearly 60,000 rental properties were affected during 1985-95.[52]

Specific Energy Efficiency Proposal

This policy would adopt RECOs either at the state or local level. It might be preferable to begin with a RECO for rental property in Salt Lake City, modeled on the Wisconsin program. Rental property owners have little incentive to upgrade the energy efficiency of their property if tenants pay the energy bills. As a result, renters often live in inefficient dwellings. At the same time, many renters have limited incomes and thus a high energy cost burden. The State's Division of Housing and Community Development is already striving for a high level of energy efficiency in the low-income housing it renovates.

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[51] M. Suozzo, K. Wang, and J. Thorne. 1997. *Policy Options for Improving Existing Housing Efficiency.* Washington, DC: American Council for an Energy-Efficient Economy.
[52] Ibid.

We suggest including the following energy efficiency requirements in RECOs in Utah. Efficiency measures already present would not need to be replaced, but property buyers would be given one year to upgrade where measures are lacking. In some cases, property owners would make the upgrades prior to sale in order to advertise that their property passes the RECO.

- Minimum attic insulation level (R-19) in accessible attics
- Double pane low-E windows or reflective low-E window film
- Heating system inspection and tune-up if not done in previous five years
- Sealing and insulating accessible heating and cooling ducts
- Caulking, weatherstripping, and other building envelope air sealing
- Programmable thermostat
- Installing at least 5 compact fluorescent lamps in commonly used light sockets
- Low-flow showerheads and faucet aerators

The State Energy Program could help local governments that adopt RECOs through training and other assistance. Utilities in Utah could support the RECOs by offering rebates and/or low-interest financing for energy efficiency upgrades. Lenders could support RECOs by adding the cost of the energy retrofit into the mortgage for a home or apartment building. Also, the federal tax credit for home retrofit would facilitate the implementation of policies such as RECOs at the state or local level.

The adoption of RECOs is likely to be more effective if there is training and certification of the contractors performing home upgrades. This is due in part to the need to upgrade the skills and work quality of many (although not all) insulation, HVAC, and other home retrofit contractors. Utilities could co-fund contractor training and certification, with the training and certification provided by existing home energy experts in the state.[53] Implementing such training and certification will lead to increased energy and cost savings in homes that are retrofit broadly, not only in those impacted by RECOs.

Experience elsewhere has shown that rigorous tracking and enforcement mechanisms are critical to the success of RECOs.[54] If RECOs are adopted in Utah, the home energy rating (HERS) infrastructure could be used to inspect homes and apartment buildings and certify compliance.

Energy Savings

There is very little information on the energy savings resulting from the implementation of RECOs in other jurisdictions. One report indicates that San Francisco's RECO is reducing average household energy consumption by more than 15 percent.[55] This seems on the high side if it applies to total household energy

[53] For example, the Utah Energy Conservation Coalition and Energy Rated Homes of Utah could provide the training and certification. See www.utahenergy.org.
[54] See Reference 51.
[55] Ibid.

consumption; the 15 percent savings value could refer to heating and cooling energy use only.

Assuming 10 percent overall energy savings on average in Utah to be more conservative, the savings would be about 1,000 kWh and 8 decatherms per year for a typical rental property. Furthermore, we assume that a RECO for rental property is enacted first in the metropolitan Salt Lake City area but then extended to other cities in the state. In total we assume that RECOs affect 150,000 housing units by 2015.[56] These assumptions lead to aggregate energy savings of around 150 GWh and 1.2 million decatherms of natural gas per year by 2015. By 2020, assuming the impacts are extended to an additional 50,000 households, the energy savings could equal 200 GWh and 1.6 million decatherms of natural gas per year.

Cost and Cost Effectiveness

Regarding the cost to the public sector, local governments would need to devote some staff for both adopting and implementing a RECO (assuming implementation is done at the local level). But as noted above, these costs can be paid for by charging a modest fee for certification of homes and apartment buildings, as has been the case in Wisconsin.

Regarding cost to the private sector, we estimate that the cost of the required upgrades would be about $750 in a housing unit that does not need attic insulation but needs all or nearly all of the other measures. Of course the cost will be less if a house or apartment building has some of the efficiency measures already installed. If insulation is needed, the cost will increase by about $800 on average. Assuming one-third of the affected housing units need attic insulation but two-thirds do not, the average upgrade cost is about $1,000 per home.

Based on the energy savings estimates provided above, a household's energy bill (gas and electric) would be reduced by about $155 per year on average given current retail energy prices in Utah. This means a typical payback period of 6.5 years based on the energy savings alone. In addition, there would be some water savings in housing units where low-flow showerheads and faucet aerators are installed. Assuming a 20-year lifetime for the efficiency measures on average, the discounted net economic benefit would be about $930 per household. In aggregate, this implies net economic benefits of $140 million if the policy affects 150,000 housing units during 2007-2015.

Environmental and Social Benefits

RECOs will reduce high energy costs and the burden they place on low-income and working class households. This will increase disposable income as well as make it more likely that these households can pay their utility bills. RECOs will also improve the quality of rental housing, indoor comfort levels, and property value.

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[56] Utah had 201,000 occupied rental housing units out of a total of 752,000 occupied housing units of all types as of 2003, according to the U.S. Census Bureau.

By reducing the amount of electricity consumed, RECOs would reduce water consumption and the pollutant emissions from operating coal- and gas-fired power plants. RECOs also would reduce direct water use by households due to installation of low-flow showerheads and faucet aerators. We estimate that adopting RECOs to the degree assumed above could reduce water consumption in the state by approximately 3.5 billion gallons during 2007-2020.[57] Furthermore, we estimate that RECOs could reduce CO_2 emissions in Utah by approximately 163,000 metric tons per year by 2015 and 219,000 tons per year by 2020.

Political and Other Considerations

It is likely that many apartment building owners and realtors will oppose the adoption of RECOs. Also, cities may view the adoption and implementation of RECOs as overly time consuming and burdensome. In order to increase the chance of success politically, it is important to involve these groups in RECO development from the outset. Also, it may be easier to gain the support of the real estate community if simple and easy-to-implement energy requirements are adopted. It may be necessary to compromise on stringency in order to gain broader support and ultimately approval.

Adopting a RECO is just one step towards achieving energy savings in existing housing. Once the ordinance is adopted, it is very important to educate building owners, contractors, auditors, and local building inspectors on the requirements and on how they can be met. In addition, it is important to enforce the ordinance and do so in a rigorous yet flexible manner; e.g., allowing extra time for compliance before any fines are levied and ensuring that homeowners with limited disposable income, such as the elderly, are given adequate technical and financial assistance.

Priority

This policy would yield relatively limited electricity and natural gas savings, but the economic, environmental and social benefits could be significant. We recommend that it be viewed by the Governor, Legislature and major cities in Utah as a **medium priority.**

[57] Most of this water savings is from the installation of low-flow showerheads and faucet aerators.

Option 7: Adopt Lamp and Appliance Efficiency Standards for Products Not Covered by Federal Standards

<u>Background</u>

The federal government has adopted minimum energy efficiency standards on a wide range of products including refrigerators, clothes washers, air conditioners, furnaces, water heaters, fluorescent lamps and ballasts, HVAC equipment used in commercial buildings, and motors. These standards have saved a large amount of energy while being very cost-effective for consumers.[58] States are preempted from adopting efficiency standards on products already regulated by the federal government, but states can adopt efficiency standards on products not covered by the national standards.

In recent years, a number of states, including Arizona, California, Oregon, and Washington, have adopted efficiency standards on products not covered by federal standards. The standards prohibit the sale of non-complying products after a phase-in period. Products covered by state efficiency standards include transformers, commercial packaged air conditioning equipment, commercial refrigerators and freezers, commercial clothes washers, exit signs, torchiere light fixtures, and traffic signals. Some of these standards were subsequently included in the Energy Policy Act of 2005 and thus became national in scope. But there are still some products that one or more states have adopted efficiency standards for, but which are not yet covered at the federal level.

The Appliance Standards Awareness Project (ASAP – www.standardsasap.org) prepares model state standards legislation and assists states by analyzing the impacts of the model standards. It is logical to consider adopting these standards in Utah, especially for those products that other states have already adopted standards.

There is growing interest in phasing out inefficient incandescent light bulbs and replacing them across the board with compact fluorescent lamps (CFLs) or other types of efficient lamps. In early 2007, the government of Australia announced that it will ban ordinary incandescent lamps by 2009 or 2010.[59] Two legislative proposals along these lines have been introduced in California—one would prohibit sale of ordinary incandescent lamps by 2012, the other would set minimum efficiency standards in two phases (in 2013 and 2018) that would effectively ban ordinary incandescent lamps.[60] California had already adopted standards that require sale of more efficiency incandescent lamps in that state, while Nevada adopted stringent efficiency standards for

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[58] S. Nadel. "Appliance and Equipment Efficiency Standards." *Annual Review of Energy and Environment*. Vol. 27, pp. 159-192. 2002.

[59] "Australia Screws in Compact Fluorescent Lights Nationwide." Environmental News Service, Feb. 21, 2007. http://www.ens-newswire.com/ens/feb2007/2007-02-21-01.asp

[60] Assembly Bill No. 722, Introduced by Assembly Member Levine, California Legislature – 2007-08 Regular Session. Feb. 22, 2007. Assembly Bill No. 1109, Introduced by Assembly Member Huffman, California Legislature – 2007-08 Regular Session. Feb. 23, 2007. Also, see "California may ban conventional lightbulbs by 2012." Reuters New Service, Jan. 30, 2007.

general service lamps in June, 2007. The standards, which take effect in 2012, cannot be met by ordinary incandescent lamps.

Specific Energy Efficiency Proposal

This policy would adopt energy efficiency standards for general service lamps, starting with a standard of 25 lumens per watt by 2012 and reaching 45 lumens per watt by 2016. Ordinary incandescent light bulbs sold today only provide about 15 lumens per watt while CFLs provide 60 lumens per watt or more. These standards would apply to general purpose lamps but not to appliance, colored, infrared, three-way, and other types of specialty lamps. These standards are consistent with recommendations made by a lighting efficiency coalition in March, 2007.[61]

This policy would also adopt minimum energy efficiency standards on four products not covered by national energy efficiency standards. Products sold in Utah would have to meet these minimum efficiency requirements once the standards take effect, say on January 1, 2009. The exact standards would be derived from the latest ASAP model bill that a number of states are likely to consider in 2007.

The products we recommend considering for state standards include metal halide light fixtures, single-voltage AC to DC power supplies, incandescent reflector lamps not covered by federal standards, and walk-in refrigerators and freezers. Standards on these products offer moderate energy savings potential and are very cost effective for consumers in Utah. Manufacturers already produce numerous products that meet the standards. And if the standards do not take effect until 2009, vendors would be given adequate time to clear out their current inventory of non-complying products.

Energy Savings

Table 5 includes estimates of the electricity savings in 2015 and 2020 from each part of this proposal. Regarding the lamp standards, we assume that the use of CFLs continues to grow in the interim period due to utility DSM programs and market forces, with households adopting three to four CFLs on average before the standards take effect. However, this policy still has a large impact on residential electricity use.[62] We estimate that it would eventually save 1,140 kWh per year per household, equivalent to about 58 percent of the total electricity use for lighting in households on average.[63] In addition to

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[61] Alliance Calls for Only Energy-Efficient Lighting in U.S. Market by 2016, Joins Coalition Dedicated to Achieving Goal. Press Release. Washington, DC: Alliance To Save Energy. March 14, 2007. http://www.ase.org/content/news/detail/3644.

[62] We do not count the savings here from the CFLs assumed to be adopted through utility DSM programs and market forces.

[63] The average household in the U.S. uses an estimated 1,946 kWh of electricity per year for lighting. See. *U.S. Lighting Market Characterization*. Report prepared by Navigant Consulting, Inc. for the U.S. Department of Energy, Sept. 2002. http://www.eere.energy.gov/buildings/info/documents/pdfs/lmc_vol1_final.pdf.

the electricity savings in homes, Table 5 includes savings from the replacement of ordinary incandescent bulbs in commercial buildings.

Table 5 – Projected Electricity Savings and Economic Benefits from Lamp and Appliance Efficiency Standards

Policy component	Electricity Savings (GWh/yr)		Net Economic Benefit (million 2006 $)
	2015	2020	
Appliance standards	107	183	103
Lighting standards	1,227	1,954	648
Combination	1,334	2,137	751

Overall, we estimate that this policy would cut electricity use in 2015 by 1,334 GWh per year with the savings growing to 2,137 GWh per year by 2020. About 90 percent of the savings results from the lamp standards.

Cost and Cost Effectiveness

Appliance efficiency standards have proven to be very cost-effective for consumers with the energy bill savings far exceeding any increased first cost. ASAP estimates a payback period of two years or less for any increase in first cost for each of the products in the proposed appliance standards package. Furthermore, ASAP estimates that this set of standards would provide about $103 million in net economic benefits for Utah's consumers and businesses.[64]

Regarding the efficiency standards on general service lamps, we assume it eventually leads to the purchase of 35 additional CFLs per household at a cost of $3.00 per CFL, on average. However, these lamps would save $88.90 in their first year of operation (2006 dollars). The net economic benefit statewide from the lamp standards would be about $648 million (discounted net present value). This estimate covers a 10-year period after general service lamps are replaced, and it includes savings to both households and businesses.

There should be very little cost to the state for adopting and implementing appliance and lighting efficiency standards, as long as the standards have already been adopted by other states.

[64] Analysis prepared by the Appliance Standards Awareness Project, Boston, MA, http://www.standardsasap.org/a062_ut.pdf.

Environmental and Social Benefits

By reducing the amount of electricity consumed, the efficiency standards would reduce water consumption by power plants. The estimated total water savings are 605 million gallons per year by 2015 and 1.0 billion gallons per year by 2020. During 2008-2020, the standards would reduce water consumption in the state by an estimated 5.9 billion gallons.

Table 6 shows the estimated pollutant emissions reductions in 2015 and 2020 from reduced operation of coal- and gas-fired power plants. By cutting air pollutant emissions, the efficiency standards would have a beneficial effect on public health and would help the state meet its air quality goals, in addition to reducing the state's contribution to global warming.

Table 6 – Estimated Emissions Reduction from the Proposed Lamp and Appliance Standards

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric tons)	895	1,433
SO_2 (short tons)	60	96
NOx (short tons)	374	598
Mercury (pounds)	5.3	8.5

Political and Other Considerations

There has been little or no opposition to the proposed appliance standards in other states. If the appliance standards are adopted, it will be necessary to monitor compliance and enforce the standards. This does not need to be onerous. The model appliance standards bill requires manufacturers to certify that qualifying products meet the standards. Utah could rely on the certification process adopted in California (i.e., Utah could state that certification in California is sufficient for a product to be sold in Utah).

The lighting efficiency standards are more controversial, as it appears that some manufacturers oppose them while others support them. However, momentum could grow to enact the standards in many states or possibly nationwide. As noted above, the policy would apply to general purpose incandescent lamps but not to specialty lamps, thereby making it less onerous. By moving ahead with this policy, Utah would be in the vanguard of an important energy efficiency initiative.

The Utah State Energy Program or some other state agency could allocate a small amount of money and staff time to: a) informing relevant vendors such as hardware stores, lighting distributors, and electric supply houses about the efficiency and lighting standards, and b) conducting spot checks in these establishments to ensure that only complying products are sold. If a non-complying product is found, both the vendor and manufacturer should be told to stop selling the product. No product testing is required to implement or enforce the standards.

<u>Priority</u>

This policy, if it includes the lighting standards, would yield relatively substantial electricity savings, economic benefits, and emissions reductions. We recommend that it be viewed by the Governor and Legislature as a **high priority.**

Option 8: Expand Low-Income Home Weatherization

Background

The U.S. Census Bureau, Utah Census 2004, indicates that 10.9 percent of individuals and 8.2 percent of families in Utah live below the federal poverty level.[65] Low-income households spend a much greater portion of their income on energy than medium and high-income households. While a median household spends about 3 percent of its income on energy, the typical low-income household spends nearly 12 percent of its limited income on energy, with very low-income households spending 20 to 25 percent.[66]

Energy prices have increased in recent years, but the incomes of low-income households have not increased in a corresponding manner, meaning that utility bills now pose an even greater challenge for low-income households. This leads to choices between heating and eating, to health and safety issues, family instability, and homelessness.

Home weatherization and energy efficiency assistance can help mitigate the effects of high utility rates for low-income families. Presently there are two low-income housing assistance programs in Utah that help reduce home energy costs: 1) the Olene Walker Housing Loan Fund, and 2) the Weatherization Assistance Program.

The Olene Walker Housing Loan Fund (OWHLF) is a revolving loan fund that provides money to build multifamily housing for low-income families. The Fund requires that housing must be ENERGY STAR-certified and offers incentives to assist with costs associated with the certification. The fund is supported by a leveraging ratio of $11 from federal and other sources for each dollar contributed by the state.[67] As of January 2007, the OWHLF has issued over 500 grants to multi-family units meeting ENERGY STAR standards.[68]

The Weatherization Assistance Program (WAP) provides energy-efficiency improvements to low-income households. The WAP is administered by the Utah Division of Housing and Community Development, which implements retrofit projects through eight government and non-profit agencies.[69,70] The bulk of the funding comes from the

[65] Direct Testimony of Christine R. Keyser on Behalf of the Utah Committee Of Consumer Services, In the Matter of HELP, Electric Lifeline Program Evaluation, Docket No. 04-035-21. September 15, 2006.
[66] Consultation with Elizabeth Wolf, Community Action Program, 4 December 2006; and Colton, Roger, *On the Brink: 2005, The Home Energy Affordability Gap.* April 2006.
[67] Utah Olene Walker Housing Loan Fund, http://community.utah.gov/housing_and_community_development/OWHLF/.
[68] Consultation with Lisa Yoder, Division of Housing and Community Development. January 11, 2007.
[69] L. Nelson. *2006 Energy Advisor Report to the Utah Legislature: Energy Policy and Development in Utah.* October 18, 2006.
[70] Weatherization Assistance Program, http://community.utah.gov/housing_and_community_development/weatherization_assistance_program/index.html (accessed July 20, 2007).

federal government (between $4-5 million per year[71]), with some supplemental funding from Questar Gas Company ($250,000 in 2006 and $500,000 in 2007[72]) and Rocky Mountain Power ($104,317 in 2004, $56,101 in 2005, and $95,567 in 2006[73]).

The WAP currently retrofits approximately 1,500 homes per year. On average, these retrofits save 1,180 kWh of electricity and 37.3 decatherms of natural gas per year per household.[74] However, there are approximately 1,000 households on the waiting list, and households generally have to wait two to three years before they are served by the program. A recent study by GDS Associates, Inc. estimates that approximately 70 percent of low-income households in Utah need additional weatherization measures.[75] It is estimated that there are 78,000 low-income households in Utah, but this number has not been updated to reflect Utah's growing population and shifts in the housing market.[76]

Distribution of low-cost energy efficiency kits along with energy education is another low-income energy efficiency program that Utah has not implemented but which has been successful in other states. On average, the kits cost between $50-100 (which includes the kit materials, education materials, and the training and implementation measures), and yield an average savings of around $117/year (977 kWh/year and 6.7 decatherms/year).[77] With the passage of House Bill 1200 in 2006, Colorado will spend $19 million over four years on low-cost home energy efficiency kits/improvements. The Colorado Governor's Office of Energy is in the process of distributing approximately 27,000 low-cost energy efficiency kits to Colorado's low-income households and is conducting an impact evaluation of three distribution methods.[78]

Specific Energy Efficiency Proposal

This policy would increase the number of energy efficiency and weatherization retrofits of low-income households in Utah through the following mechanisms:

1) Provide state funding to expand the budget of the WAP to $10 million per year. Doing so would enable the program to weatherize 3,000 low-income homes annually, for a total of 42,000 low-income homes by 2020.[79] The $10 million budget could be

[71] Weatherization Assistance Program, http://community.utah.gov/housing_and_community_development/weatherization_assistance_program/index.html.
[72] Personal communication with Dan Dent, Questar Gas Company, Salt Lake City, UT, March 12, 2007.
[73] Personal communication with Jeff Bumgarner, PacifiCorp, Portland, OR, March 12, 2007.
[74] Personal communication with Michael Johnson, State Weatherization Assistance Program, Salt Lake City, UT, March 12 and July 6, 2007.
[75] *The Maximum Achievable Cost Effective Potential Gas DSM for Questar Gas, Final Report Prepared for the Utah Natural Gas DSM Advisory Group,* March 2004, GDS Associates, Marietta, GA.
[76] See Reference 70.
[77] S.M. Khawaja and J.E. Steiner. *Energy Efficiency through Education and Low-Cost Measures*. Quantec, LLC. Home Energy Magazine. September/October 2005.
[78] Personal communication with Jeff Ackermann, Governor's Office of Energy, Denver, CO, March 15, 2007.
[79] This figure assumes that the WAP will retrofit 1,500 homes per year in 2006-2007 and begin retrofitting 3,000 homes per year starting 2008 through 2020.

achieved by supplementing federal funds with state funds as well as additional utility DSM monies.

2) Allocate $3.0 million over eight years ($375,000 per year) for the distribution of 40,000 low-cost energy efficiency kits (5,000 kits per year for eight years), reaching approximately half of Utah's low-income households. This funding could come from equal contributions from the state and the utilities. The cost (approximately $75 per kit) would include the kit components, education materials, distribution, implementation, and possibly installation. Utah could learn from and build on the experience of the Colorado effort in this area to determine the most cost-effective means of achieving high installation rates and energy savings through distribution of low-cost efficiency measures to low-income households.

Energy Savings

Table 7 includes estimates of the electricity and natural gas savings in 2015 and 2020 from each component of this option. Taken together, the two components would save around 71 GWh and 1.28 million decatherms of natural gas per year by 2015. By 2020, the projected energy savings reach 89 GWh and 1.84 million decatherms per year. These savings refer to the entire WAP effort during 2006-2020, not just the expansion called for in this option. In addition, we assume that energy savings persist through 2020.[80]

Table 7 – Projected Energy Savings and Economic Benefits from Expanding the State Weatherization Assistance Program and Distributing Low-Cost Energy Efficiency Kits

Policy component	Electricity Savings (GWh/yr)		Natural Gas Savings (million decatherms/yr)		Net Economic Benefit (million 2006 $)
	2015	2020	2015	2020	
Weatherization Program	32	50	1.01	1.57	68.8
Low-cost Kits	39	39	0.27	0.27	8.4
Combination	71	89	1.28	1.84	77.2

Cost and Cost Effectiveness

The cost per household of the WAP is approximately $3,000, while participating households realize approximately $456 savings per year[81], after the completion of weatherization improvements. The cumulative cost to implement the WAP at a higher level would be about $90 million during 2006-2015 and $140 million during 2006-2020.

[80] In situations where an energy savings measure wears out, such as in the case of a CFL burning out at the end of its lifetime, we assume that the occupant replaces the measure with another energy-efficient product.
[81] The $456 savings figure is based on WAP estimates of electricity and natural gas energy savings per household per year and current energy prices. See Reference 74.

The net economic benefit statewide from expanding the WAP starting in 2008 would be about $69 million (discounted net present value). This estimate assumes a 20-year average lifetime for energy savings measures.

The cost per household for disseminating low-cost energy efficiency kits and energy education is approximately $75 on average. However, if the measures and actions taken in response to energy education save approximately $117 per year, the payback is less than one year on average. Over the life of the kits and other actions, the savings-to-investment ratio of the kits is anywhere from two to five, depending on the education mechanisms employed and assumed lifetime of the low-cost measures. Conservatively assuming a 3-year life for the measures and actions in response to kit distribution and energy education, the net economic benefit from distributing the 40,000 kits is $8.4 million (discounted net present value).

Combined, the two components of this proposal have a net economic benefit of about $77 million. Regarding the total cost to state government, we estimate a cost of around $4 million per year primarily for the expansion of the weatherization program. This leads to a total cost to the state of about $36 million on a discounted net present value basis.

Environmental and Social Benefits

Improving the energy efficiency of low-income households will provide broad social benefits including increasing property values, making homes more comfortable and safe, reducing utility bill arrearages, and making more income available for food, medical care, child care, etc. In addition, there will be some reduction in pollutant emissions due to less consumption of electricity and natural gas. We estimate that this option would reduce CO_2 emissions in Utah by approximately 48,000 metric tons per year by 2015 and 60,000 tons per year by 2020.

Political and Other Considerations

Efforts to increase state and utility funding for low-income weatherization may be viewed as a tax or rate increase on consumers in general. Consequently, there could be political opposition to this option. On the other hand, this option serves a segment of the population that badly needs energy efficiency assistance. Also, low-income households rarely participate in other types of energy efficiency programs. Therefore, a strong case can be made for government funding (both federal and state) for this program.

Priority

Even though this option yields low energy savings and could face political opposition, it benefits a key segment of society that faces a high energy cost burden and tends not to be influenced by other types of energy efficiency programs. Therefore, we recommend that it by viewed by the Governor, Legislature, and Public Service Commission as a **high priority.**

Case Study 4:

Weatherization Assistance: Typical Home Retrofit, Northern Utah

In late 2006, a 1920's Northern Utah home was retrofitted by the Utah Weatherization Assistance Program (WAP). This home had virtually zero insulation in the attic, walls, floors and kneewalls. Due to the lack of insulation, the homeowner faced extremely high gas bills, despite participating in the utility's equal payment plan.

The WAP spent a week-and-a-half retrofitting this home with proper insulation. The efficiency measures increased the attic insulation to R38, walls and kneewalls to R13, and also improved insulation of the floors. In addition, heating ducts were sealed, the furnace was tune-up, and 18 windows were replaced with low-e, high efficiency windows.

According to the homeowner, the home retrofit cut monthly natural gas costs from about $140 to $45 per month on average.

<u>Quick Facts:</u>

Project cost: $4,400
Annual natural gas saving: $1,140
Payback period: 3.9 years

Source: Michael Johnson, Weatherization Assistance Program Director, and Loran Kowallis, Bear River Association of Governments
Photo credit: Bear River Association of Governments

Option 9: Adopt State Tax Credits for Highly-Efficient New Homes, Commercial Buildings, and Heating and Cooling Equipment

Background

Federal tax credits are now available for highly-efficient new homes and commercial buildings that exceed the ENERGY STAR performance levels. For new homes, builders are eligible for a credit of $2,000 for new homes that use 50 percent or less of the heating and cooling energy of homes just meeting the 2003 IECC building energy code. For commercial buildings, a tax deduction of up to $1.80 per square foot is available to owners or tenants of commercial buildings (both new and existing) that use 50 percent or less energy for heating, cooling, ventilation, and lighting as compared to buildings that just meet the ASHRAE 90.1 2001 standard (now part of the IECC energy code). Partial deductions of up to $0.60 per square foot are offered for improvements to lighting, the HVAC (heating, ventilation, air-conditioning and cooling) system, or the building envelope. Federal tax credits are also offered to consumers who purchase high-efficiency space heating, water heating, and cooling equipment.[82]

State tax incentives can complement the federal incentives and thereby help to establish a market for highly-efficient new homes, commercial buildings, and HVAC equipment. For example, Nevada has adopted legislation that provides a reduction in property taxes for new commercial buildings that meet or exceed the LEED (Leadership in Energy and Environmental Design) silver standards.[83] Legislation introduced in Nevada in 2007 would provide a property tax reduction to new homes that meet the LEED silver performance criteria. In addition, legislation recently adopted in New Mexico provides a state income tax credit for highly-efficient homes and commercial buildings.[84]

Specific Energy Efficiency Proposal

This policy would provide a state tax credit for new homes, heating and cooling equipment, and commercial buildings that qualify for the federal tax credit or deduction. The tax credits could be provided to building owners to complement the federal incentive provided to builders in the case of new homes. We suggest adopting state tax credits for at least ten years in order to provide builders and other market actors with some certainty that the investments they make will qualify for the incentives. At the end of this period, the tax incentives could be reviewed and either maintained, modified, or discontinued based on the impact they are having, the cost to the state, and the projected value for continuing them.

Tax credits along the lines proposed here would complement the utility incentives offered in Utah for ENERGY STAR new homes and for efficiency improvements in commercial buildings. The utility incentives encourage "good practice" while the recommended tax credits would be available for "best practice," such as new homes or

[82] For details, see the Tax Incentive Assistance Project web site, http://www.energytaxincentives.org/.
[83] For details regarding these tax incentives, see http://energy.state.nv.us/LEED/R220-05A.pdf.
[84] For details on the New Mexico legislation, see http://www.swenergy.org/legislative/2007/newmexico/index.html.

commercial buildings that use 50 percent or less energy for heating and cooling (and lighting in the case of commercial buildings), as compared to homes and buildings just meeting current energy codes.

We also suggest state tax incentives for modern energy- and water-efficient evaporative cooling systems, along the lines of the tax incentives proposed in New Mexico. Such equipment performs much better than traditional "swamp coolers" while substantially cutting electricity use and peak power demand for cooling as compared to mechanical cooling (air conditioning) systems.[85] However, there are hurdles to establishing modern evaporative cooling systems in the marketplace, including the significantly higher first cost compared to traditional evaporative coolers. Rocky Mountain Power's recent incentives have resulted in very little adoption of whole-house premium evaporative coolers in Utah.[86]

Energy Savings

It is difficult to estimate the impact that tax incentives for highly-efficient new homes, commercial buildings, and HVAC equipment could have. The purpose of the incentives is to help establish markets for state-of-the-art efficiency measures and practices, and the potential market response is uncertain. For the sake of this analysis, we assume that 5 percent of new homes and commercial buildings constructed during 2007-2020 will qualify for the tax incentives, and that these homes save 20 percent of the electricity and natural gas used for heating, cooling and water heating, in addition to the energy savings resulting from improved building energy codes and/or utility DSM programs. This is a conservative assumption but should avoid double counting of energy savings among policies and programs.

With respect to HVAC equipment, we do not assume any additional energy savings from state tax credits in order to avoid double counting savings that accrue through utility incentive programs. However, we assume that 5,000 homes install modern evaporative cooling systems over a 10-year period in response to tax credits, and that each of these homes cuts their cooling electricity use by 2,500 kWh per year as a result.[87]

Table 8 shows the resulting electricity and natural gas savings in 2010, 2015 and 2020 based on these assumptions. The energy savings are very modest, reaching 24.5 GWh and 0.14 million decatherms of natural gas per year by 2015. However, the tax incentives could still be useful for stimulating the construction of some highly-efficient new homes and commercial buildings in the state, and for establishing a market for modern, high-performance evaporative cooling equipment. This could result in further market transformation over the long run, e.g., by laying the groundwork for future utility incentive programs and/or energy code upgrades.

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[85] *New Evaporative Cooling Systems: An Emerging Solution for Homes in Hot Dry Climates with Modest Cooling Loads.* Boulder, CO: Southwest Energy Efficiency Project. April 2004. http://www.swenergy.org/pubs/Evaporative_Cooling_Systems.pdf.

[86] *2004 Evaporative Cooling and Central Air Conditioning Incentive Program: Evaluation.* Report prepared by Quantec LLC for PacifiCorp, May 10, 2005.

[87] See Reference 85, p. 8.

Table 8 – Projected Electricity and Natural Gas Savings from Tax Credits for Highly-Efficient New Homes, Commercial Buildings, and HVAC Equipment

Sector	Electricity Savings (GWh per year)			Natural Gas Savings (million decatherms per year)		
	2010	2015	2020	2010	2015	2020
Residential	4.6	14.0	21.7	0.03	0.10	0.15
Commercial	3.5	10.5	16.3	0.01	0.04	0.06
All	8.1	24.5	38.0	0.04	0.14	0.21

Cost and Cost Effectiveness

In order to estimate the potential cost to the state of Utah, we assume state tax credits of $1,000 per qualifying home, $0.50 per square foot of qualifying commercial floor space, and $750 per qualifying evaporative cooler. With the participation levels assumed above, this leads to a total cost to the state in terms of forgone tax revenue of $21.5 million over 14 years (2007-2020), or about $1.5 million per year on average. In all likelihood the cost to the state would be below average in the early years and above average in later years as the market for qualifying homes, commercial buildings, and state-of-the-art evaporative cooling systems becomes established. On a discounted net present value basis, the cost to the state would be around $15 million.

Regarding costs and cost effectiveness to the private sector, we estimate net economic benefits assuming average lifetimes of 30 years for new homes, 20 years for commercial buildings, and 15 years for evaporative coolers. With the assumed participation levels, the resulting net economic benefits are $12.3 million for the owners of highly-efficient new homes, $16.3 million for occupants of the commercial buildings, and $10.4 million for homes adopting qualifying evaporative cooling systems. The total estimated net economic benefit is $39 million.

Environmental and Social Benefits

Since this policy results in relatively limited direct energy savings, it also would have relatively limited direct environmental benefits. We estimate that the tax credits would reduce CO_2 emissions in Utah by approximately 24,000 metric tons per year by 2015 and 36,000 tons per year by 2020.

Promoting modern evaporative cooling systems would result in increased water use by households. But part of this increased water use would be offset by reduced water consumption for power generation.[88] Overall, the policy as a whole would result in no net increase in water use, as the water savings associated with reduced power generation would offset the increased water use in homes that install modern evaporative cooling systems.

[88] See Reference 85, pp. 7-9.

Political and Other Considerations

Tax credits are generally a popular policy because they provide financial support for targeted measures. Home builders and commercial property owners and managers are likely to support the proposed tax credits. The downside is the cost to the state government and the fact that many worthy initiatives compete for scarce state resources. Severance tax revenue from natural gas and other minerals production might be one source of funding for tax credits along the lines suggested here.

Priority

This policy would yield relatively modest energy savings and economic benefits. Also, the cost to the state is non-trivial. On the other hand, state tax credits focused on cutting edge energy efficiency measures could complement other state policies and programs as well as federal policy, and help to establish markets for state-of-the-art energy efficiency technologies in Utah. Taking all of this into account, we recommend that this option be viewed by the Governor and Legislature as a **medium priority.**

Chapter IV – Industrial Policies

Option 10: Undertake an Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions

Background

Utah's industrial sector is important in terms of energy use and economic impact. As of 2005, the industrial sector (including manufacturing and mining) accounted for 32 percent of electricity use and 34 percent of natural gas use statewide (excluding natural gas use for electricity generation), as well as a notable amount of coal and petroleum usage.[89] Manufacturing and mining contributed $12.2 billion towards the state's total economic output (gross state product) of $91 billion in 2005. Industry is important in terms of employment and income generation in the state, with this sector accounting for about 11 percent of non-farm jobs and 14 percent of non-farm wages.[90]

There is significant potential to increase energy efficiency in industrial facilities. For example, the U.S. Department of Energy estimates it is possible to reduce energy use in the mining industry nationwide by about 50 percent through application of current and emerging technologies.[91] As another indication of significant energy efficiency potential in the industrial sector, the self-direction program implemented by RMP allows for a large energy user to opt-out of paying one-half of its DSM surcharge if the company demonstrates it has no remaining energy efficiency projects with a payback period of eight years or less. So far no industry or large commercial facility in Utah has taken advantage of this option.

Reducing energy usage in industrial facilities will increase productivity and enhance competitiveness, thereby improving businesses profitability and contributing to the state's economic viability and diversity. But there are barriers to greater energy efficiency in industrial facilities. These barriers include: 1) relatively low energy prices paid by industries; 2) lack of priority placed on reducing energy use and costs, especially in companies where energy bills are a small fraction of the total cost of production; 3) lack of trained staff and awareness of energy efficiency measures and technologies; and 4) competition for capital.[92] These factors lead many companies to implement only those energy efficiency projects with a very rapid payback period, on the order of two years or less.

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[89] Energy Information Administration, Utah State Energy Profile, 2007. http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=UT.
[90] Bureau of Economic and Business Research, University of Utah.
[91] "Energy-Efficient Technology for Mining." Presentation by Mike Mosser, National Energy Technology Laboratory at the Utah Mining Association Annual Convention, Aug. 23, 2007.
[92] S.J. DeCanio. 1993. "Barriers within firms to energy-efficient investments." *Energy Policy 21*(9): 906-914. Also, personal communication with Todd Currier, Washington State University Energy Extension Program, March 2007.

A number of state, regional, and national industrial energy efficiency initiatives have removed barriers and resulted in significant energy and cost savings. At the state level, energy agencies in both New York and Wisconsin have implemented effective technical assistance programs for industries in their states.[93] At the regional level, the Washington State University Energy Program provides best practice training for industries throughout the Northwest, along with targeted technical assistance to individual companies.[94]

At the national level, the Canadian Industry Program for Energy Conservation (CIPEC) combines goal-setting and recognition with technical assistance, networking, incentives, audits, and process efficiency studies. CIPEC has been in operation for 30 years, with participation by more than 5,000 industrial firms representing nearly 98 percent of Canada's industrial energy consumption. Greater energy efficiency and improved energy management enabled Canadian industries to reduce their energy intensity 9.1 percent between 1990 and 2004, resulting in $3.1 billion in energy cost savings in 2004 alone.[95] In addition, the Netherlands has implemented a very effective industrial energy efficiency program featuring voluntary energy intensity reduction commitments by companies and sectors, technical assistance, and financial assistance.[96]

Various Fortune 500 companies have made commitments to reduce their energy intensity and have achieved impressive results. DuPont, for example, committed to limit its total energy use through 2010 to no more than that used in 1990, despite considerable growth in production. The company's energy efficiency efforts and process modifications resulted in energy use as of 2002-03 that was 7 percent below the level in 1990, while production increased 30 percent, meaning nearly a 29 percent reduction in energy intensity in 12 to 13 years.[97]

In Utah, Rocky Mountain Power's (RMPs) energy efficiency programs, including its Energy FinAnswer, FinAnswer Express, and Self-Direction programs, have played an important role in stimulating industrial energy efficiency improvements. Industries participating in at least one of these programs in 2006 saved about 41 GWh that year, accounting for 34 percent of the electricity savings achieved by all of RMP's efficiency programs. However, there is no state or utility program promoting more efficient use of natural gas and other fuels in the industrial sector.

Two other state programs have helped businesses in Utah improve energy efficiency and cut energy waste. The Utah Industries of the Future (UIOF) program implemented educational workshops and best practice training courses for industrial energy managers. The Intermountain Industrial Assessment Center (IIAC), administered by the

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[93] A.M. Shipley, R.N. Elliott, and A. Hinge. 2002. *Energy Efficiency Programs for Small and Medium-Sized Industries*. Washington, DC: American Council for an Energy-Efficient Economy.
[94] See http://www.energy.wsu.edu/ for details.
[95] Canadian Industry Program for Energy Conservation, 2007, accessible online: http://oee.nrcan.gc.ca/industrial/cipec.cfm?attr=24, accessed March 2007.
[96] H. Geller. 2003. *Energy Revolution: Policies for a Sustainable Future*. Washington, DC: Island Press, pp. 106-108.
[97] A.J. Hoffman. 2006. *Getting Ahead of the Curve: Corporate Strategies That Address Climate Change*. Arlington, VA: Pew Center on Global Climate Change, p. 91.

University of Utah, provided on-site energy efficiency assessments for small and medium-size industries in Utah, Idaho, and Wyoming. With a budget of $733,000 during 2001-06, the IIAC made recommendations that are expected to result in $9.6 million in annual energy savings with an average simple payback period of 1.4 years, assuming a 50 percent implementation rate on recommended actions.[98] However, due to federal funding cuts, neither the UIOF program nor the IIAC are currently in operation.

Specific Energy Efficiency Proposal

This policy option proposes establishing a Utah Industry Challenge and Recognition Program within the State Energy Program. The Challenge and Recognition Program would include the following elements:

1. Challenge industrial firms operating in Utah to voluntarily establish energy intensity (energy use per unit of output) reduction goals and to commit to implementing cost-effective energy efficiency projects at a higher rate than in the past. In particular, we suggest requiring companies that participate in the program to commit to: a) establishing energy intensity reduction goals, b) auditing all facilities that have not been audited in recent years, say within the past three years, c) implementing all energy efficiency measures and projects with a five year payback or less within say five years, and d) tracking and reporting progress annually. Likewise, the Challenge Program itself should maintain a data base on progress, including energy savings and economic benefits.

2. Implement an annual awards program to recognize and honor industrial firms that are participating in the Challenge program and have made exemplary efforts to reduce energy intensity and achieve significant energy savings. The awards program could be administered by the State Energy Program, with the awards given out by the Governor at an annual awards ceremony.

3. Increase the scope and impact of utility financial and technical assistance programs for the industrial sector. In particular, we urge Questar Gas Company (QGC) to implement natural gas demand side management (DSM) programs for industrial customers, both full service and transportation gas customers (see Option 4 above). These programs can be modeled on successful gas DSM programs for industrial customers in other jurisdictions.[99] In addition, we recommend that RMP expand marketing and promotion of their incentive programs to industrial customers, and that larger municipal utilities initiate such incentives.

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[98] Personal communication with M. Krahenbuhl, Director, Nuclear Engineering Program, University of Utah, 2007.

[99] Some gas utilities do implement DSM programs for all customers, not only their full service customers. M. Kushler, D. York and P. Witte. 2003. *Responding to the Natural Gas Crisis: America's Best Natural Gas Energy Efficiency Programs*. Washington, DC: American Council for an Energy-Efficient Economy. http://aceee.org/utility/ngbestprac/u035.pdf.

4. Expand industrial energy efficiency training and technical assistance activities such as those formerly provided by the UIOF program and the IIAC. State funding should be provided along with co-funding from industry groups, utilities, and/or federal agencies, if such funding can be obtained. Given previous experience with federal grants, state funding is critical for ensuring the stability and continuity of training and technical assistance efforts. Training and technical assistance is especially important for small and medium-size industries.

Energy Savings

Our energy savings analysis is limited to electricity, natural gas, and petroleum products. In reality there should be savings of other fuels such as coal used directly by industry, but it is unclear how much cost-effective energy savings potential exists for coal and other fuels. Electricity, natural gas, and petroleum products represent the large majority of energy consumed by industries in Utah. Regarding natural gas and petroleum products, we restrict our analysis to fuel used for energy purposes; i.e., we exclude natural gas and petroleum used as feedstocks in the chemical and other industries.[100]

Our analysis is based on assumptions regarding average energy intensity reduction over time as the Challenge Program and other activities suggested above are implemented, relative to a baseline industrial energy use scenario. Our baseline assumptions are based on forecasts from RMP and QGC, in particular baseline growth rates of 1.7 percent per year for electricity and 2 percent per year for natural gas. In addition, we assume baseline growth of 1 percent per year for petroleum products consumed by industry. These growth rates are higher than those expected in the industrial sector nationwide,[101] but Utah's population and industrial output (including natural resource extraction) are growing much faster than the national average.

Regarding reductions in energy intensity, we assume that this initiative would reduce industrial energy intensity by 0.25 percent starting in 2008, an additional 0.50 percent in 2009, an additional 0.75 percent in 2010, and an additional 1.0 percent per year in 2011 and thereafter. Our assumption of an incremental annual reduction in energy intensity of 1.0 percent per year once the program ramps up is supported by an in-depth analysis sponsored by the U.S. Department of Energy of the achievable potential for energy intensity reduction in different industrial sectors.[102] These reductions in energy intensity are in addition to those already occurring and expected in the future due to

[100] Estimates of feedstock use provided by Mike Vandenberg, Utah Geological Survey, Salt Lake City, UT, April 2007.

[101] *Annual Energy Outlook 2007*. DOE/EIA-0383(2007). Washington, DC: Energy Information Administration, U.S. Department of Energy. Feb.

[102] Interlaboratory Working Group. 2000. *Scenarios for a Clean Energy Future*. Oak Ridge, TN: Oak Ridge National Laboratory and Berkeley, CA: Lawrence Berkeley National Laboratory. www.ornl.gov/ORNL/Energy_Eff/CEF.htm.

ongoing technological advances, structural shifts, and other policies such as utility energy efficiency programs.[103]

The overall reduction in industrial energy intensity, shown in Table 9, reaches 6.5 percent in 2015 and 11.5 percent in 2020. These percentages are applied to the baseline forecasts of electricity, natural gas, and petroleum product use in order to estimate energy savings. In reality there are likely to be different rates of energy intensity reduction for different forms of energy, but we lack detailed information on industrial energy savings potential that would enable us to make such a differentiation.

Table 9 – Projected Energy Savings from the Utah Industry Challenge and Recognition Program

Year	Percent Reduction in Energy Intensity	Electricity savings (GWh/yr)	Natural Gas Savings (million decatherms/yr)	Petroleum Product Savings (trillion Btu/yr)
2007	0	0	0	0
2008	0.25	21	0.12	0.05
2009	0.75	64	0.38	0.17
2010	**1.50**	**130**	**0.78**	**0.33**
2011	2.50	221	1.32	0.56
2012	3.50	315	1.88	0.80
2013	4.50	411	2.47	1.03
2014	5.50	511	3.08	1.28
2015	**6.50**	**615**	**3.71**	**1.52**
2016	7.50	721	4.37	1.77
2017	8.50	831	5.05	2.03
2018	9.50	945	5.76	2.29
2019	10.50	1,062	6.49	2.56
2020	**11.50**	**1,183**	**7.25**	**2.83**

Cost and Cost Effectiveness

Regarding the cost to the state of Utah, we are suggesting a budget of $400,000 per year for establishing and implementing the Industry Challenge and Recognition Program as well as supporting training and technical assistance activities.[104] We expect

[103] The Energy Information Administration projects that in the absence of new energy efficiency initiatives, the overall energy intensity of the U.S. industrial sector (energy consumption per dollar of shipment) will decline 1.3% per year on average during 2005-2030. See Reference 101.
[104] The State Energy Program does not have the resources or capability to implement a program along these lines at the present time.

that it should be possible to obtain at least $100,000 per year in total co-funding from industry groups, utilities, and federal agencies.

Regarding cost to the private sector, upgrading the energy efficiency and modifying industrial operations in ways that save energy are very cost-effective. For example, energy efficiency and conservation measures recommended by the Industrial Assessment Centers funded by the U.S. Department of Energy during 2000-2005 showed a median benefit-cost ratio of 5.65 and a median simple payback period of just 0.43 years.[105]

For the policy outlined above, we assume that energy efficiency projects implemented by industries in pursuit of their energy intensity reduction targets have a simple payback of three years on average. Some projects will pay back more rapidly; others will have a longer payback period. In addition, we assume that industrial energy efficiency measures and projects have a lifetime of 15 years on average. In aggregate, we estimate that adopting this policy and meeting the energy savings targets will lead to about $145 million in investment in energy efficiency measures during 2006-2015 (discounted net present value). The resulting energy bill savings over the lifetime of these measures would equal about $500 million on a present value basis, meaning a net economic benefit of about $356 million (2006 dollars, net present value). Additional net benefits will result from efficiency measures and projects implemented during 2016-2020.

Environmental and Social Benefits

By reducing the amount of electricity consumed by industries, this option would reduce water consumption by power plants. The estimated total water savings are about 330 million gallons per year by 2015 and 630 million gallons per year by 2020. During 2008-2020, the Program would reduce water consumption in the state by an estimated 4.1 billion gallons.

Table 10 shows the estimated pollutant emissions reductions in 2015 and 2020 from reduced operation of coal and gas-fired power plants, as well as reduced direct natural gas and petroleum use in industries. By cutting air pollutant emissions, the efficiency standards would have a beneficial effect on public health and would help the state meet its air quality goals.

[105] A.M. Shipley and R.N. Elliott. 2006. *Ripe for the Picking: Have We Exhausted the Low-Hanging Fruit in the Industrial Sector?* Washington, DC: American Council for an Energy-Efficient Economy. April.

Table 10 – Estimated Emissions Reductions from the Utah Industry Challenge and Recognition Program

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric tons)	710	1,367
SO_2 (short tons)	363	676
NOx (short tons)	673	1,288
Mercury (pounds)	3.6	6.8

Increasing energy efficiency in Utah's industrial sector will provide other environmental and social benefits besides water savings and emissions reductions from reduced energy consumption. Measures such as better control of industrial process equipment or better lighting can result in productivity gains worth more than the energy savings alone.[106] Likewise, technologies such as better combustion control or more efficient burners can reduce NOx and other pollutant emissions at the same time energy savings are achieved, thereby improving air quality and/or reducing environmental compliance costs. For example, new oxy-fuel burners for the glass or steel industries reduce NOx and CO_2 emissions by 90 percent or more, reduce particulate emissions by up to 30 percent, and increase furnace production rates, in addition to cutting energy use substantially compared to traditional burners.[107]

Political and Other Considerations

The proposed Industry Challenge and Recognition program is voluntary, meaning that companies would choose whether or not to participate. It will be necessary to achieve cooperation and participation from industries representing a large fraction of total industrial energy use in order to have the impacts suggested above. Therefore, we recommend consulting with major industries in the state before defining the program in detail, if a decision is made to proceed. The challenge will be to design a program that will stimulate a high level of participation as well as a high level of incremental investment in energy efficiency measures. Identifying champions for the program within the industrial sector will be critical in this regard.

Priority

The industrial sector is an important energy-using sector in Utah, and has been slow to fully embrace energy efficiency. The potential for energy and cost savings in this sector is very significant, with additional macroeconomic and environmental benefits as

[106] See Reference 20.
[107] E. Levine and K. Jamison. 2001. "Oxy-Fuel Firing for the Glass Industry: An Update on the Impact of this Successful Government-Industry Cooperative Effort." *Proceedings of the 2001 ACEEE Summer Study on Energy Efficiency in Industry.* Washington, DC: American Council for an Energy-Efficient Economy, pp. 375-383.

well. Also, this is the only option targeted directly to the industrial sector. For these reasons, we recommend it be viewed as a **high priority** by the Governor, Legislature, and other stakeholders.

Case Study 5:

Compressed Air Systems:
ATK Launch Systems, Magna / West Valley City

ATK Launch Systems, Inc. is the world's leading manufacturer of rocket motor systems for human-rated and unmanned space launch vehicles, strategic missiles, prompt global strike missiles, and missile defense inceptors. ATK Launch Systems Bacchus Operations has been actively engaged in energy efficiency activities, having implemented more than $12 million in energy saving measures over the past ten years. Systems include SCADA, lighting, building equipment and controls, steam generation and distribution, compressed air generation and distribution, etc.

Recently ATK has focused on compressed air systems. Several projects have been completed, are in progress, or planned over the next few years. An example of a recently completed project is provided below:

Quick Facts

Total Project Cost: $130,000
Annual Energy Savings: 960,000 kWh
Annual Cost Savings: $41,000
Utility Self Direction Credit: $102,000
Measures: 1) Replaced large air compressor with smaller, load tracking compressors, added sequencing systems w/SCADA, dryer controls and other improvements,
2) Optimized system operating pressure,
3) Reduced system compressed air demand.

Benefits:

- Reduced operating costs
- Reduced system peak electrical demand
- Improved reliability
- Upgraded equipment
- Reduced emissions at coal-fired power plants

Source: ATK Launch Systems, 2007

Option 11: Remove Barriers and Provide Incentives to Stimulate Greater Adoption of Combined Heat and Power (CHP) Systems

Background

Most commercial buildings and manufacturing firms purchase electricity for cooling, fans, pumps, equipment, lighting, processes, etc., and buy fuels to generate heat. The electricity is generated at power plants distant from the industrial site at an efficiency of 30 to 40 percent, so most of the energy content of the fuel is wasted as heat to the surrounding environment. Further energy losses occur in the transmission and distribution (T&D) of electricity from the power plants to end users. The Utah energy baseline estimates T&D losses to be 9 percent of power generated in the state. On-site thermal energy is produced at efficiencies in the neighborhood of 70 percent.

Combined heat and power (CHP), or co-generation, is an efficient distributed generation technology that produces both heat and power from a single fuel source. Such systems can have overall efficiencies of 80 percent or better. These systems also provide additional savings associated with reduced T&D losses. One study estimated that the 77,000 MW of installed CHP capacity in the U.S. as of 2003 saved about 2.2 quads (quadrillion Btus) of energy.[108]

As of 2005, Utah had 16 operating CHP facilities with a total installed capacity of 239 MW, according to a recent White Paper prepared for the Western Governors' Association (WGA).[109] Existing CHP systems include a 22 MW facility at the Tesoro refinery in Salt Lake City, a 37.2 MW system at the U.S. Magnesium plant in Rowley, a 16 MW unit at Little Mountain (utility owned) in Ogden, and a 34.4 MW system owned by the City of Springville. Most of the CHP systems in Utah are fueled by natural gas, but some operate using coal, biomass, or waste materials. Systems are owned and operated by end users and utilities, including municipal utilities and Rocky Mountain Power.

In spite of the growth of CHP capacity in recent years, there are still many barriers inhibiting greater use of CHP systems. In Utah as well as many other states, these barriers include the fundamental differences in utility and end user economic perspectives, difficult and costly grid interconnection procedures and power contracting processes, high utility tariffs for standby or backup power, concerns about a potential adverse impact on air quality in non-attainment areas such as Salt Lake County, and lack of financial incentives to stimulate CHP system implementation.

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[108] H. Geller, et. al. 2006. "Policies for increasing energy efficiency: Thirty years of experience in OECD countries." *Energy Policy 34*: 556-573.

[109] Combined Heat and Power White Paper. Report prepared for the Clean and Diversified Energy Initiative, Western Governors' Association, Jan. 2006. http://www.westgov.org/wga/initiatives/cdeac/CHP-full.pdf.

Specific Energy Efficiency Proposal

Increasing the penetration of CHP into the energy supply mix in Utah will require addressing barriers and providing incentives and/or market frameworks to offset the logistical and financial challenges associated with installing and operating CHP systems. The proposals below include suggestions which could help address these challenges.

A) Remove Barriers

Current environmental regulations for combustion systems are based on fuel input. A 33-percent efficient central generation power plant (producing 1 kWh of electricity for every 10,500 Btu of fuel consumed) has the same emission limits as an 80-percent efficient CHP plant. We recommend that Utah adopt output-based emissions standards based on the model standards developed by the Regulatory Assistance Project.[110] Such standards have been adopted in other western states, including Texas and California.

Interconnection of small power systems to the distribution grid is a complex process which often creates barriers to installation of CHP and other distributed generation systems. PacifiCorp has been working on interconnection rulemaking in the eastern portion of the system, particularly in Oregon. We recommend that the State of Utah follow the Oregon rulemaking and work with RMP to develop streamlined interconnection procedures as close to those adopted in other states as possible. In addition, we recommend that the Public Service Commission undertake a review of rates, including those for standby or backup power promulgated by RMP as well as non-investor owned utilities in the state, to make sure they are not discriminatory toward CHP systems.

Installing CHP systems in buildings can create challenges for an owner dealing with building code and permitting procedures. We recommend adopting simplified, streamlined, and consistent permitting procedures for CHP systems. We also suggest providing training for local code officials, since these officials are often not familiar with CHP systems. This training can be included in the comprehensive energy efficiency training called for in Option 22.

B) Promote Alternative Fuel and Waste Heat-based CHP Systems

Natural gas has been the fuel of choice for most CHP systems to date, but recent increases in natural gas costs, due in part to the growth in central station gas-fired power plants, have adversely affected the economics of CHP systems. Increasing the use of alternative fuels such as wastewater treatment plant or other digester gases (also known as opportunity fuels) and waste heat-based CHP systems is a way to continue CHP expansion in the face of high natural gas prices.

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[110] *Model Regulations for the Output of Specified Air Emissions from Smaller-Scale Electric Generation Resources*. Gardiner, ME: Regulatory Assistance Project. October 2002. http://www.raponline.org/showpdf.asp?PDF_URL=%22ProjDocs/DREmsRul/Collfile/ReviewDraftModelEmissionsRule.pdf%22.

Specific recommendations to achieve this objective include: 1) provide utility incentives for waste heat-based power generation under utility DSM programs; 2) quantify the opportunity fuel and waste heat resource in the state and identify the most promising CHP opportunities; 3) provide technical assistance to businesses interested in evaluating waste heat and opportunity fuel CHP systems; 4) provide assistance with regulatory and permitting issues; and 5) encourage high efficiency CHP systems as an alternative to biomass-fired heating or stand-alone electric generation.

C) Establish Favorable Market Conditions

A number of steps can be taken to provide reasonable financial incentives and favorable market conditions for expansion of high performance CHP systems, meaning those with an overall efficiency of at least 60 to 70 percent. In particular, we recommend consideration of requiring utilities to pay a large fraction of full avoided costs for power supplied to the grid from high performance CHP systems. These full avoided costs should include avoided generation and T&D costs, not just fuel and operating costs. Full avoided costs are used to justify and set incentives for DSM programs. They should be used for both evaluation of and contract terms with CHP system owners as well.

Second, we recommend encouraging utility ownership or co-ownership of CHP systems, in effect converting the utility from a CHP inhibitor to a CHP proponent. Utilities should be allowed to earn their authorized rate of return on CHP investments at a minimum, and potentially a higher return if a CHP system provides significant net economic benefits for utility customers as a whole. For example, utilities could be allowed a "bonus return" equal to 10-20 percent of the net economic benefits resulting from a CHP project, meaning consumers would receive 80-90 percent of the benefits.

Third, we recommend consideration of tax credits for non-utility owners of CHP systems, with the tax credit based on electricity output similar to renewable energy production tax credits. This policy would bring greater parity between tax treatment of utility-owned power plants and customer-owned CHP and renewable energy systems. Tax incentives are justified since many of the benefits of CHP accrue to society at large rather than to the individual CHP system owner.

Energy Savings

There have been a number of evaluations of CHP or distributed generation potential in recent years. The Combined Heat and Power White Paper prepared for the WGA estimated a potential addition of 1,267 MW of CHP capacity in Utah.[111] However, this is technical potential only. It does not take into account economic or other limitations to CHP adoption.

[111] See Reference 109.

PacifiCorp (RMP's parent company) commissioned a CHP market potential study in 2003.[112] The market assessment was based on information about Utah Power's commercial and industrial customers, including size and load factor, without corresponding information on thermal loads. The study estimated a market potential of between 100 and 150 MW over a five-year period.

The Department of Energy commissioned a review and update of the CHP market potential in the West, looking at several western states including Idaho and Washington but not Utah, in 2005.[113] The study concluded that the CHP potential in the region was much lower than earlier studies, mostly due to the high and volatile price of natural gas. However, the study also concluded that there is significant potential for alternative, "opportunity fuel" based CHP systems.

Table 11 shows our assumptions regarding additional CHP system installation in Utah, assuming a number of the policies suggested above are adopted. We assume it is possible to add a total of 70 MW by 2015 and 115 MW by 2020. This means increasing CHP capacity in the state by about 50 percent, relative to the current level, by 2020.

Table 11 – Energy Impacts of Combined Heat and Power (CHP) Initiative

Year	Incremental CHP Capacity (MW)	Electricity Generation (GWh/yr)	Additional Fuel Consumption (trillion Btu/yr)	Primary Energy Savings (trillion Btu/yr)
2007	0	0	0	0
2008	5	70	0.41	0.39
2009	18	124	0.72	0.70
2010	**28**	**194**	**1.12**	**1.10**
2011	35	248	1.43	1.40
2012	45	318	1.84	1.80
2013	53	371	2.14	2.10
2014	63	441	2.55	2.50
2015	**70**	**495**	**2.86**	**2.78**
2016	80	565	3.27	3.20
2017	88	618	3.58	3.51
2018	98	689	3.98	3.90
2019	105	742	4.29	4.21
2020	**115**	**812**	**4.70**	**4.60**

Table 11 also includes estimates of electricity generation, additional on-site energy consumption, and primary energy savings from the additional CHP capacity each

[112] *Estimation of Market Potential for Combined Heat and Power Applications in PacifiCorp's Utah Service Area.* Report prepared for PacifiCorp by NOVI Energy LLC, April 2003.
[113] *CHP Market Potential in the Western States*. Report B-REP-05-5427-013. Arlington, VA: Energy and Environmental Analysis Inc., September 2005.

year. These CHP systems will most likely operate on some mix of opportunity fuels and natural gas, so we are not able to project how much of which energy sources will be used on-site. In making these estimates, we assume CHP systems have an average capacity factor of 85 percent in the industrial sector and 75 percent in the commercial sector. The estimates also take into account both avoided power generation and avoided T&D losses in response to CHP expansion.

Table 11 shows that if CHP capacity grows as projected, the incremental electricity generation would reach 495 GWh/yr in 2015 and 812 GWh/yr in 2020. The values are equivalent to about 1.4 percent and 2.0 percent of baseline electricity use in 2015 and 2020, respectively. But since the primary energy content of the electricity generation is approximately twice the additional on-site fuel use, the net primary energy savings will reach about 2.8 trillion Btu per year by 2015 and 4.6 trillion Btu per year by 2020. The primary energy savings represent the avoided fuel consumption at central station power plants minus the additional fuel consumption on-site.

Cost and Cost Effectiveness

We estimated CHP installation costs and economic benefits for typical CHP systems used in the commercial and industrial sectors. We assume that these systems will have a simple payback period of 8 years on average in the industrial sector and 7 years on average in the commercial sector (avoided electricity purchases are worth more in the latter). We also assume that CHP systems have an economic lifetime of 25 to 30 years. We ignore any financial incentives in the economic analysis since these are transfer payments from a societal perspective.

In aggregate, we estimate that adding 30 MW of CHP capacity in the commercial sector and 40 MW in the industrial sector by 2015 will cost $69 million but will result in $71 million in net economic benefits (2006 dollars) on a discounted net present value basis. The net economic benefit from the 115 MW of CHP capacity we assume is installed during 2008-2020 is $110 million. Regarding the cost to the state of Utah, we estimate a cost of about $200,000 per year for technical support, assuming no state tax credits are offered. This funding would be used for resource assessments, training, preliminary engineering analyses, and project interconnection and permitting support.

Environmental and Social Benefits

The high energy efficiency of CHP systems, and the displaced central power generation (typically coal-fired generation in Utah), translates directly to environmental benefits, including reduced water consumption and reduced CO_2 emissions. With respect to criteria air pollutants such as sulfur dioxide and nitrogen oxides, the overall impact depends on the difference in emissions rates between the avoided central station power generation and the on-site CHP system. In general the impact is favorable, meaning a net reduction in criteria pollutant emissions.[114]

[114] See Reference 109.

The estimated total water savings from this option are about 215 million gallons per year by 2015 and 354 million gallons per year by 2020. During 2008-2020, adding 115 MW CHP to the energy resource mix would reduce water consumption in the state by an estimated 2.25 billion gallons. The estimated carbon dioxide emissions reduction is about 227,000 metric tons per year by 2015 and 367,000 tons per year by 2020. We do not estimate the net change in criteria pollutants due to uncertainties about CHP system emissions rates.

Political and Other Considerations

CHP installations can provide important public benefits such as alleviating transmission and distribution constraints, energy savings, and emission reductions. But limited experience with CHP technologies as well as multiple regulatory and permitting barriers has slowed the adoption of CHP systems in Utah. In general, industrial and commercial consumers support removal of these barriers, while electric utilities tend to be less supportive. Encouraging utilities to own or co-own CHP systems, and allowing them to keep a small portion of the net economic benefits, could help to overcome the interconnection and tariff-related barriers.

Priority

Overcoming the multiple barriers to more widespread adoption of CHP systems will not be easy. Also, CHP expansion along the lines we suggest would provide moderate energy and economic benefits. For these reasons, we recommend that this option be viewed by the Governor, Legislature, and PSC as a **medium priority**.

Case Study 6:

Combined Heat and Power:
Tesoro Petroleum Refinery, Salt Lake City

Tesoro Petroleum Corporation, a Fortune 500 Company, is an independent refiner and marketer of petroleum products. Their 55,000-barrel per day Salt Lake refinery serves the growing gasoline, diesel fuel, and propane needs of the Intermountain West.

Tesoro’s modern combined heat and power (CHP) system facility, installed in 2004, uses two gas turbine generator units and two heat recovery steam generators. The refinery is able to operate on the power and steam produced by the 22 MW CHP system, with excess electricity that is sold to the utility grid. The CHP system operates 24 hours per day, 7 days per week.

Quick Facts

Equipment: 2 Solar Titan Turbines and 2 Rentech Heat Recovery Steam Generators
Fuel: Natural gas and refinery fuel gas
Total project cost: $25 million
Annual energy bills savings and electricity sales revenue: $6 million
Simple payback period: 4.2 years
Benefits:

- Reduced operating costs
- More reliable power
- Upgraded equipment
- Greenhouse gas emissions reductions

Chapter V – Public Sector Policies

Option 12: Adopt Energy Efficiency Requirements for State Agencies

Background

State-owned or leased facilities including higher education facilities consume approximately 10 percent of the electricity and natural gas consumed by all commercial sector customers in Utah. Governor Huntsman's Energy Efficiency Policy calls for state agencies to lead in meeting Utah's energy efficiency goal, thereby saving energy and saving taxpayer dollars. In 2006, the Utah State Legislature passed House Bill 80, directing the Division of Facilities Construction and Management (DFCM) to administer the State Building Energy Efficiency Program (SBEEP). This bill includes a number of provisions such as development of incentives, procurement of efficient products, requirements to track and analyze energy savings data, and reporting to the Governor and Legislature. The bill did not include energy saving targets or requirements. However, SBEEP is considering setting energy efficiency requirements on a "per agency" basis.

There are a number of examples of energy efficiency requirements in the public sector. At the national level, President Bush issued an Executive Order requiring Federal agencies to reduce energy intensity by 30 percent by the end of fiscal year 2015, relative to 2003 baseline energy intensity.[115] This is equivalent to a 2.5 percent annual improvement, on average. Previous Federal Executive Orders have been successful in achieving significant energy savings for federal agencies. For example, energy intensity (energy use per unit of floor area) in federal buildings declined 24 percent during 1985-2000.[116]

Some states have adopted energy intensity reduction requirements for state agencies. In 2003, Arizona adopted legislation requiring state agencies to reduce energy use per unit of floor area by ten percent by 2008 (with 2003 as the baseline), and an additional five percent by 2011.[117] The State of Texas has a five-year, 25-percent energy reduction target, meaning a reduction of five percent per year on average. The Texas target includes all public sector entities, i.e. both state and local government.[118] And Colorado Governor Bill Ritter recently issued an Executive Order directing state agencies to reduce energy consumption in 2011-2012 by 20 percent relative to energy use in 2005-2006.[119]

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[115] Executive Order: *Strengthening Federal Environmental, Energy, and Transportation Management*, January 24 2007, accessible online: http://www.whitehouse.gov/news/releases/2007/01/20070124-2.html, accessed August 8, 2007

[116] *Annual Report to Congress on Federal Government Energy Management and Conservation Programs Fiscal Year 2000*. Washington, DC: U.S. Department of Energy, Federal Energy Management Program, Dec. 13, 2002.

[117] Arizona 34-451. Energy conservation standards for public buildings. House Bill 2324, signed into law April 28, 2003.

[118] http://www.seco.cpa.state.tx.us/. Texas' compliance period is 2002-2007. The energy reduction targets in Texas are part of the state's larger efforts to reduce pollutant emissions for compliance with the federal Clean Air Act.

[119] Executive Order D0011-07, issued by Colorado Gov. Bill Ritter, Jr., April 16, 2007.

Limited capital or know-how can be constraints to implementing energy efficiency projects in the public sector. These constraints can be overcome by using energy service companies (ESCOs), third party financing, and performance contracting. A number of states have "ramped up" their energy efficiency investment in public buildings by utilizing this strategy.[120] For example, performance contracting and use of ESCOs has been an important strategy for upgrading public sector energy efficiency in Colorado.[121,122] However, performance contracting and ESCOs have not been widely utilized by public sector entities in Utah, in part because it reduces the economic benefits realized by the state from energy efficiency upgrades.

Specific Energy Efficiency Proposal

This policy proposes adoption of energy efficiency requirements for state agencies, including state universities and colleges. These requirements would be expressed as a reduction in energy usage per square foot of occupied floor area. We suggest mimicking the federal goals in Utah, meaning a reduction of 2.5 percent per year until 2015, i.e. requiring by 2015 a 20 percent reduction of relative energy use per unit of floor area as of 2007. We further suggest a nominal one percent reduction per year during 2016-2020.[123] Flexibility could be provided to agencies that have already achieved high levels of building thermal integrity and equipment efficiency. Additionally, requirements to purchase ENERGY STAR products could be implemented. The energy savings requirements could be established either through an Executive Order or through legislation.

In order to achieve the suggested requirements, we recommend employing the following strategies:

1. Increased use of energy benchmarking tools, such as EPA's ENERGY STAR benchmarking software, to analyze the energy efficiency of buildings relative to the national average. Use of this tool helps identify buildings that are highest priorities for action.

2. Maximizing utilization of incentive programs offered by Utah's electric and natural gas companies.[124]

[120] N. Hopper, C. Goldman, D. Gilligan D. et al. 2007. *A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000 to 2006.* LBNL-62679. Berkeley, CA: Lawrence Berkeley National Laboratory, May.
[121] State of Colorado Executive Order D 014 03, July 16, 2003. Energy Performance Contracting to Improve State Facilities, http://www.state.co.us/gov_dir/govnr_dir/exec_orders/d01403.pdf.
[122] Rebuild Colorado website, Governor's Energy Office, http://www.colorado.gov/rebuildco/success/state/dpa.htm. Also personal communication with Seth Portner, Colorado Governor's Energy Office, March 2007.
[123] These targets are lower that those seen in other leading states, i.e. Arizona, Colorado and Texas. This policy option includes a lower savings target in an attempt to avoid double counting the role of utility incentive programs.
[124] Note that energy savings resulting from utility DSM programs was not analyzed in this option.

3. Performance contracting, ESCOs, and tax-exempt lease-purchase agreements, enabling the public sector to implement energy-savings projects without government funding.

4. Full implementation of no-cost and low-cost measures, such as computer monitor power management and computer power management enabling software that can save 675 kWh per desktop computer per year.[125]

5. Hiring and training internal energy managers to seek energy conservation and efficiency projects, as well as review utility bills for errors and to identify opportunities to reduce demand charges through better building occupancy/use scheduling, and operations and maintenance changes. In a one-year period, one Utah School District saved over $40,000 by auditing its billing charges and fees.[126]

6. Awarding construction contracts based on lifecycle cost analysis and prohibiting construction change orders that would compromise energy-efficient design features and energy saving measures.

7. Creating incentives, such as allowing state agencies to keep a portion of the monetary benefits from energy saving projects.

Energy Savings

Table 12 presents our estimates of energy savings in state facilities from meeting the recommended efficiency requirements. We estimate that doing so would result in electricity savings of 253 GWh and natural gas savings of 1.4 million decatherms per year in 2015. The savings grow to 316 GWh and 1.8 million decatherms in 2020. These savings estimates are not adjusted to account for savings resulting from other policies such as expanded utility DSM programs or new efficiency standards.

Cost and Cost Effectiveness

We estimate that the State agency energy efficiency requirements would cut energy costs by $24.5 million in 2015 and $30.6 million in 2020 (undiscounted values). On a discounted net present value basis, the cumulative savings during 2007-2020 would be $165 million (2006 dollars). Assuming an average payback period of seven years, $113 million would be invested in energy efficiency measures during 2007-2015 to meet the energy intensity requirements; i.e., $14 million per year on average. Assuming an average measure lifetime of 20 years, the net economic benefit associated with efficiency measures installed during 2007-2015 would be $88 million (discounted net present value basis).

[125] Savings based on 500 computers and monitors with electricity cost of $.0561/kWh using ENERGY STAR's online power management calculator: http://pmdb.cadmusdev.com/powermanagement/quickCalc.html.

[126] Personal communication with P. Barnes, Davis School District Energy and Utilities Manager, February, 2007.

Table 12 – Energy and Cost Savings from State Agency Energy Efficiency Improvements

Year	Electricity Savings (GWh per year)	Natural Gas Savings (million decatherms per year)	Energy Cost Savings[1] (million 2006 $)
2007	30	0.17	3.02
2008	56	0.31	5.67
2009	82	0.46	8.21
2010	**109**	**0.61**	**10.79**
2011	137	0.76	13.43
2012	165	0.92	16.13
2013	194	1.08	18.87
2014	223	1.24	21.67
2015	**253**	**1.40**	**24.53**
2016	265	1.47	25.70
2017	277	1.54	26.88
2018	290	1.61	28.10
2019	303	1.68	29.34
2020	**316**	**1.76**	**30.60**

1 - Undiscounted values.

Environmental and Social Benefits

Improving O&M procedures and performing energy retrofits will help meet comfort, health, and safety needs of building occupants. Implementing energy saving projects in many cases will enhance employee productivity and reduce absenteeism through better lighting and ventilation. Also, these projects tend to be labor intensive, thereby increasing local employment.

By cutting energy use, this policy option reduces pollutant emissions from power plants. Table 13 shows the estimated emissions reductions in 2015 and 2020. The reductions provide environmental benefits including reduced contribution to global global warming due to lower CO_2 emissions, improved air quality, and reduced regional haze that impacts Utah's scenic areas and national parks.

Political and Other Considerations

With the passage of the House Bill 80 in 2006, the success of energy intensity reduction requirements for federal agencies, and Utah's energy efficiency expertise in the Division of Facilities Construction and Management, Utah is poised to take the next step of adopting energy efficiency targets for state agencies. Adopting and complying with energy efficiency targets or requirements will require political will and cooperation throughout state government. This means securing a commitment to meet the targets on the part of department heads and budget directors as well as gaining cooperation from state employees. It will require a commitment of additional staff, training, and software support.

Table 13 – Estimated Emissions Reductions from State Agency Energy Efficiency Improvements

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric itons)	244	305
SO_2 (short tons)	11.4	14.2
NOx (short tons)	70.7	88.4
Mercury (pounds)	1.0	1.3

Priority

This policy would result in significant electrical and natural gas savings as well as lower energy costs for state governments. It would demonstrate leadership by example, as well as save the state money. We recommend that it be viewed by the Governor and Legislature as a **high priority**.

Option 13: Support Energy Efficiency for Local Government and K-12 Schools, Including the Expansion of Utah's Revolving Loan Fund

Background

Municipal governments and school districts have taken a number of positive steps to increase energy efficiency and lower energy bills. For example, Salt Lake City and County have improved the energy efficiency of their buildings and facilities through lighting retrofits, cogeneration at the wastewater treatment plant, and requirements that new or renovated buildings meet the USGBC Leadership in Energy and Environmental Design (LEED) standards. Additionally, Salt Lake County has adopted a target to increase energy efficiency by four percent per year. However, there still exists a tremendous backlog of cost-effective energy efficiency projects in local government buildings and K-12 schools in Utah. Additional financial and technical assistance, as well as encouragement, are needed to help K-12 schools and local governments reap the benefits of greater energy efficiency.

Diverse funding mechanisms are available that can provide needed capital for energy efficiency projects by local governments and school districts. A revolving loan fund (RLF) is one such mechanism. In Utah's 2007 legislative session, a $5 million RLF was established for energy efficiency projects implemented in K-12 schools.[127] There are a number of other such funds around the United States, including funds in California, Idaho, Iowa, Missouri, Nebraska, Ohio, Oregon, and Texas. These funds typically feature below-market interest rates ranging from three to five percent, although zero interest loans also exist. When interest is charged it enables the fund to preserve its capital, thereby providing funding capacity over the long term.

Energy service companies (ESCOs) also provide funding for energy efficiency projects in the public sector while guaranteeing energy savings. A recent report by Lawrence Berkeley National Laboratory shows the important role ESCOs play in implementing public sector energy efficiency projects. The public sector market accounted for over 80 percent of the $2.5 billion in energy efficiency projects implemented by ESCOs in 2006.[128] Performance contracting with ESCOs provides both capital and technical expertise for implementing energy efficiency projects.

Specific Energy Efficiency Proposal

We suggest the adoption of a multi-pronged approach to support at least a 15 percent increase in energy efficiency in Utah's local government and K-12 schools by 2015. This goal could be accomplished through:

1. State collaboration with local governments and K-12 schools to support setting energy efficiency goals at the local level (possibly following the state agency efficiency targets proposed in Option 12);

[127] House Bill 351, Revolving Loan Fund for Certain Energy Efficient Projects, Rep. R. Barrus, http://le.utah.gov/~2007/htmdoc/hbillhtm/HB0351.htm.
[128] See Reference 120.

2. Expansion of the Revolving Loan Fund to $25 million and including local governments as an eligible entity;[129]

3. A full-time state-level staff person who would provide technical assistance to local governments and K-12 schools related to performance contracting and use of ESCOs.

This approach would assist schools and local governments in meeting future energy needs while saving taxpayers money and reducing capital constraints. While it would be difficult for the state to require energy efficiency improvements by local governments, the state can provide technical expertise and financial support. This collaboration would promote cooperation and information-sharing between governments toward mutually beneficial goals, namely cutting energy waste and lowering energy costs.

Energy Savings

In evaluating this option, we assume that 1.5 percent of projected energy consumption in local governments and K-12 schools is saved each year, on average. As shown in Table 14, this assumption results in 700,000 decatherms of natural gas and 168 GWh of electricity savings per year by 2015. The savings grow to 1.2 million decatherms of natural gas and 288 GWh of electricity per year by 2020.

Table 14 – Projected Energy Savings in Local Government and K-12 Schools

Year	Electricity Savings (GWh per year)	Natural Gas Savings (million decatherms per year)	Energy Cost Savings[1] (million 2006 $)
2008	20	0.08	1.9
2009	40	0.17	3.8
2010	**60**	**0.25**	**5.8**
2011	81	0.34	7.8
2012	102	0.43	9.8
2013	124	0.52	11.9
2014	146	0.61	14.1
2015	**168**	**0.70**	**16.2**
2016	191	0.80	18.4
2017	215	0.90	20.7
2018	238	1.00	23.0
2019	263	1.10	25.4
2020	**288**	**1.20**	**27.8**

1 -Undiscounted values.

[129] In the future, if demand for energy efficiency projects and loans is sustained, the fund could be increased to $50 million.

Cost and Cost Effectiveness

The cost of to the State for implementing this option through 2020 is approximately $21.5 million. This includes a one-time appropriation of $20 million for the RLF and a new state position to support the policy's implementation. We estimate that approximately $15 million needs to be invested in energy efficiency measures each year in order to meet the energy savings targets outlined above. We suggest that about one third of this, or $5 million per year, be provided by the expanded RLF. Financing for additional efficiency projects could come from ESCOs, municipal bonds, or other fund mechanisms available to local governments and school districts.

We assume that projects will have a payback period of seven years on average and that 60 percent of the energy savings would be in the form of electricity savings and 40 percent in natural gas.[130] The value of the energy savings statewide reaches over $16 million in 2015 and nearly $28 million in 2020 (undiscounted). Assuming efficiency measures have a 20-year lifetime on average, the net economic benefits from efficiency projects implemented during 2007-2015 is $67 million (discounted net present value).

Environmental and Social Benefits

Table 15 shows the estimated emissions reductions in 2015 and 2020. The environmental benefits from these emissions reductions include reduced contribution to global global warming, improved air quality, and reduced regional haze.

This option will also provide social benefits. By reducing energy costs, energy efficiency projects in the public sector enable school districts and local governments to increase their primary services (e.g., hire more teachers or spend more on other public sector efforts). Additionally, well-designed, energy-efficient school buildings improve the learning environment and student performance. In particular, high-quality daylighting in schools is associated with students achieving higher scores on standardized tests, as measured through sophisticated statistical analyses.[131]

Table 15 – Estimated Emissions Reduction in Local Government and K-12 Schools

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric tons)	150	257
SO_2 (short tons)	7.6	12.9
NOx (short tons)	47.1	80.5
Mercury (pounds)	0.7	1.2

[130] J. Osborn, C. Goldman, N. Hopper, and T. Singer. 2002. *Assessing U.S. ESCO Industry Performance and Market Trends: Results from the NAESCO Database Project*. LBNL-50304. Berkeley, CA: Lawrence Berkeley National Laboratory, Aug.

[131] L. Heschong and R.L. Wright. 2002. "Daylighting and Human Performance: Latest Findings." *Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy. pp. 8.91-104.

Political and Other Considerations

This option is important to the success of Utah's public sector in meeting current and future energy efficiency goals and is important for fostering collaboration between governments. School districts and local governments in general should support this policy, as should private sector stakeholders such as contractors and ESCOs. The biggest obstacle is likely to be the additional appropriation for the RLF given the competition for state monies. In case expansion of the RLF is not possible, we recommend that local governments and K-12 school districts maximize their use of performance contracting (ESCOs) as well as utility DSM programs in order to leverage limited state dollars.

Priority

This policy would yield moderate electricity and natural gas savings as well as economic benefits. The policy could be especially helpful to local governments and schools, with notable social benefits. But the additional appropriation for the revolving loan fund could be problematic. We recommend that it be viewed by the Governor and Legislature as a **medium priority**.

Case Study 7:

ENERGY STAR Vending Machines: Davis School District, Farmington

Rising energy costs are a major concern for school districts across the country. In light of this challenge, many are trying to reduce the operating cost of lighting, appliances and other equipment. After Vender Misers proved unsuccessful, the Davis School District began contracting for ENERGY STAR vending machines. The District's Director of Utility Services began requiring these vending machines for a selection of their units beginning in 2006. A schedule was developed for replacing 221 machines by 2007.

Each of these energy-efficient vending machines reduces annual energy use by 1,800 kWh and saves the school district nearly $150, for an overall savings of over $33,000. The machines are also programmed to turn off their lights on nights and weekends.

Quick Facts

Annual energy savings: 398,000 kWh
Annual cost savings: $33,150
Annual Cost: Zero (put into place through contract requirements)
Number of units: 221 machines

Source: Davis School District, 2007 and U.S. Environmental Protection Agency, 2007

Option 14: Implement Energy Efficiency Education in K-12 Schools

Background

Educating Utah's children on energy efficiency through school curriculum will have long-range benefits for the entire state. Not only will educating our children today produce immediate energy and cost savings through the efficient use of energy, it will also foster an ethic of energy conservation that will improve energy usage patterns in the future and yield an adult population with a greater understanding of energy efficiency and conservation. The vital need for increased energy literacy is underscored by the National Energy Education Development Project, a national organization that develops energy education programs and materials:

> *Energy is the vital link between everything that happens in this world, but there is no single or simple world vision. Energy choices and challenges will become increasingly complicated as the nation and the world balance the expanding need for energy supply with the importance of increasing energy efficiency and conservation.*[132]

In Utah, three key entities are working to implement energy efficiency education in Utah's public schools: the National Energy Foundation (NEF), Utah Society for Environmental Education (USEE), and the Urban Trace-Gas Emissions Studies (UTES) Junior Partner Program. The UTES Program has successfully incorporated energy education into Utah's core curriculum on a pilot basis with several classes, demonstrating that energy and energy efficiency/conservation topics and activities can be tied into the Utah State Core Curriculum in the subjects of Language Arts, Social Studies, Science, and Mathematics.[133] One of the most successful trials to incorporate energy education into the classroom resulted in a sixth grade class receiving the 2006 President's Environmental Youth Award (PEYA).[134]

While the existing efforts of the aforementioned organizations are noteworthy and important, a sanctioned energy efficiency curriculum implemented statewide in all public schools would be a significant step towards achieving lasting transformations with regard to energy efficiency and conservation.

Specific Energy Efficiency Proposal

This proposal consists of four recommendations, which seek to expand and prioritize energy education in Utah's schools. These recommendations overlap and dovetail with other policy options presented, most notably Option 22.

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[132] National Energy Education Development Project, 2006 Annual Report, accessible online: http://www.need.org/needpdf/NEEDAnnualReport.pdf (accessed March 2007).
[133] Personal communication with D. Richerson, UTES Program, University of Utah, February 2007.
[134] 2006 President's Environmental Youth Awards, EPA Region 8, *Get Really Energy Efficient Now!*, Morningside Elementary GREEN Team; see: http://www.epa.gov/peya/peya2006.html#8 (accessed March 2007).

1. Initiate a statewide energy efficiency and conservation program for K-12 students in order to educate today's children, and tomorrow's adults. Efficiency and conservation segments should be incorporated into the energy curriculum taught in the 2nd, 5th, 6th, 8th and 9th grades.[135]

2. Allocate $100,000 per year for two years to develop and implement an energy efficiency education program for Utah's public schools. Since working relationships have already been developed between National Energy Foundation (NEF), Utah Society for Environmental Education (USEE), and the UTES program, free or low-cost materials and teacher training programs are readily available.

3. Direct the State Board of Education to incorporate energy efficiency modules into the state's core curriculum. Partnerships with strategic organizations (e.g. USEE, NEF), and key state agencies (e.g. Dept. of Environmental Quality) with experience preparing educational modules and professional development could be maintained to ensure that Utah's teachers have adequate resources to effectively implement this directive.

4. Establish an ongoing funding mechanism that will ensure the program's viability into the future. The State Office of Education could require that a percentage of the money saved through energy efficiency programs in Utah school districts (say 5 percent) be dedicated to curriculum development and teacher training. Alternatively, a small percentage (10-20 percent) from the yearly interest earned from Utah's Energy Efficiency Loan Fund could be dedicated to public school energy efficiency and conservation programs.

Energy Savings

Since this option focuses on increasing energy literacy of school children, it is very difficult to estimate energy savings or the permanence of any energy savings. For the purpose of this report, we assume that any resulting energy savings will be accounted for in the evaluation of Option 21.

Cost and Cost Effectiveness

Given that energy efficiency curriculum has already been created and successfully implemented on a pilot basis, the cost to tailor this model curriculum to meet the needs of Utah's public schools would be relatively minimal. We estimate that approximately $200,000 ($100,000 per year for two years) would be needed to create a Utah-specific curriculum and effectively implement the curriculum.

The overall cost-benefit ratio of educating Utah's students is not easily quantifiable. The cost of this option is arguably counter-balanced by the economic gain from energy and cost savings, but again the benefits are very difficult to quantify.

[135] See Utah State Core Curriculum: http://www.schools.utah.gov/curr/core/ (accessed February 2007).

Environmental and Social Benefits

This option will yield the significant social benefit of fostering energy efficiency literacy among future adults who will hopefully put into practice in their homes and workplaces some of what they learn in the classroom. In addition, some students may immediately take actions such as turning off lights and computers more consistently as well as urging their parents to conserve energy.

Political and Other Considerations

The need for energy education is never-ending as new children will always be entering schools. Implementing this option may be challenging due to the need to maintain energy efficiency education indefinitely and overcome barriers to modifying the state's core education curriculum. Other priorities such as preparing for standardized tests compete for limited curriculum space. In addition, professional development for teachers will be fundamental to the success of this option.

Priority

This option yields little or no measurable energy savings; however, energy education is complementary to many of the other policy options recommended. This option is a low-cost investment that could have a significant pay-off over the long run. We recommend that it be viewed as a **medium priority** by the Governor, Legislature, and State Office of Education.

Chapter VI – Transportation Policies

Option 15: Adopt Clean Car Standards for New Cars and Light Trucks

Background

The energy efficiency of automobiles relates directly to their emissions of carbon dioxide, the dominant greenhouse gas (GHG). States developing plans to reduce GHG emissions are eager to include cars and light trucks, which contribute 27 percent to U.S. GHG emissions.[136] Eleven states have adopted a clean car standard that will reduce greenhouse gas emissions from new vehicles by 30 percent in 2016 while cutting emissions of traditional pollutants as well. These states are: California, Connecticut, Maine, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington. The governors of Arizona and New Mexico have issued executive orders requiring adoption of the standards, and Maryland enacted legislation doing so in April 2007. Legislation has been introduced in Minnesota, Nevada, Tennessee, and Texas as well.

Measures available to meet the GHG requirements include increased use of alternative fuels and improved air conditioners, for example. But in practice, the primary pathway to meeting the standard will be improvements in vehicle fuel efficiency. Thus, if Utah were to adopt the clean car standard, it could greatly improve vehicle fuel efficiency, thereby helping the state meet the Governor's energy efficiency goal. This would come about through accelerated penetration of technologies that are already entering the market, such as variable valve timing, cylinder deactivation, and 5-speed transmissions, as well as increased sales of hybrid and diesel vehicles.

States adopting the clean car standard have done so through their federal Clean Air Act compliance programs. The Clean Air Act allows states to choose between the federal vehicle pollution control program overseen by the U.S. Environmental Protection Agency and the Low Emission Vehicle program devised by the California Air Resources Board (CARB). The latter program is the clean car program already mentioned.

If Utah chooses this program, it would then regulate emissions of greenhouse gases, hydrocarbons (HC or NMOG), oxides of nitrogen (NOx), carbon monoxide (CO), particulate matter (PM), and formaldehyde (HCHO) as well. The requirements for non-greenhouse gas emissions are similar to, but somewhat more stringent than, the federal program that Utah currently follows. Phase-in of both Tier 2 and the California ("LEV II") program began in 2004. Automakers are finding it easier to comply with both sets of standards with a single set of vehicle offerings, and consequently the vast majority of vehicle models sold carry both federal and LEV II certifications.

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[136] U.S. EPA, "Greenhouse Gas Emissions from Transportation and Other Mobile Sources," http://www.epa.gov/otaq/greenhousegases.htm.

Specific Energy Efficiency Proposal

In this policy, Utah would adopt the clean car standards already adopted by the eleven states listed above. Doing so would mean that new vehicles sold in Utah by each manufacturer would need to meet the requirements shown in Table 16 for GHG emissions, on average. The standards divide vehicles into two categories; larger vehicles are allowed higher emissions than smaller vehicles.

Table 16 – Clean Car Program Greenhouse Gas Tailpipe Standards, 2009-2016

		CO_2-equivalent emissions standard (g/mi)	
	Year	Passenger cars and small trucks/SUVs	Large trucks/SUVs
Near-term	2009	323	439
	2010	301	420
	2011	267	390
	2012	233	361
Mid-term	2013	227	355
	2014	222	350
	2015	213	341
	2016	205	332

Source: California Air Resources Board[137]

Energy Savings

It is expected that manufacturers will meet the greenhouse gas requirements of the clean car standards largely by adding efficiency technologies to their vehicles. If efficiency accounted entirely for the GHG emissions reductions, new vehicles would consume on average 22 percent less fuel in 2012, and 30 percent less fuel in 2016, than the average vehicle consumed in 2002.

This new vehicle efficiency would take some years to spread throughout the vehicle stock. Given the efficiency gains among new vehicles, a "stock model" calculates the increase in average efficiency of all vehicles over time. This leads to the reductions in fuel consumption shown in Table 17, relative to the consumption that would have occurred in the absence of the standards. The stock model used here reflects a "rebound effect": energy savings resulting from higher efficiency are discounted by 10 percent to account for the possibility that purchasing an efficient vehicle causes the owner to drive slightly more.[138]

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[137] Fact Sheet: Climate Change Emissions Control Regulation. Available at http://www.arb.ca.gov/cc/factsheets/cc_newfs.pdf.

[138] Recent research indicates that rebound is under 10%. See K. Small and K. Van Dender "Fuel Efficiency and Motor Vehicle Travel: The Declining Rebound Effect," forthcoming in *Energy Journal*.

Table 17 – Light-duty Vehicle Fuel Savings in Utah from Adoption of a Clean Car Standard

Year	Percent Gasoline savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (trillion Btu per year)
2009	0.3	78	0.41
2010	**0.9**	**238**	**1.24**
2011	1.7	472	2.46
2012	2.8	796	4.15
2013	4.0	1,172	6.11
2014	5.4	1,600	8.34
2015	**6.9**	**2,076**	**10.83**
2016	8.5	2,595	13.53
2017	10.0	3,108	16.21
2018	11.4	3,615	18.85
2019	12.7	4,108	21.42
2020	**13.9**	**4,586**	**23.92**

Cost and Cost-Effectiveness

The levels for GHGs in the clean car standards were based on an examination of existing and emerging vehicle efficiency technologies that could be applied cost-effectively to new vehicles. The assessment assumes that the distribution of vehicles among size classes will not be affected by implementation of the standards.

CARB estimated the increase in the purchase cost of vehicles as the new standards are phased in over the period 2009-2016. The extra first cost is less than $100 in the early years (2009-2010), but then rises to about $275-375 by 2012 and $1,000-1,500 by 2016. Using these cost estimates, and assuming that vehicle sales in Utah continue increasing at 3.4 percent per year as they have on average over the past decade, we estimate that the clean car standard leads to an investment in vehicle efficiency totaling $250 million in the period 2009-2015, on a present value basis.

The resulting savings in fuel costs over the lifetime of these vehicles (on average15 years) would equal about $1.41 billion (present value), assuming gasoline prices remain at their 2006 levels. This gives a net economic benefit of $1.16 billion (2006 dollars) over the life of the vehicles purchased in 2009-2015. Here, fuel savings exclude state gasoline tax (24.5 cents per gallon). Hence the net economic benefits reflect the loss to the state in fuel tax revenues but not the wealth transfer from the state to consumers.[139] Additional net benefits result from more efficient new vehicles purchased

[139] It should also be noted that the loss in the state's gasoline tax receipts is in the context of growing gasoline consumption; adoption of the clean car standard would slow the growth in gasoline use, and therefore gasoline tax receipts, but they would not actually decline.

during 2016-2020. In fact, the bulk of the savings occur after 2016, because the standard reaches its maximum in 2016 and the new, efficient vehicles penetrate the vehicle stock gradually over the following fifteen years.

Environmental and Social Benefits

The clean car standard requires reductions in vehicles' greenhouse gas emissions. CO_2 is the primary GHG associated with vehicles. Total avoided CO_2 emissions follow from the fuel savings estimates above, using the fact that each gallon of gasoline consumed produces 19.3 pounds CO_2.[140] Emissions of CO_2 are reduced by 763,000 metric tons in 2015 and by 1.69 million metric tons in 2020. In addition to these "in-use" CO_2 emissions, each gallon burned represents another 5.2 pounds CO_2-equivalent of "upstream" emissions in the production and distribution of the fuel. Thus, global greenhouse gas reduction benefits are 27 percent higher than the figures above indicate.

Because adoption of the clean car standard would include adoption of the LEV II regulations for criteria pollutants, reductions in emissions of pollutants other than GHGs will follow as well. In particular, smog-forming emissions, hydrocarbons, and air toxics will decline somewhat more than they would under the federal Tier 2 program. These benefits will vary from state to state. In Massachusetts, New York, and Vermont, for example, emissions of hydrocarbons in 2020 are projected to decline by 14-17 percent, and air toxics by 19-25 percent, as a result of adopting the LEV II program.[141] Similar benefits in Utah would mean a reduction of about 2,170 tons in hydrocarbon emissions annually by 2020. It should be noted, however, that the LEV II program is not included in the above discussion of costs and cost-effectiveness of the clean car standard.

Being out of compliance with at least one of the National Ambient Air Quality Standards is a prerequisite, under the Clean Air Act, for adoption of the clean car standard. Utah has non-attainment designations only for CO at present and has requested to be redesignated as in attainment for CO statewide. However, under a new federal standard adopted by the U.S.EPA last fall, Utah expects to have non-attainment areas for PM 2.5 once designations under the new standard have been made.

Political and Other Considerations

The clean car program as adopted by eleven states is being challenged by auto dealers and manufacturers on the grounds that federal fuel economy (CAFE) standards preempt state actions to regulate vehicles' emissions of greenhouse gases. The case is before a federal district court in California, which postponed the proceedings in January 2007 pending the outcome of a related suit before the U.S. Supreme Court. The Supreme Court decided the latter suit on April 2, 2007, ruling that the U.S. EPA has authority under the Clean Air Act to

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[140] Based on fuel carbon content in M. Wang "GREET 1.6", Argonne National Laboratory.

[141] Northeast States for Coordinated Air Use Management, "Comparing the Emissions Reductions of the LEV II Program to the Tier 2 Program," 2003. White paper, available at www.nescaum.org/documents/**lev**_report_final.pdf.

regulate vehicles' greenhouse gas emissions. Because the states adopting the vehicle GHG standard did so as part of their compliance with Clean Air Act requirements, this finding was a prerequisite for states to proceed with implementation of the clean car program. Remaining hurdles are the preemption case and the need for California to obtain a waiver from EPA allowing adoption of air pollution standards more stringent than federal standards.

Utah has had no official deliberations and taken no steps with regard to the clean car standard. The Governor recently announced a global warming initiative for the state, however, and states undertaking such plans have often found the clean car standards to be among the most effective ways to reduce transportation sector GHG emissions. Also, Utah has joined the Western Climate Initiative and the other five states participating in this initiative have either adopted or are in the process of adopting the clean car standards.

Priority

Based solely on its ability to improve energy efficiency in the 2010-2020 timeframe and provide large net economic benefits, the clean car standard should receive **high priority** among transportation sector measures.

Option 16: Adopt Incentives to Stimulate Purchase of More Efficient Cars and Light Trucks

Background

Both state and federal governments have provided monetary incentives to promote the purchase of more efficient vehicles. At the federal level, for instance, there is a "gas guzzler tax" that imposes a surcharge on cars with a fuel economy of less than 22.5 miles per gallon.[142] There are also federal tax credits for the purchase of efficient, advanced technology vehicles such as hybrid vehicles. Tax credits for hybrids are offered by some states as well.

In its 2007 session, the Utah Legislature debated House Bill 122, offering a $1,000 tax credit for the purchase of any vehicle meeting certain stringent greenhouse gas and air pollution requirements. As discussed above, a qualifying vehicle would typically be fuel-efficient as well, due to the close relationship between fuel consumption and greenhouse gas emissions. Although the bill faced no major opposition, it did not pass.

A comprehensive, market-based approach to promoting vehicle efficiency is a "feebate," a system of fees and rebates based on vehicle fuel economy and applying across the spectrum of vehicles. Part of the rationale for a feebate is that consumers tend to undervalue fuel economy when they are choosing a vehicle. A feebate can be designed to be "revenue-neutral," i.e. so that the implementing entity incurs no net cost or revenue. Another positive feature of feebates is that they provide an incentive for improvement in vehicles of any efficiency level and continue to do so as long as the program remains in place.

Feebates have not been implemented anywhere in the U.S. to date. California and Maryland passed feebate legislation in the early 1990s, and Connecticut in 2005; however, none of these programs have reached the implementation stage. Several states are currently considering feebates.

Specific Energy Efficiency Proposal

This policy would establish a feebate program for new light duty vehicles (cars and light trucks) sold in Utah. The simplest form for an incentive program of this type is to set the amount of the fee or rebate for a given vehicle to be proportional to the number of gallons it consumes relative to a vehicle with a chosen fuel economy baseline. The feebate is then entirely determined by the choice of baseline and a constant of proportionality, i.e. the feebate "rate" in dollars per gallon consumed relative to the baseline.

[142] The gas guzzler tax has been successful in minimizing the production of highly-inefficient cars, but it does not apply to SUVs, minivans, and pickups.

The rate we propose here is $1,000 per gallon per 100 miles, along with a baseline of 21 miles per gallon in a combined city/highway rating.[143] Under this feebate, a vehicle with a fuel economy of 35 miles per gallon, for example, would receive a rebate of

$$\$1,000 \text{ x } (100/21 – 100/35) = \$1,900$$

Similarly, a vehicle with a fuel economy of 15 miles per gallon would pay a fee of $1,900. These examples fall near the ends of the fuel economy spectrum; most vehicles would receive a rebate or fee of under $1,000.

The feebate would go into effect in 2008. Each year, the baseline would need to be adjusted upwards to keep up with the rising efficiency of vehicles sold; otherwise, the state would sustain a net revenue loss through the program. Given that the adjustment will need to be set in anticipation of the year's average fuel economy, some guessing will be required. Small errors in projected fuel economy can be corrected in subsequent years.

As an alternative to the feebate, Utah could continue to pursue the incentives for high-efficiency vehicles proposed in H.B. 122. Under this proposal, gasoline vehicles would need to meet a fuel economy threshold of 36 miles per gallon to qualify, and also meet the criteria emissions requirements of either the federal Tier 2 bin 2 standard or California's LEV II SULEV standard, both relatively stringent standards. Under H.B. 122, the tax credit would be in place from January 1, 2008 through December 31, 2010.

Energy Savings

Projecting the effect of a feebate program on consumers' vehicle choices is a somewhat speculative undertaking, given that no feebates have yet been implemented. Extensive modeling of feebates has been done, however, because feebates have been regarded for some time as a promising vehicle efficiency policy. Two analyses were conducted by U.S. Department of Energy's national laboratories using "discrete choice" models of consumer buying decisions.[144] Both concluded that the primary effect of a feebate at the national level would be that manufacturers would put more and better efficiency technologies into their vehicles, while direct consumer response (i.e. altering the choice of vehicle to buy) would be limited.

In the case of a state-level program, though, manufacturers would be far less responsive, because the feebate would affect only a fraction of the vehicle market, for which a vehicle redesign would not be warranted. Therefore, a state feebate would be most effective if several other states were adopting the program as well. On the other hand, a single-state

[143] This is EPA's projected national average on-road ("adjusted") new vehicle fuel economy for 2006 and should be slightly above the average for new vehicles in Utah, where the percentage of light trucks (SUVs, minivans, and pickups) is 7% higher than the national average (see UT vehicle data sheet).

[144] D. Greene, P. Patterson, M. Singh, and J. Li. 2005. "Feebates, Rebates and Gas-Guzzler Taxes: A Study of Incentives for Increased Fuel Economy." *Energy Policy,* 33 (6); and W.B. Davis, W.B., M.D. Levine, K.Train, and K.G. DuLeep. 1995. "Effects of Feebates on Vehicle Fuel Economy, Carbon Dioxide Emissions, and Consumer Surplus," DOE/PO-0031, U.S. Department of Energy, Office of Policy.

program could still improve efficiency because in the absence of a manufacturer response consumers will have substantial incentive to switch to more efficient models.

Here we estimate energy savings from a feebate by applying a modification of a model developed by the agency Transport Canada, which was in turn based on one of the national laboratory models mentioned above, but which can evaluate a state-level program.[145] The version we use assumes that manufacturers will improve the fuel economy of a given vehicle model in response to a feebate if and only if sales of that model exceed 10,000 vehicles per year in the market to which the feebate applies.

No vehicle models meet that sales criterion in Utah alone. In the absence of a manufacturer response to the feebate, consumers will change their choice of vehicle to some degree. The model predicts that a Utah-only feebate program would improve the fuel economy of new vehicles by 2 percent relative to business-as-usual. This increase would be realized from the outset, because no new products would need to be brought to market.

The model also predicts that if Utah were one of a group of states comprising, say, 25 percent of the national vehicle market that jointly adopts the program, new vehicle fuel economy would improve by 9 percent. In this case, the improvement requires more time to materialize, because the response is dominated by manufacturers' addition of fuel-saving technologies to certain high-volume vehicles over several years. Applying a stock model to determine the effect of increasing new vehicle fuel economy on the entire vehicle stock gives the results shown in Table 18.

Table 18 – Savings from a Multi-State Feebate Program

Year	Percent Gasoline savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (trillion Btu per year)
2009	0.3	67	0.35
2010	**0.6**	**164**	**0.86**
2011	1.0	290	1.51
2012	1.6	464	2.42
2013	2.2	636	3.32
2014	2.7	811	4.23
2015	**3.3**	**984**	**5.13**
2016	3.8	1,152	6.01
2017	4.2	1,318	6.87
2018	4.7	1,480	7.72
2019	5.1	1,635	8.53
2020	**5.4**	**1,784**	**9.31**

[145] Thanks to Transport Canada for granting permission to use this model and for providing helpful suggestions for doing so.

Energy savings from H.B. 122 would be considerably smaller, due to the small number of vehicles involved. Only four model year 2007 vehicles available in Utah would qualify: Honda's Civic Hybrid and the natural gas-powered Civic GX, and Toyota's Prius and Camry Hybrid. Sales of these vehicles in 2005 and 2006, as well as currently applicable federal tax credits, are shown in Table 19.

Table 19 – Incremental Cost and Sales Data for Eligible Vehicles

Model	Approximate Incremental Cost ($)	Current Federal Tax Credit ($)	Sales in 2005[146]	Sales in 2006 (prorated)
Civic Hybrid	3,000	2,100	191	203
Civic GX	5,000	4,000	10	20
Prius	3,000	788	693	805
Camry Hybrid	4,000	650	NA	362

Additional models having fairly high sales volumes, such as the Toyota Corolla, could become eligible in an upcoming model year as a result of meeting a higher tailpipe emissions standard. This would increase both benefits and costs of the program. To get a sense of the magnitude of energy savings, assume that the number of eligible vehicles sold will be 2,800 in 2008, 4,200 in 2009, and 5,600 in 2010, out of approximately 120,000 light-duty vehicle sales per year in Utah. We also assume that 1,400 of these vehicles each year are "free riders", i.e. they would have been purchased whether or not the incentives were in place.

Taking into account that these eligible vehicles typically would substitute for relatively light vehicles, we estimate savings per car sold to be about 150 gallons per year. Total savings would then be roughly 5,000 barrels in 2008, 15,000 barrels in 2009, and 30,000 barrels in 2010.

Cost and Cost-Effectiveness

The initial cost of a feebate program to a consumer is the incremental cost of the vehicle purchased by the consumer under the feebate, plus the fee or rebate incurred by the vehicle. If the zero point for the feebate is set so that the program is revenue-neutral, the value of the feebate for the average car buyer will be zero. Vehicles will have more efficiency technologies; the incremental first cost of these vehicles is computed by the model we used to project energy savings. In the case in which Utah joins 25 percent of the U.S. vehicle market in adopting a feebate, the cost of this added vehicle efficiency totals $176 million in the period 2009-2015, on a present value basis.

[146] Utah State Tax Commission data, available at http://tax.utah.gov/esu/motor/index.html. 2006 sales numbers are estimates based on part-year data and do not reflect seasonal variations in sales.

The resulting savings in fuel costs (again, exclusive of state tax) over the 15-year life of these vehicles would be $1.12 billion (present value). Net economic benefits of the feebate would then be $950 million (2006 dollars) over the life of the vehicles purchased in 2009-2015. Additional net benefits result from more efficient new vehicles purchased during 2016-2020.

In the case of tax credits, cost of the measure will depend greatly on which models qualify over the three year period. We assume here that the average incremental cost of eligible vehicles is $1,000, so that the state incentive fully offsets the extra cost of the vehicle. The total cost of the incentive is then $8 million, while fuel cost savings over the life of the vehicles purchased is $36 million (present value). The cost would be greater if tax credits were in effect for more than three years.

Environmental and Social Benefits

We estimate that the vehicle efficiency increase due to the multi-state feebate program would result in a reduction in CO_2 emissions of 362,000 metric tons per year by 2015 and 656,000 metric tons per year by 2020.

The proposed feebate program has no explicit requirements for emissions of regulated air pollutants, and no such benefits are assured. High fuel economy vehicles are more "inherently low-emitting" than are low fuel economy vehicles in the sense that reducing fuel throughput reduces the amount of pollution generated, all other things being equal. However, today's emissions control systems depend heavily on advanced technologies far more than reduced fuel throughput to reduce emissions, and a very efficient vehicle lacking these technologies could be far dirtier than a less efficient vehicle that has them. Moreover, making cars more efficient by moving to diesel or another "lean burn" technology can increase regulated pollutants, especially NOx and PM. On balance, it seems likely that average emissions of regulated pollutants is likely to decline as a result of a feebate, but ensuring this outcome would require adding an emissions-based criterion to the feebate. A feebate program could include an emissions component, but this would make it more complicated.

The tax incentives in H.B. 122 would reduce CO_2 emissions by 10,000 tons per year in 2015 and by 8,000 tons per year by 2020. In this case the stringent threshold for criteria pollutant emissions guarantees pollution benefits. NO_x and hydrocarbons, for example, would be reduced by roughly 5 tons per year and 7 tons per year, respectively, in 2015.

Political and Other Considerations

A feebate would be a useful complement to the clean car standard (Option 19). Auto manufacturers assert that meeting standards for fuel economy and greenhouse gas emissions require distorting the market, given the limited roles these matters play in consumers' vehicle choices. Feebates help to align consumer interests with more stringent vehicle standards.

Should legal obstacles arise to the implementation of a clean car standard as described above, feebates could serve as a partial alternative. In this case, it is likely that states that have already adopted the clean car standard would consider a feebate. These states comprise over 25 percent of the U.S. vehicle market, consistent with the multi-state feebate scenario discussed above.

As a market-based, self-funding measure, a feebate will appeal to many who dislike regulation. Others may object that a feebate of the simple form discussed here is unfair to consumers who need larger vehicles. Compact cars, for instance, will typically receive rebates, while large SUVs will typically incur fees. One approach to addressing this concern is to set separate baselines for separate classes of vehicles. This structure will raise objections as well, since the situation can arise that a given car will have to pay a fee while an SUV that consumes more gasoline than the car will receive a rebate. Increasing the number of vehicle classes will reduce the fuel economy gains from the feebate, but in the multi-state feebate scenario, the reduction in energy savings will be small.

Other departures from the simple feebate structure discussed above will be advanced as a feebate program is publicly vetted. One proposal has been to exempt work trucks, for instance. Rather than changing the structure to accommodate concerns of the various interests, we suggest that mitigation measures outside of the basic structure be considered to offset any inequitable outcomes.

The tax credit provision is likely to be politically popular. Cost to the state is not reflected separately in the discussion above; with the illustrative assumptions used there, cost to the state over the three-year incentive program would be $12.6 million.

Priority

A feebate policy could have a significant impact on new vehicle energy efficiency while being revenue neutral, or close to revenue neutral, for the State Treasury, assuming it is adopted by a number of states in a coordinated manner. However, given the difficulty in ensuring such coordinated state action, we recommend that feebates be viewed as a **medium priority** option by the Governor and Legislature.

Option 17: Adopt Pay-As-You-Drive Auto Insurance

Background

One reason that people use their vehicles as much as they do is that a high percentage of total driving costs are "fixed" costs, i.e. they are independent of the number of miles driven. The impacts of driving, however, are very dependent on how much people drive. One approach to reducing miles driven is to convert a largely fixed cost, such as insurance, to a variable cost. "Pay-as-you-drive" (PAYD) insurance accomplishes this by having the rate paid by an individual depend heavily on the number of miles driven. Drivers would pay a portion of their premiums up front, and the remainder would be charged in proportion to mileage, as determined by a global positioning device or periodic odometer readings. In principle, this makes sense from the insurance industry's perspective as well, because those who drive fewer miles have lower accident exposure, on average. It is estimated that increasing the variable cost of driving through PAYD insurance can reduce vehicle use by 10-12 percent.[147]

The 2005 federal transportation funding law "SAFETEA-LU" includes a new $3 million per year set-aside for experimental, market-based incentive programs like PAYD insurance. Several states have already applied for funding.[148]

A PAYD program could be an insurance company policy or product, but some action on the part of the state may be required to remove regulatory obstacles to changing the basis for premiums or to promote the program. Few insurance companies have come out in support of PAYD, but some experimental programs are already in place: GMAC offers a mileage-based discount in Arizona, Indiana, Illinois, and Pennsylvania, and Progressive Insurance has a pilot program in Minnesota and is launching one in Texas, where the Legislature has passed a bill allowing companies to offer mileage-based coverage. California recently approved regulations increasing the mileage-based component of insurance rates, and Oregon is providing tax credits to insurers offering pay-as-you-drive policies. Georgia is conducting a PAYD study, and Washington a pilot project, both funded by the Federal Highway Administration.[149] While some states' insurance laws prohibit changing the rate basis for insurance policies in the way that PAYD insurance would require, there are no legal barriers in Utah.[150]

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[147] T. Litman. 2005. Pay-As-You-Drive Vehicle Insurance: Converting Vehicle Insurance Premiums Into Use-Based Charges. http://www.vtpi.org/tdm/tdm79.htm . Victoria Transportation Policy Institute**.**

[148] Environmental Defense, *Pay-As-You-Drive Auto Insurance.* http://www.environmentaldefense.org/article.cfm?contentid=2205

[149] Federal Highway Administration, *Value Pricing Project Quarterly Report October-December 2006* http://www.ops.fhwa.dot.gov/tolling_pricing/value_pricing/quarterlyreport/qtr4rpt06/index.htm; Sightline Institute, *Pay-as-You-Drive Pilot in Washington* http://www.sightline.org/daily_score/archive/2007/03/29/pay-as-you-drive-pilot-in-washington (2007).

[150] R. Guensler, A. Amekudzi, J. Williams, S. Mergelsberg and J. Ogle, *Current State Regulatory Support for Pay-As-You-Drive Insurance*. Journal of Insurance Regulation, Vol. 21, No. 3, Spring 2003.

Specific Energy Efficiency Proposal

This policy would phase in PAYD insurance in Utah, starting with a pilot program. For three years beginning in 2008, Utah would offer incentives for insurance policies based largely on miles driven. More specifically, the state would grant $200 to insurance agencies for each one-year policy they write for which 90 percent or more of the pre-program policy cost is scaled by the ratio of miles driven to the state average miles driven. The incentive is necessary so long as PAYD is optional; without it, insurance companies will lose money on the low-mileage customers who would choose such a policy without being able to offset these costs with higher premiums for high-mileage customers. Should the pilot program prove successful, we recommend phasing in a mandatory PAYD insurance program over the next ten years (2011-2020).

Insurance companies would be responsible for converting a percentage of their policies to PAYD, with the percentage increasing each year until PAYD is universal in 2020. Along with implementing PAYD insurance, the state should educate vehicle owners on how they can reduce their insurance payments by driving less.

Energy Savings

Estimates of the reduction in vehicle-miles traveled (VMT), and therefore energy use, resulting from a PAYD policy depend upon the price elasticity of travel demand, i.e. the percent change in travel resulting from each percent increase in the cost of travel. Estimates of elasticity vary considerably among those who study them, and differ also according to the time elapsed between the change in price and the response to it. We use here a value of -0.2 for the long-term elasticity of driving with respect to gasoline price; that is, over 10-15 years, we assume there is a 2 percent reduction in driving for a 10 percent increase in gasoline price.[151] At $2.60 per gallon, gasoline for an automobile or light truck having the average on-road fuel economy of 20.2 miles-per-gallon costs 13 cents per mile.[152] The cost of the average insurance policy in Utah in 2005 was $913, and vehicles in Utah are driven 12,124 miles per year on average.[153] This means an average insurance cost of 7.5 cents per mile.

If 90 percent of the cost of the insurance premium were charged on a per-mile basis, the average cost per mile would then be 6.8 cents per mile, about half the per-mile cost of fuel. Variable driving costs would increase by 51 percent as a result. An elasticity of -0.2 implies a corresponding reduction in driving of 10 percent. Thus 100 percent adoption of PAYD insurance would be expected to reduce car and light truck energy use in Utah by 10 percent over 10-15 years.

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[151] See, e.g., D. Greene and P. Leiby, *The Oil Security Metrics Model Oak Ridge National Laboratory*, 2006 and T. Litman, *Transportation Elasticities: How Prices and Other Factors Affect Travel Behavior*, Victoria Transportation Policy Institute http://www.vtpi.org/tdm/tdm11.htm#_Toc119831339. Updated March 7, 2007.

[152] *Annual Energy Outlook 2006*. DOE/EIA-0383(2006). Washington, DC: Energy Information Administration, p. 145.

[153] Insurance rates from Bureau of Labor Statistic http://data.bls.gov; miles per year calculated from 2005 vehicle registration and miles traveled data from UDOT and the Utah State Tax Commission.

The program proposed here begins with a 3-year pilot program subsidized by the state. The state would offer insurance companies a $200 incentive per PAYD policy, with goals of 2,000 policies in 2008, 10,000 policies in 2009, and 20,000 policies in 2010. A mandatory program would then be phased in over the next ten years. This program would be expected to result in a 10 percent reduction in driving and VMT, and consequently light-duty vehicle energy use, by 2020. Table 20 presents the projected impacts by year. Gasoline savings reach 1.5 million barrels per year by 2015 and 3.3 million barrels per year by 2020.

Table 20 – Estimated Impacts of a Mileage-Based Pay-As-You-Drive Insurance Program

Year	Percent Reduction in VMT	Gasoline Savings (thousand barrels per year)	Gasoline Savings (trillion Btu per year)
2008	0.01	3	0.015
2009	0.06	15	0.078
2010	**0.11**	**30**	**0.16**
2011	1.0	279	1.46
2012	2.0	569	2.96
2013	3.0	869	4.53
2014	4.0	1,180	6.16
2015	**5.0**	**1,503**	**7.84**
2016	6.0	1,838	9.58
2017	7.0	2,184	11.39
2018	8.0	2,543	13.26
2019	9.0	2,915	15.20
2020	**10.0**	**3,299**	**17.20**

Cost and Cost-Effectiveness

Direct costs to the state would be $200 per PAYD policy in the first three years. This means costs of $400,000 in 2008, $2 million in 2009, and $4 million in 2010 assuming the goals are met. The present value of these costs (2006 dollars) is $5.4 million. This sum goes to insurance companies and their customers, and should perhaps not be regarded as net costs, but we will treat them as such here. To estimate benefits in a manner similar to that used for policies discussed previously, we consider fuel savings only for insurance policies written through 2015, although one could argue that once the policy is fully established, it continues to provide the full benefit of a 10 percent fuel cost reduction for every year thereafter. PAYD policies written during 2008-2015 would save $303 million. Net benefits are therefore $298 million. We do not attempt to quantify savings to the state with respect to infrastructure and highway patrol costs, although these costs should decline with a reduction in driving.

This account of net benefits does not include consumer insurance premiums. Once PAYD is universal, consumers will pay either more or less than they did prior to program implementation, depending on how much they drive. On average, however, insurance premiums should decline by 9 percent as a result of the reduction in driving. This means a decline in revenues to insurance companies, but the companies should experience a commensurate decline in claims as well.

Environmental and Social Benefits

Reducing VMT will reduce emissions of both greenhouse gases and criteria pollutants. Emissions reductions will be roughly proportional to the reduction in miles driven; this leads to the estimates in Table 21. The hydrocarbon and NOx reductions were estimated as follows: Utah's 2002 emissions inventory shows light-duty emissions of 39,400 tons per year of NOx and 49,300 tons of hydrocarbons. The 2007 Ozone Maintenance Plan for Salt Lake and Davis counties projects hydrocarbon and NOx emissions for these two counties out to 2014.[154] Extrapolating these projections to 2020, and assuming that tailpipe emissions will decline by roughly the same percentage statewide as they will for these two counties, due to the federal Tier 2 Program, we arrived at estimates for light-duty NOx and hydrocarbon emission for the state in 2015 and 2020. Multiplying by the percent reduction in vehicle miles traveled brought about by PAYD insurance yields the emissions reduction estimates in Table 21.

Table 21 – Estimated Emissions Reduction from Pay-As-You-Drive Insurance

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric tons)	552	1,212
Hydrocarbons (short tons)	1,033	1,446
NOx (short tons)	657	856

Reducing VMT will reduce vehicle accidents and congestion; in fact, by some accounts, the value of these benefits of PAYD insurance is of the same order as the benefit of reduced energy consumption.[155] Implicit in the discussion of consumer premium reductions above is the notion that accident costs would be reduced by 6.7 percent once PAYD is fully phased in, an amount in excess of $100 million per year in Utah. Preliminary studies on the correlation of insurance claims and miles driven confirm a linear relationship, although the results may not justify the relative sizes of fixed and variable components of insurance premiums assumed.[156]

PAYD insurance would also improve the equity of insurance rates. Low-income drivers drive less on average than do high-income drivers. Insurance would become more

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[154] *Utah State Implementation Plan, Section IX, Part D, 8-Hour Ozone Maintenance Provisions for Salt Lake and Davis Counties*. Adopted by the Air Quality Board January 3, 2007. http://www.airquality.utah.gov/Planning/SIP/popups/SecIX/SIP_O3_IX.D_popup.htm.
[155] See, for example, I. Parry, *Is Pay-As-You-Drive Insurance a Better Way to Reduce Gasoline than Gasoline Taxes?* Resources for the Future, RFF DP 05-15, April 2005.
[156] *Texas Mileage Study: Relationship Between Annual Mileage and Insurance Losses Progressive Insurance*, December, 2005. http://www.nctcog.org/trans/air/programs/payd/PhaseI.pdf.

affordable for low-mileage drivers, which could reduce the number of uninsured motorists. In individual cases, however, as when the high cost of housing forces those in low-wage jobs to live far from their places of work, PAYD would increase the burden of transportation costs. A special fund could be established to subsidize the increase in insurance to low-income workers with commute distances in excess of the average.

Political and Other Considerations

Although many states and several insurance companies have shown an interest in PAYD insurance, the insurance industry as a whole has not been very receptive to date. In a voluntary program, companies already in the market could lose low-mileage customers to new companies that can afford to offer these drivers mileage-based premiums without having to subsidize coverage for high-mileage drivers. To avoid this potential source of opposition to the program, the state could offer incentives only for policies that insurance companies write for their existing customers or for drivers new to the state. When the program becomes mandatory, this concern disappears, because reduced premiums for low-mileage drivers will be offset by increased premiums for high-mileage drivers.

An alternative approach to reduce VMT through monetary incentives would be increasing the state gas tax. At 24.5 cents per gallon, Utah has the 14th highest gas tax in the nation; the national average is 20.3 cents per gallon. As noted above, PAYD insurance would in effect increase the variable cost of driving by 6.8 cents per mile. Achieving the same result by raising the gas tax would require an increase of roughly $1.33 per gallon in the gas tax, something that would not be popular with the general public.[157] Also, a gas tax increase, unlike PAYD insurance, would increase the tax burden in aggregate unless offset by reductions in other taxes such as the state income tax.

Objections are sometimes raised to PAYD insurance based on privacy concerns. This is particularly the case when the proposed mileage verification system relies upon GPS-based information. A system based on periodic odometer readings will probably be adequate for such a program, however. Also, citizens from rural areas and their representatives object to PAYD insurance due to the above-average amount of driving that typically occurs in such areas.

Priority

PAYD insurance could be an important strategy for reducing vehicle fuel use and thereby helping to meet the Governor's energy efficiency goal. It also would provide ancillary benefits, including less traffic congestion, fewer vehicle accidents, and greater equity with respect to insurance premiums. For these reasons, we recommend implementation of this policy as a **high priority.**

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[157] A gas tax increase of $1.33 per gallon would in fact reduce fuel consumption by more than a PAYD policy in the long-term because it would affect not only the amount people drive but also their choice of vehicle. We are proposing other mechanisms to increase vehicle efficiency, however.

Option 18: Reduce the Rate of Growth in Vehicle-Miles Traveled

Background

Utah's population is now growing at a rate of 2.3 percent per year and is expected to grow at over 2 percent per year through 2017.[158] This is more than twice the rate of population growth in the U.S. as a whole. The high growth rate represents a challenge to efforts to reduce light-duty vehicle energy use in absolute terms, but creates opportunities to reduce energy use relative to a business-as-usual scenario. The faster construction of homes and commercial buildings in rapidly-growing areas increases the potential to integrate transportation and land use planning and implement principles of smart growth, including increased density, infill and mixed use development, and improved access to transit.

Research has shown in general terms that the amount of travel done by households could be reduced by about 20 percent through application of smart growth principles. Assuming that vehicle-miles traveled (VMT) grows at the same rate that population does, this would imply that the 25 percent population growth anticipated for Utah over the next decade could be accommodated in such a way as to keep VMT growth to 20 percent, while improving quality of life. The passenger transportation sector would then be 4 percent more efficient than it would otherwise have been.

In reality, however, the amount of travel in Utah is projected to grow even faster than population due to the dispersion of new development and rising incomes, among other factors. If the state were to implement programs that reduce the growth in VMT, energy savings could be substantial, especially in the medium-to-long term. In fact, if this growth goes unchecked, it will be difficult to realize a long term reduction in transportation energy use, no matter what technological advances are made on the vehicle side.

While planning decisions are made at the local level, state policies influence development decisions through infrastructure investment and incentive programs. In Maryland, for example, state dollars go only to projects that are consistent with statewide growth management policy. Massachusetts has a suite of programs to promote smart growth, including a Smart Growth Zoning Incentive, which offers municipalities about $6,000 per residential unit built in any transit-accessible area rezoned to increase density.

In Utah, 80 percent of the population lives in the rapidly growing Wasatch Front region. Envision Utah recently released the findings of its Wasatch Choices 2040 project, including a Vision Scenario that reflects the preferences of participants in a visioning process that involved 1,000 area residents. The Vision Scenario steers 13 percent of new development (compared with 4 percent in a business-as-usual scenario) into walkable, mixed-use districts,[159] like those under development in Kennecott Land's new Daybreak community. Envision Utah's modeling results show a modest but measurable reduction in VMT in the Vision Scenario relative to business-as-usual.

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[158] http://www.governor.utah.gov/dea/Projections/05Baseline/5yearagegroupbyareagender.xls.
[159] Envision Utah, *Wasatch Choices 2040*. 2007.

Realizing a statewide growth scenario having the features of Envision Utah's Vision Scenario would involve the actions of communities across Utah. It would also depend upon the state's willingness to alter its infrastructure investments accordingly. In addition, the state could provide considerable assistance through training and support functions such as those offered through the Quality Growth Commission.

Specific Energy Efficiency Proposal

This policy proposes that the state use its funding and support programs to keep the annual percent growth in VMT to no more than the percent growth in population, beginning in 2010. This is a modest goal that could be strengthened in the future. While local government would determine how to moderate VMT growth, the state could ensure that the growth goal was met by, for example, making this a precondition for approval of the Statewide Transportation Improvement Program (STIP). The STIP is in turn a product of the Utah Department of Transportation's work with Utah's four Metropolitan Planning Organizations (MPOs), which represent local governments.

In particular, we are proposing that distribution of state and federal funds for roads, transit, and other transportation projects and programs be contingent upon MPOs developing and implementing transportation plans that meet the VMT growth goal stated above. This approach would lead to additional funding for transit projects and other alternatives to driving, and some alterations in planned highway projects. State contributions to and incentives for non-transportation projects and programs relating to development patterns should also carry a requirement of consistency with the goal for growth in VMT. This may affect school and water/wastewater projects, for example.

Energy Savings

The Utah Foundation projects VMT growth in 2004-2030 of 87 percent, compared with 69 percent growth in population.[160] This corresponds to a difference of roughly 0.4 percent per year between the two growth rates. Consequently, we calculate energy savings from implementing our proposal by reducing projected growth in gasoline use by 0.4 percent per year from 2010 through 2020. As shown in Table 22, the reduction in VMT and hence energy savings reaches about 2.4 percent in 2015 and 4.3 percent in 2020, relative to the reference projections.

Cost and Cost-Effectiveness

Smart growth can produce substantial cost savings in a wide range of categories.[161] While an effective program to reduce growth in VMT will require major new investments in transit and other alternatives to the automobile, it also can reduce costs for road construction and maintenance, as well as other infrastructure expenses. Estimating the magnitude of these shifts in investment would require, among other things, an analysis of changes to the projects and programs in the STIP that would allow Utah to

[160] Utah Foundation, *Fueling Our Future*, September 2004.
[161] See, e.g., Transit Cooperative Research Program Report 74, *Costs of Sprawl – 2000*.

meet the goal of limiting growth in VMT. We do not propose to do that here, but an analysis conducted by Envision Utah in 2000 gives a sense of the results one might expect.

Envision Utah estimated infrastructure costs for a Quality Growth Strategy that could be viewed as a precursor to the Vision Scenario described above. For the period 1998-2020, combined road, transit, water, and other (sewer and utility) costs in a Baseline scenario totaled $26.5 billion (in 1999 dollars), while costs for the Quality Growth Strategy were $21.9 billion, a 17 percent reduction.[162] In addition, if we consider only the reduction in VMT following from implementation of this policy through 2015, fuel savings through 2030 total $709 million (present value).

Table 22 – Savings from Keeping Growth in VMT at or Below Population Growth

Year	Percent Reduction in VMT	Gasoline Savings (thousand barrels per year)	Gasoline Savings (trillion Btu per year)
2010	**0.4**	**110**	**0.57**
2011	0.8	223	1.16
2012	1.2	340	1.77
2013	1.6	461	2.40
2014	2.0	585	3.05
2015	**2.4**	**714**	**3.72**
2016	2.8	847	4.42
2017	3.2	985	5.13
2018	3.5	1126	5.87
2019	3.9	1272	6.64
2020	**4.3**	**1423**	**7.42**

Environmental and Social Benefits

Like pay-as-you-drive (PAYD) insurance, smart growth policies will reduce emissions of greenhouse gases and other pollutants in proportion to the reduction in driving. The reductions in Table 23 were estimated using the same approach described in the PAYD discussion above.

Table 23 – Estimated Emissions Reduction from Reducing the VMT Growth Rate

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand metric tons)	262	522
Hydrocarbons (short tons)	491	624
NOx (short tons)	312	369

[162] Envision Utah, "Quality Growth Strategy and Technical Review," 2000.

A host of other environmental benefits would follow, including open space and habitat preservation and improved water quality due to reduced watershed damage and roadway runoff.

Smart growth policies nationwide have gained a large and diverse following for reasons that have nothing to do with energy savings or air pollution reductions. Reducing highway congestion is one of the primary reasons there is broad public support for Smart Growth initiatives. Even a 4 percent reduction in VMT can have a significant impact on road congestion and trip times during peak driving periods. Formation of Utah's Quality Growth Commission in 1999 attests to the view of the Legislature that successful growth management is a major determinant of quality of life.

Political and Other Considerations

Establishing the goal proposed here and taking the steps necessary to meet that goal would be a political challenge. However, the Wasatch Front Regional Council, which is the metropolitan planning organization for the area that is home to over 80 percent of Utah's residents, is considering the adoption of this same goal of no net increase in per capita VMT in its next Long Range Transportation Plan. The goal proposed here for the state would then simply represent the state's commitment to ensuring that its funding decisions and development-related policies support the goal proposed by local officials responsible for transportation and land use planning in the Wasatch Front Region. This commitment will in fact be essential to the success of the WFRC goal, assuming it is adopted.

Smart growth and alternatives to driving are crucial components of energy efficiency planning for the transportation sector. Even in a rapidly-growing state like Utah, land use changes are best viewed as shifts occurring over decades. Ultimately, growth patterns, transit investment, and support for walking and biking will strongly influence the efficacy of pricing strategies, because drivers' receptivity to price signals depend upon the availability of alternative mode and location choices.

Priority

Despite the relatively modest energy savings shown here, a program to manage growth in VMT is essential to any comprehensive state energy efficiency plan. Consequently, we recommend that policy makers view this option as a **high priority**.

Case Study 8:

Wasatch Choices 2040: Land Use and Transportation Planning Case Study

Over 80 percent of Utah's population lives along the rapidly-growing Wasatch Front where approximately 34,000 people are expected to be added each year. The Wasatch Front Regional Council (WFRC) and the Mountainland Association of

Governments (MAG) are responsible for creating the official, federally-recognized regional transportation plan for the Wasatch Front.

Following the formation of a Steering Committee, 14 public workshops, and expert analysis from Envision Utah (a local not-for-profit planning organization), a comprehensive plan, or “vision” report, for land use and transportation in the Wasatch Front was developed. The report, *Wasatch Choices 2040*, reflects the input of 1,000 area residents. The Vision Scenario in this report steers 13 percent of new development (compared with 4 percent in a business-as-usual (BAU) scenario) into walkable, mixed-use districts with 12 percent more mass transit compared to a 2030 BAU plan, thereby reducing the need for driving.

Envision Utah’s modeling results show a modest but measurable reduction in vehicle-miles traveled in the Vision Scenario relative to business-as-usual scenario. The Growth Principles included in the report were adopted unanimously by the elected officials of WFRC and MAG and include ten strategies that local governments can use in planning considerations.

Implementation Strategies for Local Government

1. Develop a Local Land Reuse Strategy
2. Provide Incentives for Contiguous Growth and Infill
3. Preserve Future Transportation and Utility Corridors
4. Create Walkable Commercial and Mixed-Use Districts
5. Plan for Transit Oriented Development
6. Plan for and Build Neighborhood-friendly Elementary Schools
7. Create a Plan for Workforce Housing
8. Interconnect Roadways and Pedestrian Paths
9. Plan for Job Centers and Economic Development Readiness
10. Plan to Minimize Development and Maximize Conservation on and near Critical Lands

Source: Envision Utah, Wasatch Choices 2040, 2007

Option 19: Improve Enforcement of Highway Speed Limits

Background

At high speeds, vehicle efficiency falls off rapidly with further increases in speed, as aerodynamic drag begins to dominate vehicle energy requirements. The speed at which fuel economy is highest varies from vehicle to vehicle, but is typically below 60 miles per hour (mph) for a light-duty vehicle.[163] Federal Highway Administration tests of nine light-duty vehicles in 1997 found that fuel economy declined on average by 3.1 percent when speed increased from 55 mph to 60 mph and by 8.2 percent increasing from 65 to 70 mph.[164] For a heavy truck such as a tractor trailer, fuel economy declines by about 2 percent per mph at highway speeds.[165] Thus, slowing high-speed driving would be one means of improving the real-world efficiencies of cars and trucks. This could be accomplished by reducing the maximum speed limit for all vehicles to 65 mph or more stringently enforcing the existing speed limits.

House Bill 199, considered but not adopted in the 2007 legislative session, would have limited speed limits on limited access highways for Class 7&8 vehicles (those with Gross Vehicle Weight over 26,000 lbs.) to at most 65 miles per hour. At the same time, a bill (Senate Bill 17) increasing the maximum speed limit from 75 miles per hour to 80 miles per hour, among other changes to the traffic code, passed the State Senate during the 2007 legislative session but was subsequently amended to eliminate the speed limit increase.[166]

The Utah Department of Transportation (UDOT) sets speed limits for roads based on traffic engineering and safety studies, among other considerations. The maximum speed limit allowed on rural highways is 75 mph. Reduction in speed limits has been proposed on previous occasions in Utah and has met with little favor. In fact, UDOT notes that reducing speed below the design speed for the given roadway is ill-advised: "Setting an unrealistically low speed limit that is not appropriate for road conditions generally has no effect on vehicle speeds or safety. This has been demonstrated in numerous 'before and after' research studies of speed limits changes. The majority of drivers tend to drive a speed that their experience indicates is safe for the road conditions. An unrealistic speed limit may be disregarded and result in disrespect for the law by normally law-abiding drivers."[167]

Specific Energy Efficiency Proposal

Rather than lowering current speed limits, this policy proposes more stringently enforcing the existing highway speed limits. Doing so could both increase highway safety

[163] "Drive more efficiently." U.S.DOE and U.S. EPA, http://www.fueleconomy.gov/feg/driveHabits.shtml.
[164] *Transportation Energy Data Book*, 2006. Oak Ridge National Laboratory.
[165] "Factors Affecting Truck Fuel Economy." Goodyear Tire, http://www.goodyear.com/truck/pdf/radialretserv/Retread_S9_V.pdf.
[166] http://le.utah.gov/~2007/htmdoc/sbillhtm/SB0017S02.htm.
[167] *Speed Limits.* Utah Department of Transportation, Division of Traffic and Safety. www.udot.utah.gov/dl.php/tid=1342/save/**Speed**%20studies%20brochure%20June%2005%5B1%5D.pdf.

and provide fuel savings. Given demands on the time of police and highway patrol, additional enforcement would best be approached through other means, including increased use of radar, lasers and speed cameras, and education.

<u>Energy Savings</u>

In Utah, as in many other states, recommended practice is to set speed limits at the 85th percentile of driving that occurs on the roadway. In reality, speed limits are set lower than this for most roads; on average, over half of all traffic travels over the speed limit. Surveys have shown that, on highways, 50 percent of vehicles exceed the speed limit. Virtually all vehicles are within 10 miles of the limit, however.[168]

To estimate energy savings from additional enforcement, we assume that: 1) 50 percent of vehicles on highways are exceeding speed limits; 2) that they are exceeding the limit by 5 miles per hour on average; and 3) that their fuel economy is consequently 8 percent lower than it would be traveling at the speed limit. In Utah, 49 percent of all travel is on arterials and 39 percent is on freeways, giving a total of 88 percent highway driving. This leads to an estimate of energy savings of up to 3.3 percent from improved enforcement of speed limits. If we assume the enforcement program leads to a 50 percent reduction in speeding, estimated energy savings would be as shown in Table 24.

Table 24 – Estimated Benefits of Improved Speed Limit Enforcement

Year	Percent Fuel Savings	Gasoline Savings (thousand barrels per year)	Diesel Savings (thousand barrels per year)	Total Fuel Savings (trillion Btu per year)
2008	1.6	430	159	3.16
2009	1.6	438	168	3.26
2010	**1.6**	**446**	**175**	**3.34**
2011	1.6	455	182	3.43
2012	1.6	463	189	3.51
2013	1.6	472	197	3.60
2014	1.6	481	204	3.69
2015	**1.6**	**490**	**212**	**3.79**
2016	1.6	499	221	3.88
2017	1.6	508	229	3.98
2018	1.6	518	239	4.08
2019	1.6	528	248	4.19
2020	**1.6**	**538**	**258**	**4.30**

It should be noted that, if combined with policies proposed above to increase vehicle efficiency or reduce vehicle miles traveled, enforcing the speed limit would save

168 *Design Speed, Operating Speed, and Posted Speed Practice.* National Cooperative Highway Research Program Report 504. Transportation Research Board, 2003.

somewhat less fuel. If the clean car standard, PAYD insurance, and smart growth policies were in place, for example, gasoline savings from speed limit enforcement would be 400,000 barrels per year in 2015 and remain at that level through 2020. Diesel savings would be largely independent of the heavy truck policies described below, however. This is because most truck miles in Utah are driven by out-of-state trucks,[169] which would not be eligible for the efficiency improvement loans we propose.

Cost and Cost-Effectiveness

The cost to the state for this effort could be paid for in full or in part from additional revenue from speeding fines. In the case of commercial trucks, drivers' time warrants special consideration; it can be a greater financial consideration than fuel costs. As an example, consider a truck that reduces speed from 70 mph to 65 mph, thereby increasing fuel economy from 6.1 mpg to 6.7 mpg.[170] This would save 1.8 gallons per hour while reducing the distance covered and therefore the productivity of driver and truck by 7 percent. At $2.80 per gallon, the average 2006 pump price of diesel in Utah, savings are $5. However, the value of the time lost, at a rate of $60 per hour, is $4.20. Thus there are net savings inclusive of driver costs.

There are motivations to reduce speed other than fuel savings, however, including complying with speed limits, improving safety, and limiting roadway damage, which increases with the square of vehicle speed. This discussion considers energy benefits only, but a comprehensive analysis of benefits would be well worth pursuing.

Unlike some of the efficiency policies discussed above, benefits for this policy accrue only for the time period in which it is in place; cumulative fuel cost savings from improved speed limit enforcement from 2008 through 2015 would be $400 million (present value), with all savings generated by 2015.

Environmental and Social Benefits

Emissions of CO_2 would be reduced by 272,000 metric tons per year in 2015 and 309,000 tons in 2020. Criteria pollutant emissions are regulated on a grams-per-mile basis (or, in the case of heavy trucks, a grams per brake-horsepower-hour basis), but nonetheless are affected to varying degrees by speed. NOx emissions in particular consistently increase with speed and should therefore decline with better enforcement of speed limits.

The safety effects of reducing excessive highway speeds are complicated, but certain basic facts remain. Perhaps most importantly, the likelihood that an accident will produce a fatality increases exponentially with the speed at which it occurs.[171] The

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[169] Federal Highway Administration, 1998, "Freight Transportation Profile—Utah Freight Analysis Framework," http://ops.fhwa.dot.gov/freight/freight_analysis/state_info/utah/ut2.pdf.

[170] U.S. Department of Transportation, 2000, "Technology Roadmap for the 21st Century Truck Program."

[171] Insurance Institute for Highway Safety, *Q&A: Speed and Speed Limits*, January 2007. http://www.iihs.org/research/qanda/speed_limits.html#7.

differential in speed between vehicles greatly exceeding the speed limit and those within the limit also creates a hazard, and speed limit enforcement would reduce that hazard.

Political and Other Considerations

While reducing the speed limit is generally difficult politically, better enforcing current law should be less controversial, and may be politically viable primarily on the basis of enhanced public safety and the reduction in serious injuries and deaths from vehicular accidents. On the other hand, if a large percentage of drivers regularly exceed the speed limit, as assumed above, much of the traffic engineering community would take this as an indication that existing speed limits are set too low. Given the recent debate in the Utah Legislature over a proposed increase in speed limits and the Utah Highway Patrol's testimony against the measure, the proposal to better enforce today's speed limits would likely be controversial. This holds true for speed requirements for heavy trucks as well: the American Trucking Association recently endorsed a proposal to limit the speed of heavy trucks to 68 miles per hour; the Owner-Operator Independent Drivers Association opposed the idea.[172]

Priority

This policy is not likely to be popular with the majority of the public and also will result in energy savings that increase relatively slowly over time. Therefore we recommend it be viewed by policy makers as a **low priority.**

[172] See http://www.truckline.com/NR/exeres/CB4D4AAD-27EB-4801-8F4A-B82F45E03D70.htm and http://www.landlinemag.com/Special_Reports/2007/Jan07/SR%2001-29-07%20OOIDA%20speed%20limiters%20by%20JJ.htm .

Option 20: Improve the Efficiency of Heavy-Duty Trucks and the Goods Movement System

Background

Heavy trucks are responsible for 20 percent of Utah's transportation energy use and this usage is growing faster than light-duty fuel consumption. Tractor-trailers dominate heavy-duty fuel use due to their high annual mileage and relatively low fuel economy. Many tractor-trailers traveling Utah highways are out-of-state trucks.

Trucking companies are sensitive to fuel costs, which are often second only to labor among their business expenses; a tractor-trailer may consume tens of thousands of dollars of fuel annually. Truck manufacturers may therefore be more aggressive in improving the fuel economy of their products than are light-duty vehicle manufacturers. Yet substantial barriers to efficiency do exist in the truck market, including the rapid turnover of trucks from first to second owner and the absence of standards for heavy-duty fuel economy, or even a standardized test procedure to measure it. Consequently, there are numerous technologies and strategies available to improve fuel economy that are not fully utilized. Indeed, average fuel economy for new tractor-trailers could be raised by over 50 percent through a variety of cost-effective existing and emerging technologies, including engine improvements, transmission enhancements, and weight reduction.[173]

Another opportunity to save fuel is by reducing idling of long-haul trucks. Long-haul tractor-trailers typically idle several hours per day to produce heating, cooling and power for drivers when their vehicles are stationary. Various devices are available or under development to eliminate the need for extended idling, including direct-fired heaters, auxiliary power units (APUs), and truck stop electrification. None is yet widely used in the U.S.

Companies with large trucking operations are beginning to take on ambitious truck efficiency targets. In 2005, Wal-Mart announced its intention to improve the efficiency of its heavy-duty fleet by 25 percent in three years and to double it in ten years. FedEx has committed to purchase of hybrid delivery trucks that are being developed to their specifications, including a target of 50 percent improvement in fuel economy and reduced tailpipe emissions.

Retrofitting long-distance tractor-trailers with energy-saving equipment is a relatively fast and inexpensive way to make a dent in heavy-duty energy use. For trucks that travel extensively in stop-and-go traffic, hybrid technology is attractive. While heavy-duty hybrids are mostly still at the prototype stage, progress is rapid, and hybrids should soon be available for parcel delivery, utility, and refuse disposal trucks, to name a few important applications. The federal government currently offers tax credits for heavy-duty hybrids, which should play a role in accelerating the arrival of these vehicles in the market. These credits pay for

[173] T. Langer, 2004, "Energy Savings through Increased Fuel Economy for Heavy-Duty Trucks." Report prepared by the American Council for an Energy-Efficient Economy for the National Commission on Energy Policy.

only a portion of the incremental costs, however. Furthermore, the federal credits expire at the end of 2009.

Apart from improving truck efficiency, freight energy use can be reduced by increasing the share of goods traveling by rail, a far less energy-intensive mode. The two major cross-country freight routes passing through Utah, Route 80 and Route 70-Route 15, both are paralleled by Class I rail lines. Increased freight volumes on these routes, especially in the Los Angeles-Chicago-New York corridor due to increased trade with Asia, call for a rethinking of opportunities to maximize the use of rail and intermodal services. This corridor is the most favorable in the U.S. for intermodal freight; however, 72 percent of potential intermodal rail traffic has already been captured.[174] For freight originating or terminating in Utah, intermodal options currently are more limited. UDOT has listed several freight projects, including two outside Utah, which would assist in the operation of rail freight in Utah.

An increasingly important corridor is the CANAMEX Corridor, following Route 15 in Utah. The route is thought to be too taxing for rail due to the steep ascents required in Northern Arizona, so all attention to upgrading the corridor has focused on truck movement.[175]

Specific Energy Efficiency Proposal

Our first policy proposal is to establish a low-interest loan program, beginning in 2008, to promote the purchase of new trucks or the retrofit of existing trucks with approved energy efficiency technologies and equipment. In particular, equipment in the efficiency package identified by U.S. EPA's SmartWay Transport Partnership would be eligible. This SmartWay upgrade kit, which includes aerodynamic add-ons for trailers, efficient tires, and APUs allowing long-distance truckers to dramatically reduce idling, has been found to reduce fuel consumption by 15 percent or more while reducing emissions.

The U.S. EPA is seeking state partners to offer loans to truckers to assist with the purchase of these technologies. Under the proposed loan program, heavy-duty hybrids would be eligible for loans as well. If properly designed, such loan programs can result in net monthly savings to truckers beginning at the time of purchase. A state agency would provide the loans at an interest rate comparable to the state's cost of capital.

Our second proposal is for another low-interest loan program, this one for the electrification of truck stops in Utah to allow drivers to turn off their trucks during rest stops. Truck stop electrification (TSE) can be done using on-board or off-board systems. An on-board system simply provides power outlets for trucks that have electrical heating/ventilation/air conditioning (HVAC) systems and an electrical plug, while an off-board system brings HVAC to the truck, requiring no special equipment on the truck. For this discussion, we assume off-board systems will be used, since Utah cannot control the

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[174] American Association of State Highway and Transportation Officials, *Freight-Rail Bottom Line Report*. 2002. www.transportation.org.
[175] Wasatch Front Regional Council, *Long-Range Plan 2030.* December 2003. http://www.wfrc.org/reports/lrp/CHAP%204%20Capacity%20Needs.pdf.

equipment on the out-of-state trucks that are the primary users of truck stops. On-board systems would be far less expensive to truck stop owners, however, and the number of trucks manufactured with electric HVAC systems will increase, so the best strategy might be a mixture of the two system types.

With regard to increased use of freight rail, rail freight projects in the UDOT 2030 Long Range Transportation Plan should be completed.[176]

Energy Savings

We first estimate savings from the loan program for truck efficiency equipment, beginning with its application to the improvements identified by SmartWay. Determining what trucks are likely candidates for the program requires a breakdown of the heavy-duty truck stock. By far the biggest consumers of diesel fuel in the aggregate are "heavy-heavy" trucks (those having Gross Vehicle Weight of at least 26,000 pounds), primarily tractor-trailers.

Half of all heavy-heavy truck miles driven by Utah-registered trucks are driven by long-distance trucks, i.e. those having a primary range of operation over 500 miles. These are the trucks that would use APUs, since they would frequently be away from their home bases at night. The number of Utah trucks fitting this description is 6,282; of these we estimate that 20 percent already have anti-idling technology, leaving 5,025 trucks eligible to acquire auxiliary power units.[177] Fuel consumption at idle is roughly one gallon per hour, and typical annual hours of idling is 1,830 per year. A diesel-fueled APU uses on the order of 0.18 gallons per hour, resulting in net savings for these trucks of 1,500 gallons per year.[178]

The other efficiency equipment in the SmartWay upgrade kit, namely energy-efficient tires and trailer side skirts, is beneficial to the somewhat larger set of heavy-heavy trucks that travel largely at highway speeds. We assume that trucks typically driving 200 or more miles per day fall into this category; there are 7,742 such trucks registered in Utah. We assume that the fuel savings from this equipment totals 8 percent.

The U.S. EPA has demonstrated that a low-interest loan program would allow truckers purchasing equipment in the SmartWay package to realize fuel cost savings that would exceed their monthly loan payments. We assume that usage of the loan program ramps up over five years, reaching 75 percent of trucks eligible for the various types of equipment by 2012. This results in a 4.1 percent reduction in fuel consumption over the entire truck stock.

[176] Utah Department of Transportation, *Utah Transportation 2030*. January 2004.
[177] Based on queries of the *2002 Vehicle Inventory and Use Survey*, U.S. Census Bureau. http://www.census.gov/svsd/www/vius/2002.html.
[178] F. Stodolsky, L. Gaines, and A. Vyas. 2000. *Analysis of technology options to reduce the fuel consumption of idling trucks.* Argonne, IL: Center for Transportation Research, Argonne National Laboratory, June.

These technologies will be joined by others, including a variety of hybrid technologies in the succeeding years, and the loan program should evolve to reflect this. We assume that the fuel savings of vehicles eligible for loans under the program will double over the period 2012 to 2017, leading to the savings shown in Table 25.

Table 25 – Savings from Low-Interest Loans for Heavy Truck Efficiency Improvements

Year	Percent Diesel Savings	Diesel Savings (thousand barrels per year)	Diesel Savings (trillion Btu per year)
2009	1.0	107	0.62
2010	**2.1**	**222**	**1.29**
2011	3.1	346	2.01
2012	4.1	480	2.78
2013	5.0	599	3.47
2014	5.8	726	4.21
2015	**6.6**	**862**	**5.00**
2016	7.4	1,009	5.85
2017	8.3	1,165	6.76
2018	8.3	1,211	7.02
2019	8.3	1,259	7.30
2020	**8.3**	**1,309**	**7.59**

We next estimate the fuel savings resulting from the loan program for truck stop electrification. There are over 50 truck stops on I-15, I-70, and I-80 in Utah.[179] If ten truck stops install TSE each year from 2010 through 2014, and the average installation size is 25 spaces, there will be 1,250 spaces available by 2014.[180] Idling of a heavy-heavy truck consumes about one gallon per hour.[181] Assuming each space is used for two 6-hour periods per day, fuel savings would be as shown in Table 26. The power requirement of the truck while using the TSE system is approximately 2.1 kW.[182] Table 26 shows net energy savings of the program by year. The diesel savings is six times the additional electricity consumed based on a comparison of primary energy content.

Cost and Cost-Effectiveness

State expenses, which would amount to administrative costs for the loan programs and any write-off of bad debt, should be modest. If so desired, loans could be offered at

[179] See, e.g., http://www.aitaonline.com/TS/UT.html.
[180] We estimate this is slightly less than half of all commercial truck stop spaces in Utah.
[181] F.Stodolsky et al. 2000. "Analysis of technology options to reduce the fuel consumption of idling trucks," Center for Transportation Research, Argonne National Laboratory.
[182] N. Lutsey. 2003. "Fuel Cells for Auxiliary Power in Trucks: Requirements, Benefits, and Marketability," Institute for Transportation Studies, University of California, Davis.

an interest rate slightly higher than the state's cost of capital in order to cover these expenses.

Table 26 – Savings from Truck Stop Electrification

Year	Diesel Savings (thousand barrels per year)	Electricity Consumed (GWh per year)	Net Savings (trillion Btu per year)
2010	**26**	2	0.13
2011	52	5	0.25
2012	78	7	0.38
2013	104	9	0.51
2014	130	11	0.64
2015	**130**	11	0.64
2016	130	11	0.64
2017	130	11	0.64
2018	130	11	0.64
2019	130	11	0.64
2020	**130**	11	0.64

Regarding overall cost, the typical SmartWay upgrade kit costs $16,500.[183] Based on the fuel savings associated with that package and decline in truck miles per year over time, we estimate that the benefit-cost ratio for the package will be about two-to-one over the life of the truck. The proposed loan program could shift some of this cost from the truck owner to the state but this would not affect the overall cost effectiveness of the efficiency improvements from a societal perspective.

For truck loans granted through 2015, fuel cost savings out to 2030 total $657 million, present value. If we assume the benefit-cost ratio for the loan program as a whole is the same as it is for the SmartWay upgrades, then cost of the program through 2015 would be about $328 million, giving a net savings of $328 million during 2008-2030.

The cost of truck stop electrification is about $15,000 per space for an off-board system.[184] We assume all 1,250 spaces are converted prior to 2015. Net cost savings, including capital costs, fuel savings, and electricity costs at 6.6 cents per kilowatt hour, are $112 million (present value) over the period 2010-2030.

Environmental and Social Benefits

Fuel savings associated with the heavy-duty truck policy would result in a reduction in CO_2 emissions of 375,000 metric tons in 2015 and 568,000 tons in 2020. Heavy-duty trucks are a major contributor to total Utah highway emissions of NO_x (49

[183] U.S. EPA "Innovative Financing – Frequently Asked Questions," http://epa.gov/smartway/documents/420f07027.htm.
[184] Electric Power Research Institute, "Truck Stop Electrification: A Cost-Effective Solution to Reducing Truck Idling." December 2004.

percent) and PM 2.5 (76 percent, exhaust component),[185] and reduced fuel throughput of more efficient trucks could be expected to reduce these emissions. Since emissions standards for trucks are not regulated on a per-gallon basis, however, it is difficult to estimate the magnitude of these reductions.

The truck stop electrification program would reduce CO_2 emissions an additional 56,000 metric tons in both 2015 and 2020. Based on U.S. EPA estimates on the emissions of idling trucks,[186] the program would reduce NO_x by 814 tons in both 2015 and 2020. PM reductions would be 5 tons in 2015 and 3 tons in 2020.

Political and Other Considerations

The loan programs proposed here would presumably be welcomed by trucking companies and truck stop owners. In general, we expect little or no political opposition to this proposal.

Priority

Improvements to trucks and to the goods movement system as a whole are an essential component of an energy-efficient transportation sector. But because the loan programs proposed here achieve moderate savings, we recommend that they be viewed as **medium priority** by policy makers.

Case Study 9:

Truck Stop Electrification: Sapp Brothers Travel Center, Salt Lake City

In 2007, the Sapp Brothers Travel Center, a truck stop in Salt Lake City located along I-215, was retrofitted with devices that eliminate semi-truck idling. These devices, called auxiliary power units (APUs) provide power to 51 parking spaces via a plug-in window adapter, allowing drivers to rest and stay comfortable while their engines remain off. The APUs save fuel and money while reducing the associated emissions that typically result from semi-truck idling during federally required breaks.

The APU device was created by IdleAire Technologies Corp., based in Knoxville, Tennessee. The Sapp Brothers project is a cooperative effort between IdleAire and the Utah Department of Transportation, which funded 80 percent of the project's installation cost.

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185 Percentages cited were calculated from the Utah DEQ calendar year 2002 on-road mobile emissions inventory.

186 U.S. EPA. 2004. "Guidance for Quantifying and Using Long Duration Truck Idling Emission Reductions in State Implementation Plans and Transportation Conformity," EPA420-B-04-001.

The Sapp Brothers Travel Center was the first truck stop in Utah to offer the APU technology. Other facilities in Utah are considering installing the fuel-saving device.

Quick Facts

Total Project Cost: $850,400
Projected Annual Fuel Savings: 175,000 gallons of diesel fuel
Projected Annual Cost Savings: $580,000
Projected Cost Savings After 15 Years: $6.3 million
Benefits:

- Saves energy
- Eliminates noise associated with idling
- Eliminates particulate and other emissions from diesel exhaust

Source: Utah Department of Environmental Quality, 2007; IdleAire Technologies Corporation, 2007
Pictured: IdleAire system installed at Petro Travel Center, Knoxville, Tennessee

Option 21: Require Energy-Efficient Replacement Tires for Light-Duty Vehicles

Background

Energy losses due to tire rolling resistance account for about 20 percent of total vehicle energy use. Some tires perform significantly better than others in this regard, however. In particular, "original equipment" (OE) tires, i.e. tires sold with a new vehicle, typically have lower rolling resistance than aftermarket tires, because energy-efficient tires help manufacturers comply with Corporate Average Fuel Economy standards. In 2003, the California Energy Commission issued a report on tire efficiency that found significant potential for oil savings through low rolling resistance tires.[187] The National Academy of Science issued a National Tire Efficiency Study that reached similar conclusions in 2006.[188]

Specific Energy Efficiency Proposal

Starting in 2010, the state would require that replacement tires sold in Utah have rolling resistance less than or equal to the average OE tire in the U.S.

Energy Savings

Each 10 percent reduction in tire rolling resistance leads to roughly a 1-2 percent increase in fuel economy.[189] While data on the efficiency of tires now on the road is limited, analysts estimate that the average OE tire has a rolling resistance on the order of 20 percent lower than that of the average replacement tire. Thus, if aftermarket tires were as efficient as the average tires on new vehicles, vehicle fuel economy would improve by 2-4 percent.

The average life of a tire is about 36,000 miles, or about one-quarter of lifetime vehicle miles. This means that at any given time, about three-fourths of all miles driven are driven on replacement tires. If we assume that replacement OE tires raise fuel efficiency by 3 percent on 75 percent of vehicles, overall vehicle efficiency will increase by 2.25 percent after about three years, when all replacement tires on the road will have been purchased subject to the new requirements. Table 27 shows the resulting gasoline and energy savings. We estimate the gasoline savings would reach 676,000 barrels per year by 2015.

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[187] *California State Fuel-Efficient Tire Report*, California Energy Commission 600-03-001F, January 2003.
[188] National Research Council. 2006. "Tires and Passenger Vehicle Fuel Economy." Transportation Research Board Special Report 286.
[189] See Reference 187.

Table 27 – Savings from Fuel-Efficient Replacement Tires

Year	Percent Gasoline Savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (trillion Btu per year)
2010	**0.75**	**205**	**1.07**
2011	1.50	419	2.18
2012	2.25	640	3.34
2013	2.25	652	3.40
2014	2.25	664	3.46
2015	**2.25**	**676**	**3.53**
2016	2.25	689	3.59
2017	2.25	702	3.66
2018	2.25	715	3.73
2019	2.25	729	3.80
2020	**2.25**	**742**	**3.87**

Cost and Cost-Effectiveness

The extra cost of a low rolling resistance tire is small, roughly $1 to $2 per tire.[190] If replacement tires were purchased for one-quarter of light-duty vehicles registered in Utah each year beginning in 2010, the extra cost of low rolling resistance tires through 2015 would be $9 million (present value). Fuel savings from the tires purchased over this six-year period would continue through 2017; total fuel savings (present value) for the years 2010-2017 would be $309 million, leading to net savings of $300 million.

Environmental and Social Benefits

The reduction in CO_2 emissions from requiring low rolling resistance replacement tires would be 249,000 metric tons in 2015 and 272,000 tons in 2020. Emissions of regulated pollutants will decline in proportion to the reduction in fuel consumption; reductions are shown in Table 28.

Table 28 – Estimated Emissions Reduction from Energy-Efficient Replacement Tires

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020
Carbon dioxide (thousand short tons)	249	272
Hydrocarbons (tons)	465	325
NOx (tons)	296	193

[190] See Reference 188.

Tire rolling resistance, dry and wet traction, and tread wear are interrelated in complex ways. Safety concerns have been raised over years of discussion of low rolling resistance tires, but recent studies, including the National Academy of Sciences tire study, have concluded that reducing rolling resistance would have no discernable effect on safety. The OE tires that are driven on for the first 3-4 years of owning a new car do not exhibit inferior safety performance.

Political and Other Considerations

A rolling resistance requirement for tires is likely to have public support, because costs would be minimal while collective fuel savings would be substantial. Similar standards proposed at the national level have generated opposition from the tire manufacturing trade association, however. Also, it would be difficult to ensure the availability of low rolling resistance aftermarket tires if Utah were the only state to require them. As in the case of a feebate program, the feasibility of the proposal would be greatly increased if other states were to adopt similar policies at the same time that Utah does. California is currently conducting tire tests in preparation for adopting a requirement that manufacturers report rolling resistance of their tires. California is considering a rolling resistance standard as well.[191] Other states, including Massachusetts and New York, have also expressed interest in tire efficiency standards.

Priority

Improving the fuel-efficiency of tires would save substantial quantities of fuel, and would do so comparatively quickly. The principal challenge to the proposed measure is that Utah may need to rely on other states to adopt identical or similar measures in order to ensure the availability of low rolling resistance tires. Given the need for coordinated state action, we suggest this policy be assigned **medium priority**.

[191] See http://www.energy.ca.gov/transportation/tire_efficiency/index.html.

Chapter VII – Cross-Cutting Policies

Option 22: Undertake a Broad-Based Energy Efficiency Public Education Campaign

Background

One of the barriers to widespread adoption of energy conservation and energy efficiency is lack of public awareness and understanding about energy efficient technologies, appliances, building practices and behaviors, and the associated benefits of choosing efficient technologies. A general energy efficiency education campaign will help inform consumer decision-making, and will lead to behavior changes, conservation measures, and support the increased adoption of energy-efficient products and building practices.

Currently, Utah consumers receive information on available energy efficiency programs and products via communications from utility companies, web-based resources, emails, community events/workshops, in-store displays, and infrequent media coverage. While the aforementioned mechanisms have increased the adoption of energy efficiency over the past decade, the majority of Utahns still remain largely uninformed about energy efficiency. A comprehensive educational effort is necessary to reach this untapped population.

Utah's PowerForward program is an example of an effective broad-based education campaign geared towards reducing summer peak electricity usage through voluntary conservation measures via targeted education and outreach. PowerForward is a $60,000[192] campaign sponsored by the Utah Department of Environmental Quality and Utah's electric utilities.[193] At the heart of the campaign is the PowerForward alert system, which notifies Utah citizens and businesses on days when additional electricity conservation measures are needed. Preliminary estimates show that from June 1 to September 15, 2006, these alerts helped save an estimated 60-100 MW of electricity demand during peak hours (12:00 p.m. - 8:00 p.m.).[194] The principal modes of communication for these alerts are: email announcements, website updates, and daily news updates.

Albeit successful, the PowerForward Campaign is limited in its reach and scope because the campaign 1) runs only during the summer months, 2) focuses only on electricity conservation during peak hours on a limited number of days, and 3) emphasizes immediate conservation measures versus long-term efficiency efforts and/or changes in energy habits and usage patterns.

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[192] Consultation with Glade Sowards, Energy Program Coordinator, Utah Division of Air Quality, Department of Environmental Quality. March 9, 2007.
[193] Power Forward, URL: http://www.powerforward.utah.gov/about.htm.
[194] See Reference 192.

Specific Energy Efficiency Proposal

We recommend that the state and other sponsors implement a multi-year energy efficiency and conservation education program at a funding level of $500,000 per year. Continuing this funding through 2015 would require a total of $4 million (undiscounted). This funding would cover the costs of a campaign consultant, marketing, advertising, and outreach materials. Ideally, this program should have multiple partners and funding sources, as is the case with the PowerForward campaign, and should be designed to withstand changes in political leadership. The campaign could include the following elements:

- A consistent message from a broad array of leaders, including elected officials such as the Governor and mayors, utility executives, and religious leaders;
- Provide simple action items for consumers explaining what specific steps they can take to become more energy efficient;
- Build off of existing efforts, partnerships, state, and utility efforts;
- Involve all state utility providers, including municipal utilities and rural co-ops;
- Involve the state's key media and advertising outlets: local television, commercial radio, public radio, newspapers, billboard agencies, etc.;
- Coordinate campaign messaging and communication efforts with existing utility energy efficiency/DSM incentive programs and national campaigns (i.e. ENERGY STAR campaign), where applicable;
- Develop a clear, recognizable image and brand name/slogan, similar to "Slow the Flow" or "PowerForward";
- Incorporate and utilize ENERGY STAR messaging, resources, and tools;
- Identify clear savings goals and metrics to measure savings; and
- Regular reporting on campaign progress.

Energy Savings

Education campaigns in California, Texas, and elsewhere have been shown to produce lasting demand reductions. A recent report assumes that a short-term education campaign in Texas will produce 3 percent energy savings and 5 percent peak demand savings through behavior changes.[195]

It is assumed that a general energy efficiency education campaign in Utah will gradually build up to 2 percent electricity and natural gas savings per year by 2012, and remain at this level through 2020. We assume the savings occur in the residential and commercial sectors, but not in the industrial sector. It should be possible to achieve this level of savings through behavior and lifestyle changes such as reducing unnecessary operation of lights and personal computers and lower/higher thermostat settings in the winter/summer. The savings estimates are conservative in order to avoid double counting

[195] R.N. Elliott, et. al. 2007. *Potential for Energy Efficiency, Demand Response, and Onsite Renewable Energy to Meet Texas's Growing Electricity Needs.* Washington, DC: American Council for an Energy Efficient Economy, March, pp. 26-27. http://aceee.org/pubs/e073.pdf.

of savings achieved through DSM programs or other policy options that result in technological changes to save energy. However, the general education campaign should help to increase participation in and energy savings from these other efforts.

Table 29 shows the estimated energy savings in 2010, 2015, and 2020 under two scenarios. The first is based on achieving the 2 percent savings by 2012 and thereafter without accounting for the effects of other options in this strategy. The second scenario takes into account the other options; i.e., savings are estimated using a lower base level of energy consumption. In this second scenario, the savings reach 393 GWh of electricity and 1.75 million decatherms of natural gas per year by 2015.

Table 29 – Projected Electricity and Natural Gas Savings from a Broad-based Energy Efficiency Education Campaign

	Electricity Savings (GWh per year)			Natural Gas Savings (million decatherms per year)		
Scenario	**2010**	**2015**	**2020**	**2010**	**2015**	**2020**
Base case energy use forecast	242	476	561	1.14	2.02	2.14
Adjusted energy use forecast	226	393	420	1.09	1.75	1.69

Cost and Cost Effectiveness

The overall cost of developing and implementing a multi-year energy efficiency and conservation education program would be approximately $4 million through 2015, and $6.5 million through 2020. We estimate annual energy bill savings of about $34 million in 2015 in the base energy use scenario and $29 million in 2015 in the adjusted energy use scenario. The total energy bill savings during 2008-2015 under the first scenario is about $209 million and under the second scenario about $186 million (discounted net present value basis). Since we assume these savings can be realized through behavioral and lifestyle changes alone, no monetary costs are included for energy efficiency measures.

Environmental and Social Benefits

Implementing a comprehensive education campaign will help increase the adoption of energy efficiency measures and conservation techniques, providing net environmental and social benefits to Utah. Table 30 estimates the emissions reductions for the two energy savings scenarios outlined above.

Table 30 – Estimated Emissions Reduction from a Broad-based Energy Efficiency Education Campaign

Pollutant	Avoided Emissions (base case energy savings)		Avoided Emissions (adjusted energy savings)	
	2015	2020	2015	2020
Carbon dioxide (thousand metric tons)	319	376	264	282
SO_2 (short tons)	21.4	25.2	17.7	18.9
NOx (short tons)	133.2	157.0	110.0	117.7
Mercury (pounds)	1.9	2.2	1.6	1.7

Political and Other Considerations

Creating and implementing a successful energy efficiency education program will require collaboration, cooperation, and resources from all involved stakeholders. One challenge will be getting municipal utilities and rural electric co-ops to participate in such an effort given their limited budgets for education and outreach. Additionally, tracking and reporting specific savings associated with behavior changes is difficult to accomplish. While it is not politically controversial, securing adequate resources will be necessary to make this effort a success.

Priority

This option should lead to non-trivial energy savings as a result of behavior changes that cost little or nothing to implement. In addition, this option is a foundation activity that will contribute to the success of other efforts such as utility DSM programs. For these reasons, we recommend that it by viewed by the Governor, Legislature, and PSC as a **high priority.**

Case Study 10:

Public Education Campaign:
Slow the Flow

Utah is the second driest state in the nation, but its residents consume large amounts of water. As water purveyors began looking at growth projections and how to meet future demands, the state mandated that regional or local water agency create and implement water conservation plans.

As part of their water conservation plan, the Jordan Valley Water Conservancy District (JVWCD) earmarked funds for a public outreach campaign. A water conservation program entitled "Slow the Flow: Save H2O" was created, which was used across all media channels. In 2001, Governor Leavitt created the Governor's

Water Conservation Team, which includes a representative from each of the state's five major water conservancy districts, Utah Division of Water Resources, and Rural Water Association of Utah. Slow the Flow was incorporated as the main component of the Team's conservation efforts. Since the program's inception, dozens of press events, editorial board tours, media interviews, have been held.

The scope of the statewide Slow the Flow campaign has been primarily promotional. The funds contributed to date from participants in the Water Conservation Team, about $1.5 million, have been used towards television and radio spots, print advertising, community outreach, and promotional items.

The statewide education program has been a success with estimated water savings of 2 percent in 2001, 8 percent in 2002, and 4 percent in 2003. Awareness of the Slow the Flow campaign is very high, and is judged to be effective.

Quick Facts

Total Project Cost: $1.5 million during 2001-2006
Total Cost Savings: Not available
Total Water Savings to Date: Approximately 13 billion gallons
Highlights:

- Water conservation is now one of the top issues recognized statewide
- The vast majority of Utahns have heard of the Slow the Flow campaign, and most of the population report acting on its message

Source: Jordan Valley Water Conservation District, and State Division of Water Resources, 2007

Option 23: Increase Energy Efficiency Expertise through Training and Certification

Background

Investments in energy efficiency not only save energy and money, but also create new economic development and new job opportunities. Currently in Utah and across much of the nation, there is a shortage of trained energy efficiency professionals for performing energy audits, retrofits, and implementing energy efficiency programs. What's more, often energy professionals are not fully aware of the benefits of certain energy-efficient technologies, and/or there is a disincentive for them to promote these products because of lower profit margins and higher risk of call-backs. For example, the majority of HVAC installers and dealers in Utah encourage the purchase of central air conditioning as a replacement for outdated evaporative cooling technologies; newer evaporative cooling technologies are rarely promoted by HVAC businesses, despite their energy saving benefits.

Lack of energy efficiency expertise is a particular challenge outside of the Salt Lake valley. In rural areas and areas with small populations, utilities have found it challenging to attract trade allies and to promote energy-efficient products. For example, Rocky Mountain Power (RMP) and Utah Clean Energy partnered with the City of Moab and Moab businesses to launch the Moab Energy Efficiency Challenge in 2005. The goal was to increase business participation in RMP's FinAnswer and FinAnswer Express Programs. However, the partners found it difficult to attract local lighting and HVAC contractors to participate in the program because they lacked awareness of and interest in marketing and installing energy-efficient products.

Across the country, numerous universities, colleges, and technical schools are teaching energy efficiency courses and training students and professionals. For example, Northampton Community College (NCC) in Bethlehem, PA offers an Energy Efficiency Specialist program, while Lane Community College in Portland, OR operates an Energy Management Technician program. NCC collaborated with the U.S. Department of Energy to create the curriculum for a community college-based energy efficiency program that can be used as a national model and replicated at community colleges and vocational schools nationwide.[196] The curriculum is available free of charge to other schools interested in implementing similar programs. The diploma program, offered in response to industry demand for energy efficiency specialists, covers energy usage in a manufacturing setting; applications of energy efficient technologies; energy assessment methodologies; tools available to assess energy systems, such as DOE's Best Practices tools; and energy-economic analysis.

Lane Community College has offered an Energy Management Technician program since 1980. The program trains students to be energy efficiency technicians and energy

[196] US DOE, Energy Efficiency and Renewable Energy, Industrial Technologies Program, "Energy Efficiency Tools go to School." URL: http://www.eere.energy.gov/industry/bestpractices/energymatters/articles.cfm/article_id=44.

analysts in the residential and commercial sectors. The program currently operates on an annual budget of $250,000, which covers one full-time faculty member, 8 adjunct professors, and 3 support staff. Approximately 25 students graduate from the program each year. The program also offers several professional development workshops throughout the year to train construction and building trade professionals on matters related to energy and energy efficiency.[197]

The Building Operators Training and Certification program (BOC) is another well-proven energy efficiency training program for commercial and industrial building operators and facility managers. It features a series of one- and two-day courses, followed by students taking a test and receiving a certificate if the test is passed. Surveys have shown that 75-85 percent of students report taking some actions that saved energy and money after completing this training and certification program.[198]

As Utah moves towards the goal of a 20 percent increase in energy efficiency by 2015, there will undoubtedly be a growing demand for workers who can market, install, operate, and service energy-efficient lighting, HVAC equipment, refrigeration systems, energy management, and other systems used in businesses and industries. There will also be a need for skilled professionals to staff utility DSM and other programs, design and construct efficient new buildings, and perform energy audits and retrofits on existing buildings.

Specific Energy Efficiency Proposal

In order to meet the demand for energy efficiency professionals, we recommend funding energy efficiency training and certification programs in one or more of Utah's universities, community colleges, and technical schools. It is worth noting that the Governor's former Energy Policy Advisor made the following recommendation in her *2006 Energy Advisor Report to the Utah Legislature: Energy Policy and Development in Utah*:

> *It is recommended that in order to remain competitive in the region, be progressive in matters of conservation and efficiency, and avoid increased labor shortages, the legislature earmark funding for education and training in the energy sectors. Funding can be directed through the Department of Workforce Services, the office of the Energy Advisor, the Governor's Office of Economic Development, or through higher education appropriations. Funding could come from a portion of the severance tax, bonus payments, royalties paid to the state from minerals' extraction, or other available sources that stem from the energy boom.*

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[197] Personal communication with Roger Ebbage, Program Advisor, Energy Management Technician, Lane Community College, March 9, 2007.

[198] For more information on the BOC program, see www.theboc.info. Also, McRae, M.R. and B. Mayo. 2006. "What Building Operators Are Saying About the BOC Training." *Proceedings of the 2006 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy.

It is also recommended that the Energy Policy (Utah Code Section 63-53b-301) be modified as follows to reflect that energy education of all types is a priority in this State:

> *(X). Utah will promote training and education programs that focus on energy related matters, including such issues as conversation, energy efficiency, and workforce development.*[199]

We recommend a total budget of approximately $500,000 per year for energy efficiency courses and training, relying primarily on existing curriculum such as the BOC program and the community college courses mentioned above. Simultaneously, the state could partner with utilities and other organizations such as trade groups to train existing workers in areas of concern. In fact, Rocky Mountain Power periodically hosts various training sessions to generate "trade allies" for their demand-side management programs. Additionally, Utah could reinstate funding for the University of Utah's Intermountain Industrial Assessment Center (IIAC), which was previously funded by the Department of Energy. Due to reallocation of national funds, the IIAC was terminated in 2006. The IIAC trained students in energy auditing and provided free on-site energy efficiency audits to small and medium-size industries in the state.[200] Reinstating the IIAC with state and/or private money would certainly prove beneficial to Utah's industries and to energy efficiency efforts in general.

<u>Energy Savings</u>

We do not attribute any direct energy savings to this option. Implementing training and certification will enhance the effectiveness of other options in the strategy.

<u>Cost and Cost Effectiveness</u>

Given that energy efficiency curriculum has already been created and successfully implemented elsewhere, the cost to tailor these curriculum to the needs of Utah would be minimal. Regarding training itself, we suggest funding one community college or vocational school to run an energy efficiency training program along the lines discussed above; implementing the BOC program; and reinstating the IIAC program. Combined, the cost should be on the order of $500,000 per year.

The three programs combined could potentially train 50-75 students per year. The overall benefit of increasing the number of trained energy efficiency professionals in the state is not easily quantifiable. But it will no doubt indirectly contribute to energy savings as these students obtain jobs in businesses and industries in the state, including utilities, engineering firms, and energy service companies.

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[199] L. Nelson, *Energy Advisor Report to the Utah Legislature: Energy Policy and Development in Utah.* October 18, 2006.

[200] Utah Industrial Assessment Center, URL: http://web.utah.edu/iac/ and http://www.umpic.utah.edu/iac.html.

Environmental and Social Benefits

The environmental and social benefits resulting from this option are difficult to quantify, but implementing a successful education and training program will bolster the success of the other policies outlined in this strategy. Moreover, education and training will improve the skills of Utah’s workforce and spur economic development.

Political and Other Considerations

Obtaining state funding for energy efficiency training is challenging because it competes with other funding priorities. Additionally, it may be difficult to demonstrate the need for such training because energy management expertise is dispersed across a wide range of businesses and sectors. But procuring adequate funding is critical to the success of this option. In that regard, it may be possible to obtain some of the funding from charitable foundations and/or corporate donors who understand the importance and value of energy efficiency training.

Priority

Even though it is difficult if not impossible to quantify the benefits of this option, we believe it is critical activity for achieving the Governor’s energy efficiency goal. We recommend it be pursued as a **medium priority.**

Chapter VIII – Conclusion

The 23 policy options presented above offer a wide range of benefits to the state of Utah including energy savings, economic benefits, water savings, and reduced pollutant emissions. In total, the options provide primary energy savings of 127.6 trillion Btus (16.7 percent) by 2015 and an estimated net economic benefit of $7.3 billion over the lifetime of efficiency measures installed during 2006-2015. Below we summarize those benefits and review our recommended high priority policies.

Energy Savings

Table 31 shows the electricity savings in 2010, 2015, and 2020, by option. These options were analyzed in a manner that attempted to avoid double counting of energy savings, so the savings are additive. The options that offer the largest savings potential in 2015 and 2020 are expanded electricity DSM programs and lamp and appliance efficiency standards. The total electricity savings potential in 2015 is 6,189 GWh per year, which represents an 18.1 percent reduction from projected baseline electricity consumption that year. Thus the electricity saving options are adequate to meet the 20 percent efficiency improvement goal for electricity, which means at least a 16.7 percent reduction in electricity use in 2015 from the otherwise forecast level. Note that no electricity savings are assumed for the CHP option since it leads to a shift in electricity generation from central station power plants to on-site generation, not electricity savings per se.

The electricity savings potential continues to grow significantly after 2015, reaching over 10,300 GWh per year by 2020. This savings potential represents about 25.7 percent of projected electricity demand for that year, in the absence of the efficiency initiatives. In addition to the substantial electricity savings, implementing the options listed in Table 31 would also greatly reduce peak power demand. RMP's DSM programs in particular emphasize air conditioning efficiency and load control, meaning a larger reduction in peak demand in percentage terms relative to the reduction in electricity use. Building code upgrades and better code enforcement should have a similar impact.

Table 31 – Total Electricity Savings Potential

	Savings Potential (GWh/yr)		
Option	**2010**	**2015**	**2020**
Electricity DSM expansion	894	2,375	4,108
Building code upgrades	214	674	1,391
Appliance standards	137	1,334	2,137
Industrial challenge	130	615	1,183
Public sector initiatives	169	421	604
Public education	226	393	420
Other	202	377	476
TOTAL	**1,972**	**6,189**	**10,319**

Figure 3 shows the growth in electricity use during 2005-2020 in the baseline and high-efficiency scenarios; i.e., assuming implementation of all electricity savings options. In the baseline scenario, electricity demand grows 3.2 percent per year on average, based on RMP's most recent electricity demand forecast and with the effects of planned DSM programs removed. In the high-efficiency scenario, electricity demand growth is limited to 1.2 percent per year on average during 2005-2020. Thus, implementing all of the electricity savings options would not entirely eliminate load growth, but it would reduce it by over 60 percent.

Figure 3 – Electricity Consumption by Scenario

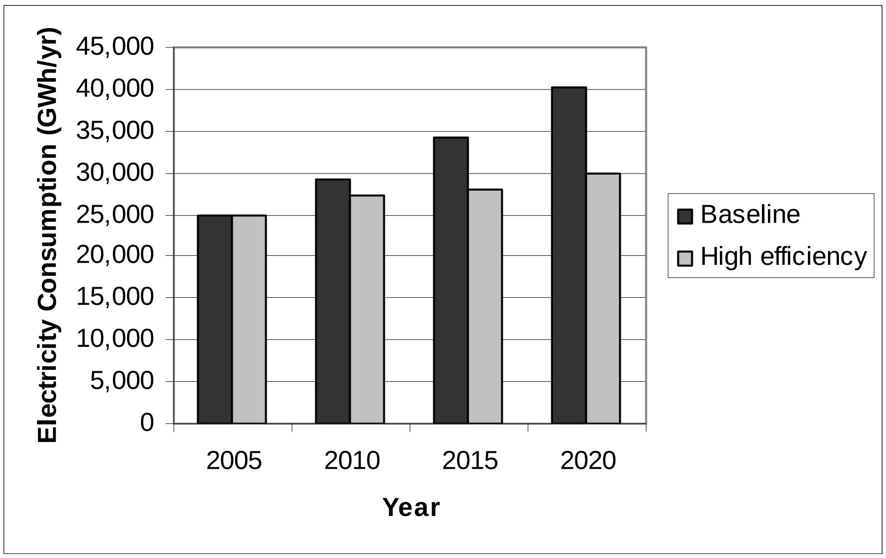


Table 32 shows the natural gas savings by option. These options were also analyzed to avoid double counting of savings, so the savings are additive. The options that offer the largest gas savings potential include gas utility DSM programs, building energy codes, and the industrial challenge and recognition option. The total gas savings potential in 2015 is about 22.2 million decatherms per year. This represents 14 percent of projected baseline gas consumption for that year, in the absence of energy efficiency initiatives. Thus, the natural gas saving options are not adequate to meet the 20 percent efficiency improvement goal for natural gas, interpreted to mean at least a 16.7 percent reduction in gas use in 2015 from the otherwise forecast level.

The gas savings potential continues to grow significantly after 2015, reaching nearly 38 million decatherms per year by 2020. This savings potential represents over 22.3 percent of projected natural gas demand for that year, in the absence of the efficiency initiatives. The gas savings potential is limited in part by the fact that natural gas use has declined somewhat in recent years due to high gas prices and other factors, meaning that significant efficiency improvements have already occurred.

Table 32 – Total Natural Gas Savings Potential

Option	Savings Potential (million decatherms per year)		
	2010	**2015**	**2020**
Gas DSM expansion	2.33	8.27	14.94
Building code upgrades	1.25	3.74	7.48
Conservation ordinances	0.40	1.20	1.60
Low-income weatherization	0.48	1.28	1.84
Industrial challenge	0.78	3.71	7.25
Public sector initiatives	0.86	2.10	2.96
Public education	1.09	1.75	1.69
Other	0.04	0.14	0.21
TOTAL	**7.23**	**22.19**	**37.97**

Figure 4 shows the growth in natural gas use during 2005-2020 in the baseline and high-efficiency scenarios; i.e., assuming implementation of all natural gas savings options. The scenarios do not include natural gas use for electricity generation in the electric utility sector. In the baseline scenario, natural gas consumption increases 1.5 percent per year on average, based on QGC's most recent forecast and an estimate of industrial natural gas demand growth. In the high-efficiency scenario, gas demand increases slightly in the early years but then declines in absolute terms. By 2020, total natural gas consumption is slightly below that in 2005. Thus, we estimate that the energy efficiency options are adequate to eliminate growth in natural gas consumption over the medium-term in Utah.

Figure 4 – Natural Gas Consumption by Scenario

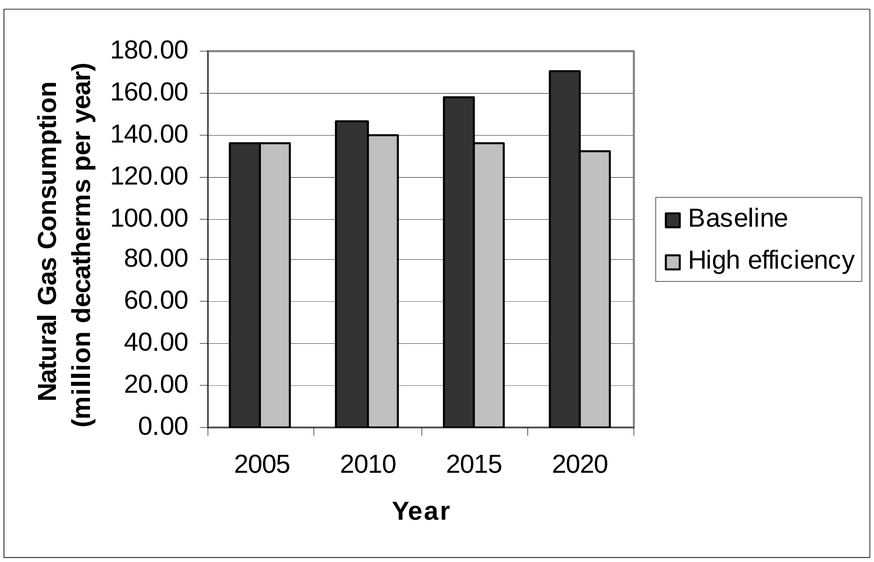


Table 33 shows the potential savings of gasoline and diesel fuel. In Chapter VI, each transportation option is analyzed independent of the other options. However, adjustments are made here to consider the gasoline and diesel savings options in combination and avoid double counting of energy savings; e.g., the savings from vehicle efficiency improvements is reduced if VMT is being reduced at the same time, and vice versa. The options that offer the largest potential gasoline savings are the clean car standards and pay-as-you-drive insurance. The total fuel savings potential is estimated to be about 6.7 million barrels of fuel per year in 2015. The gasoline savings from the measures in combination represents 18.3 percent of projected gasoline consumption for that year, in the absence of energy efficiency efforts. Thus, the gasoline savings options in combination meet the 20 percent efficiency improvement goal. However, the diesel fuel savings in 2015 represent only about 9 percent of projected diesel fuel use for that year, in the absence of new efficiency initiatives. Thus, the diesel fuel option is not adequate to meet the 20 percent efficiency improvement goal by 2015.

The gasoline and diesel fuel savings continue to grow significantly after 2015, reaching about 11.8 million barrels per year in 2020. This savings potential represents over 30 percent of projected gasoline demand and over 11 percent of projected diesel fuel demand for that year, in the absence of the efficiency initiatives. These energy savings values are conservative in that they do not include the upstream savings in petroleum refining and transport.

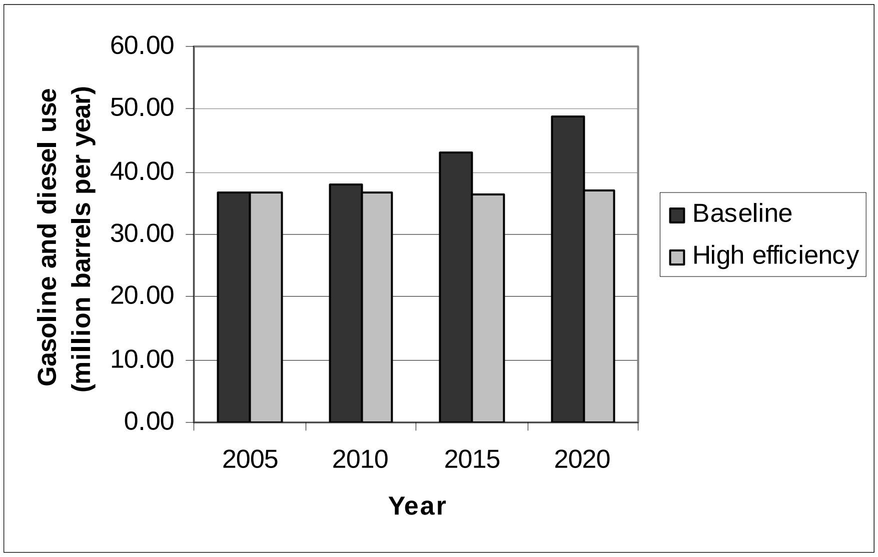
Table 33 – Total Gasoline and Diesel Savings Potential

	Savings Potential (million barrels per year)		
Option	**2010**	**2015**	**2020**
Clean car standards	0.238	2.076	4.586
Feebates	0.164	0.984	1.784
PAYD insurance	0.030	1.503	3.299
Reduce VMT growth	0.110	0.714	1.423
Enforce speed limits	0.621	0.702	0.796
Truck efficiency measures	0.248	0.992	1.439
Replacement tire standards	0.205	0.676	0.742
TOTAL[1]	**1.518**	**6.718**	**11.803**

[1] The totals do not equal the sum of the values in the columns in order to take into account the interactive effects of the options.

Figure 5 shows the growth in gasoline and diesel fuel use during 2005-2020 in the baseline and high efficiency scenarios; i.e., assuming implementation of all of the transportation options. In the baseline scenario, demand for these fuels increases close to two percent per year on average given expected growth in driving and assumptions about vehicle efficiency. In the high-efficiency scenario, demand for these transportation fuels increases only about 0.3 percent per year on average during 2005-2020. Gasoline consumption actually falls but diesel fuel use still rises during this time period.

Figure 5 – Gasoline and Diesel Fuel Use by Scenario



We also examine the overall energy savings from all fuels and options combined by converting fuels and electricity to primary energy units. In doing so, we account for energy losses in electricity production and delivery using the average efficiency of power plants and average transmission and distribution losses in Utah. Natural gas and liquid fuels are converted to primary energy based on their direct energy content only. Table 34 shows the resulting primary energy consumption for the baseline and high-efficiency scenarios. The values cover only those fuel types considered in this study; i.e., we do not include other forms of energy such as jet fuel or coal directly consumed by industry. The primary energy savings shown in Table 34 includes the savings from the CHP option.

Table 34 – Primary Energy Savings Potential

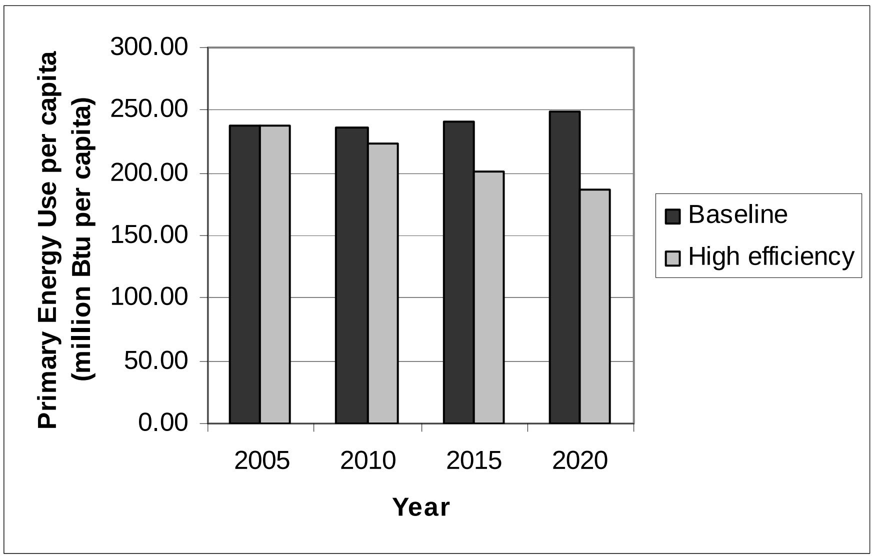
	Primary Energy Consumption or Savings (trillion Btu per year)			
	2005	**2010**	**2015**	**2020**
Baseline Scenario	598.5	669.3	762.0	868.7
High Efficiency Scenario	598.5	631.4	634.0	651.3
Energy use per capita – Baseline Scenario [1]	237.8	236.3	241.1	249.2
Energy use per capita – High Efficiency Scenario [1]	237.8	222.9	200.6	186.8
Savings in High Efficiency Scenario	0.0	37.9	128.0	217.4
Savings as percent of baseline energy use	0.0	5.7	16.8	25.0

[1] The unit is million Btu per capita.

Table 34 shows that the options reduce primary energy use by 128 trillion Btus (16.8 percent) by 2015. This is slightly more than is necessary to meet the 20 percent energy efficiency improvement target that year. The savings continue to increase rapidly after 2015 as the buildings, appliance, and vehicle stock continues to turnover, reaching over 217 trillion Btus of savings in 2020. This is equivalent to about 25 percent of baseline primary energy use by 2020.

Figure 6 shows projected primary energy per capita over time in each scenario. In the baseline scenario, energy use per capita is projected to increase slightly during 2005-2020. But energy use per capita is projected to decrease over 21 percent between 2005 and 2020 in the high-efficiency scenario.

Figure 6 – Energy Use per Capita by Scenario

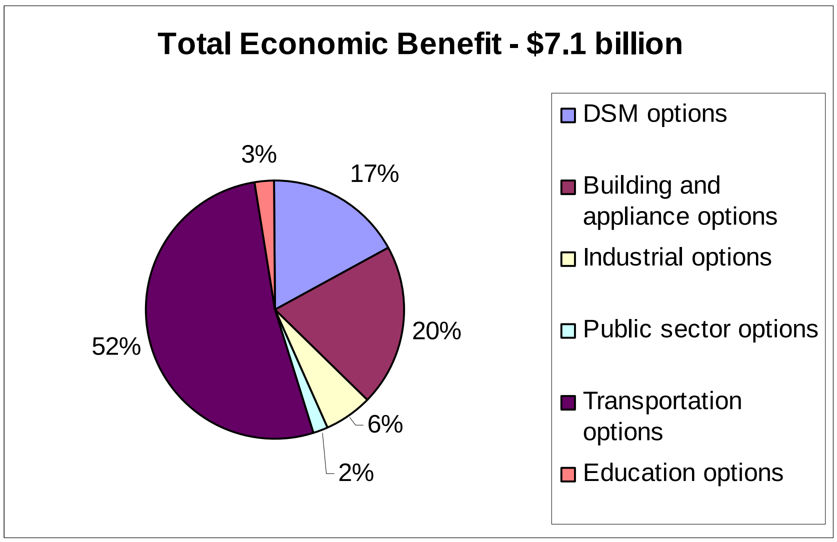


Economic Costs and Benefits

Figure 7 shows the estimated net economic benefits of the options where net economic benefits have been quantified. The net economic benefits are the net present value of benefits minus costs for efficiency measures installed during 2006-2015, considering the energy savings over the lifetime of measures installed during this period and using a five percent discount rate to discount future costs and benefits. The options are clustered by area, and in the transportation area are adjusted compared to those reported above in order to avoid double counting and the overestimating of benefits when options are implemented in combination.

In total, the estimated net economic benefits are about $7.1 billion. This is equivalent to saving about $6,700 per household on average, considering the projected number of households in Utah as of 2015.[201] Approximately 52 percent of the benefits result from the transportation options, 20 percent from the building and appliance options, 17 percent from the DSM options, and 11 percent from the remaining options. We believe these estimates are conservative because energy prices are not assumed to rise above inflation. In reality the cost of both fuels and electricity is likely to rise faster than inflation due to supply constraints, rising construction costs, and other factors. Also, we do not include valuation of non-energy benefits, which in some cases could be substantial.

Figure 7 – Net Economic Benefit of Energy Efficiency Options



It should be noted that economic benefits have not been quantified for a few of the options, although these are expected to be minor and largely covered by the options where energy savings and economic benefits have been quantified. In addition, further economic benefits will result from efficiency measures adopted after 2015 assuming the policies and programs remain in effect.

Regarding the potential costs and benefits to Utah's state government, upgrading energy efficiency in state buildings and facilities (Option 12) is the most costly but also results in a significant net economic benefit. With an investment of about $14 million per year in efficiency measures in state facilities, we estimate net economic benefits of $88 million over the lifetime of efficiency measures implemented during 2007-2015, on a net present value basis. This is more than adequate for offsetting the cost to state government of all the other options combined. These costs to the state are estimated to equal about $9 million per year on average during 2008-2015. The largest item, representing nearly half the total, is the additional state contribution to low-income home weatherization. Other significant provisions include tax credits for highly-efficient buildings and appliances,

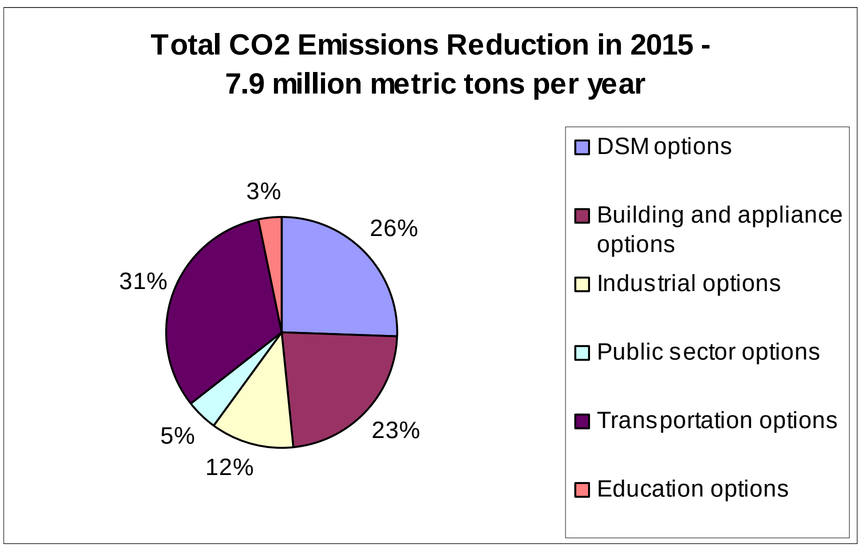
[201] The projected number of households in 2015 is 1.06 million according to the Governor's Office of Planning and Budget, 2005 Baseline Projections. The savings per household includes savings realized by businesses.

pay-as-you-drive insurance subsidies, the public education campaign, and energy efficiency training and certification efforts.

Environmental Benefits

Implementing the energy efficiency options would provide substantial environmental benefits within and beyond the state of Utah. Carbon dioxide (CO_2) emissions, the main pollutant contributing to global warming, would be reduced as a result of decreased fossil fuel consumption for power generation, vehicle operation, space heating, and other purposes. Figure 8 shows the estimated CO_2 emissions reductions in 2015 by option cluster. Of the total of 7.9 million metric tons of avoided CO_2 emissions that year, transportation options provide about 31 percent, DSM options about 26 percent, and building and appliance options about 23 percent. The estimated CO_2 emissions reduction grows to about 14.0 million metric tons per year by 2020.

Figure 8 – Carbon Dioxide Emissions Reductions in 2015 from Implementation of the Energy Efficiency Options



There also will be significant water savings, particularly from options that result in reduced operation of fossil-fuel based power plants because these plants consume sizable amounts of water in their cooling systems. We estimate that the options taken together will lower water consumption in power plants by approximately 3.4 billion gallons per year in 2015 and 5.6 billion gallons per year in 2020. The latter is equivalent to the annual water use of 36,600 average Salt Lake City households.[202] Furthermore, there will be additional water savings from promotion and increased adoption of energy and water-conserving devices such as resource-efficient clothes washers and dishwashers.

[202] Residential water consumption in Salt Lake City averages about 140 gallons per day per capita, or 153,000 gallons per year. See *Water Conservation Master Plan 2004*. Salt Lake City Department of Public Utilities. Salt Lake City, UT.

Priority

Among the 23 options developed in this report, we suggest that 11 be viewed as high priority by the Governor, the Legislature, the Public Service Commission, and other key decision makers. These options provide the greatest energy savings and consequently the bulk of the economic and environmental benefits. The following list presents our suggested high priority options:

- Energy Savings Standards or Targets for Electric Utility Demand-Side Management Programs
- Expanded Natural Gas Utility Energy Efficiency Programs and Energy Savings Targets for These Programs
- Upgraded Building Energy Codes and Funding for Code Training and Enforcement
- Lamp and Appliance Efficiency Standards for Products Not Covered by Federal Standards
- Expand Low-Income Home Weatherization
- Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions
- Energy Savings Targets for State Agencies
- Clean Car Standards for New Cars and Light Trucks
- Pay-As-You-Drive Auto Insurance
- Reduce the Rate of Growth in Vehicle-Miles Traveled
- Broad-Based Public Education Campaign

In conclusion, Utah would save a large amount of energy if it adopted the high priority energy efficiency policy options, and possibly other options, described and analyzed in this study. By 2015, electricity use could be reduced by 18 percent, natural gas use by nearly 14 percent, and gasoline use by 18 percent, all in comparison to otherwise forecasted levels of energy use that year. By implementing all of the options, the ambitious energy efficiency goal set by Governor Huntsman could be achieved, at least for the forms of energy considered in this study. Furthermore, the energy savings would continue to grow rapidly during 2016-2020, reaching 25 percent primary energy savings by 2020.

Substantial benefits would result from achieving these levels of energy savings. Consumers and businesses in Utah could save over $7 billion net during the lifetime of efficiency measures implemented through 2015. Water savings would reach 3.4 billion gallons per year by 2015 and about 5.6 billion gallons per year by 2020. Pollutant emissions would be cut as well. Most notably, Utah would significantly reduce its carbon dioxide emissions, thereby contributing to the worldwide effort to limit global warming, and would do so very cost effectively. Local air quality would also improve. Aggressively pursuing greater energy efficiency is truly a winning opportunity for Utah's citizens, businesses, government, and environment.

APPENDIX A

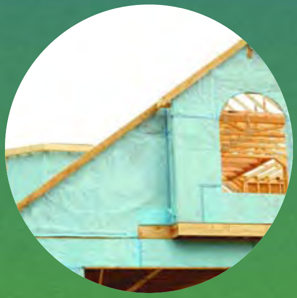
Acronyms and Abbreviations

AC	air conditioning, or alternating current
ADRS	Automated Demand Response System
APU	auxiliary power unit
ASAP	Appliance Standard Awareness Project
ASHRAE	The American Society of Heating, Refrigerating and Air-Conditioning Engineers
Btu	British thermal unit
CARB	California Air Resources Board
CFL	compact fluorescent light-bulb
CIPEC	Canadian Industry Program for Energy Conservation
CO_2	carbon dioxide
Coops	Rural electric cooperatives
DC	direct current
DSM	demand-side management
DOE	(United States) Department of Energy
ESCO	energy service company
ESPP	energy smart pricing program
FEMP	Federal Energy Management Program
GHG	greenhouse gas
GW	Gigawatt
GWh	Gigawatt-hour
HVAC	heating, ventilation, air-conditioning and cooling
IECC	International Energy Conservation Code
IIAC	Intermountain Industrial Assessment Center
IRP	Integrated resource plan
kW	kilowatt
kWh	kilowatt-hour
LEED	Leadership in Energy and Environmental Design
LEV II	Low Emission Vehicle II program
LPG	liquefied petroleum gas
Munis	municipal electric utilities
MW	Megawatt
MWh	Megawatt-hour
NEMS	National Energy Modeling System
NOx	nitrogen oxides
O&M	operation and maintenance
OE	original equipment
OWHLF	Olene Walker Housing Loan Fund
PAYD	pay-as-you-drive insurance

PM	particulate matter
PSC	Public Service Commission
QGC	Questar Gas Company
RECO	residential energy conservation ordinance
RFP	request for proposal
RLF	revolving loan fund
RMP	Rocky Mountain Power
SBEEP	State Building Energy Efficiency Program
SO_2	sulfur dioxide
STIP	State Transportation Improvement Plan
SULEV	Super Ultra Low Emission Vehicle
SWEEP	Southwest Energy Efficiency Project
T&D	transmission and distribution
TOU	time-of-use
TRC	total resource cost
TSE	truck stop electrification
UDOT	Utah Department of Transportation
UIOF	Utah Industries of the Future
VMT	vehicle-miles traveled
WAP	Weatherization Assistance Program
WFRC	Wasatch Front Regional Council
WGA	Western Governors Association

Definitions of Key Energy Units

Btu	British Thermal Unit. Unit of energy measurement, namely the quantity of heat required to raise the temperature of one pound of water by one degree Fahrenheit.
Kilowatt	Unit of electric power equal to one thousand watts
Megawatt	Unit of electric power equal to one million watts
Gigawatt	Unit of electric power equal to one billion watts
Kilowatt-hour (kWh)	A measure of electricity equivalent to one kilowatt of power expended for one hour. The average Utah household consumes 9,650 kWh of electricity per year.
MWh	Unit of electricity equal to one thousand kilowatt-hours
GWh	Unit of electricity equal to one million kilowatt-hours
Therm	Unit of natural gas measurement, equal to 100,000 Btus and approximately equivalent to the energy content of 100 cubic feet of natural gas. The average Utah household consumes about 800 therms of natural gas per year.
Decatherm	Unit of natural gas measurement equal to 10 therms or one million Btus.



Energy efficiency is a proven, cost effective energy resource that can help meet Utah's growing energy demands. Energy efficiency improves Utah's competitiveness and has the potential to save billions of dollars, while creating jobs, reducing emissions, and preserving resources for future generations. Utah is well-poised to lead the nation toward a more energy efficient future.

Utah Energy Efficiency Strategy: Policy Options, October, 2007

Photo credits:

Salt Lake Valley at Night courtesy Utah Office of Tourism, photographer Jerry Sintz

Bryce Canyon National Park courtesy Utah Office of Tourism, photographer Frank Jensen

FrontRunner commuter train courtesy of Utah Transportation Authority