New Mexico Energy Efficiency Strategy:

Policy Options

Southwest Energy Efficiency Project

American Council for an Energy-Efficient Economy

ETC Group, LLC

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Prepared for the New Mexico Energy, Minerals
and Natural Resources Department

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Preface and Acknowledgements

The New Mexico Energy Efficiency Strategy was prepared by a team of researchers and analysts led by Howard Geller, Executive Director of the Southwest Energy Efficiency Project (SWEEP). Co-authors of the Strategy are Steve Dunn and Tammy Fiebelkorn of SWEEP, Therese Langer and Shruti Vaidyanathan of the American Council for an Energy-Efficient Economy, and Patti Case of ETC Group, LLC. Gene Dilworth of SWEEP provided skillful editing.

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Questions or comments on the New Mexico Energy Efficiency Strategy should be directed to Howard Geller, hgeller@swenergy.org and Ken Hughes, ken.hughes@state.nm.us.

About the Southwest Energy Efficiency Project

The Southwest Energy Efficiency Project (SWEEP) is a public interest organization promoting greater energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. For more information, visit SWEEP online at www.swenergy.org.

Executive Summary

On November 14, 2007, Governor Bill Richardson announced the goals of reducing energy use per capita in New Mexico 10 percent by 2012 and 20 percent by 2020, relative to energy use per capita in 2005. 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 New Mexico one of the nation's most energy-efficient states, thereby lowering energy bills paid by consumers (including low-income households), enhancing energy security and reliability, improving business profitability and competitiveness, and reducing greenhouse gas emissions.

In order to help the state examine options for achieving the energy efficiency goals, the Energy, Mineral, and Natural Resources Department (EMNRD) asked the Southwest Energy Efficiency Project (SWEEP) 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 goals, examine the feasibility of achieving the goal for different types of energy, and estimate what the economic and environmental impacts of achieving the goals would be.

The New Mexico Energy Efficiency Strategy contains 25 major policies, programs, or initiatives that could be implemented in order to accelerate energy efficiency improvements in the state and achieve the goals where possible. The policies save electricity, natural gas, or gasoline. These energy sources account for 77 percent of primary energy consumption in the state and 65 percent of energy consumption on a secondary (site) basis. We do not consider diesel fuel use in the main part of this study because a significant fraction of the diesel consumed in New Mexico is due to trucks passing through the state. However, we provide an appendix presenting an option for increasing the efficiency of heavy-duty trucks.

Methodology

The methodology involves developing baseline and high efficiency scenarios for 2008 through 2025. 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 1.9 percent per year, growth in natural gas consumption of 1.2 percent per year, and growth in gasoline consumption of 0.8 percent per year during 2008-2025. Growth in gasoline consumption is relatively low in the baseline scenario due to the assumptions that vehicle use per capita remains constant while vehicle fuel economy increases modestly.

We examine the potential of each option in the strategy, and the combination of options, to reduce this baseline energy demand projection. We include the effects of current policies and programs (for example, 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 2025. In some cases, the energy savings are moderate by 2020 but increase significantly between 2020 and 2025.

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. For example, 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 2007 dollars with costs and benefits after 2007 discounted using a five percent annual discount rate. Electricity prices are assumed to remain constant at their levels in 2007, other than increasing with inflation. This is a conservative assumption given that electricity prices are rising due to increasing fuel costs, increasing construction costs, and tightening environmental standards. Natural gas prices, on the other hand, are assumed to increase 10 percent in addition to inflation in 2008, and 1 percent per year above inflation after that. This is due to the recent spike in natural gas prices and expectation that gas prices will remain high. The price of gasoline is assumed to be $4.00 per gallon as of 2008 and is held constant at this level in real dollars. Net economic benefits are considered over the lifetime of energy efficiency measures installed during 2008-2020; that is, 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. 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 25 options grouped by category. For each option, we provide a background discussion, a description of the specific proposal, estimated energy savings that would result by 2012, 2020 and 2025, analysis of 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: Expand Electric Utility Demand-Side Management Programs – ensure that utilities meet and go beyond the minimum electricity savings requirements in the 2008 amendments to the Efficient Use of Energy Act (partially adopted)

Option 2: Adopt Decoupling and/or Shareholder Incentives to Stimulate Greater Utility Support for Energy Efficiency Improvements – adopt decoupling and/or performance-based incentives to encourage utilities to maximize the amount of cost-effective energy savings they achieve (partially adopted)

Option 3: Adopt Innovative Electricity Rates in Order to Stimulate Greater Electricity Conservation and Peak Demand Reduction – adopt critical peak pricing or real-time pricing for residential customers with central air conditioning (not yet adopted)

Option 4: Expand Natural Gas Utility Energy Efficiency Programs and Establish Energy Savings Targets for these Programs – expand natural gas DSM programs implemented by gas utilities in order to save 5 percent of gas sales by 2015 and 10 percent by 2020 (partially adopted)

Buildings and Appliances Policies

Option 5: Upgrade Building Energy Codes and Provide Funding for Code Training and Enforcement Activities – upgrade the statewide building energy code in 2009 and every three years after that, and train builders, contractors, and local code officials regarding code requirements (partially adopted)

Option 6: Adopt Residential Energy Conservation Ordinances (RECOs) to Upgrade the Energy Efficiency of Existing Homes – adopt energy efficiency requirements at the time a home is sold, beginning with a RECO for rental property in Albuquerque (not yet adopted)

Option 7: Lamp Efficiency Standards – adopt efficiency standards on general service lamps included in the 2007 Energy Independence and Security Act (already adopted)

Option 8: Expand Retrofit of Homes Occupied by Low-Income Families – triple the number of low-income homes retrofitted each year (not yet adopted)

Option 9: Tax Credits for Highly-Efficient New Homes, Commercial Buildings, and Heating and Cooling Equipment – offer 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 (partially adopted)

Industrial Policies

Option 10: Undertake an Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions – encourage industrial firms to set voluntarily energy intensity reduction goals; provide recognition and technical assistance to help firms meet their goals (not yet adopted)

Option 11: Remove Barriers and Provide Incentives to Stimulate Greater Adoption of Combined Heat and Power (CHP) Systems – adopt 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 (not yet adopted)

Option 12: Increase Energy Efficiency in the Oil and Gas Sector – accelerate energy efficiency improvements in this important industrial sector by removing barriers, providing targeted financial incentives as part of utility DSM programs, and promoting industry-focused training and information exchange (not yet adopted)

Public Sector Policies

Option 13: Adopt Energy Efficiency Requirements for Public Colleges and Universities and Extend the Requirements for State Buildings – require all state agencies, including state universities and colleges, to reduce energy use per unit of floor area at least 20 percent by 2015, and an additional 10 percent during 2015-2025 (partially adopted)

Option 14: Support Energy Efficiency Improvements by Local Governments and K-12 Schools – require local governments and K-12 school to meet energy savings requirements in order to receive state funds; also expand technical and financial assistance to assist with implementation (partially adopted)

Option 15: Implement Energy Efficiency Education in K-12 Schools – incorporate energy efficiency and conservation themes into curriculum and energy education blocks taught to K-12 students (partially adopted)

Transportation Policies

Option 16: Higher Fuel Economy Standards for New Cars and Light Trucks – adopt the Corporate Average Fuel Economy (CAFE) standards included in the 2007 Energy Independence and Security Act (already adopted)

Option 17: Clean Car Standards for New Cars and Light Trucks – greenhouse gas emissions standards for new cars and light trucks (partially adopted)

Option 18: Adopt Incentives to Stimulate Purchase of More Efficient Cars and Light Trucks – establish fees and rebates (a so-called feebate program) for new cars and light trucks based on the rated fuel consumption of each new vehicle (not yet adopted)

Option 19: Adopt Pay-As-You-Drive (PAYD) Auto Insurance – pay a large 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 of PAYD if the pilot is successful (not yet adopted)

Option 20: Reduce Vehicle-Miles Traveled Through Improved Transportation and Land Use Planning – require regional transportation agencies to develop and implement transportation plans that reduce vehicle-miles traveled (VMT) per capita by at least 1 percent per year; link transportation infrastructure funding to this requirement (not yet adopted)

Option 21: Improve Enforcement of Highway Speed Limits – better enforce highway speed limits through increased use of radar, lasers, and speed cameras, as well as education (not yet adopted)

Option 22: Replacement Tire Efficiency Standards – require that replacement tires have a rolling resistance no greater than that of tires used on new vehicles (not yet adopted)

Option 23: Accelerated Retirement of Inefficient Cars and Light Trucks – provide vouchers to individuals who turn in inefficient vehicles; redeem vouchers when a new energy-efficient vehicle is purchased (not yet adopted)

Cross-Cutting Policies

Option 24: Undertake a Broad-Based Public Education Campaign – educate the public regarding energy efficiency and conservation measures through a mass media campaign and other messaging techniques (not yet adopted)

Option 25: Increase Energy Efficiency Expertise through Training and Certification – create opportunities for training and certification of energy efficiency professionals through community college, vocational, and other types of courses (not yet adopted)

Results

Table ES-1 shows the electricity savings by option. The options that offer the largest savings potential are expanded electricity DSM programs, building energy codes, and lamp efficiency standards. The total electricity savings potential in 2020 is 6,793 GWh per year, a 24 percent reduction from projected baseline electricity consumption that year. On a per capita basis, total electricity use in 2012 is just 2 percent below the level in 2005 while electricity use per capita in 2020 is 15 percent below the level in 2005.

Table ES-1 – Total Electricity Savings Potential

Option	Savings Potential (GWh/yr)		
	2012	**2020**	**2025**
Electricity DSM expansion	776	3,379	4,641
Building code upgrades	152	740	1,310
Lamp standards	231	1,288	1,587
Industrial challenge	137	599	907
Public sector initiatives	87	259	415
Public education	305	282	280
Other	62	246	350
TOTAL	**1,750**	**6,793**	**9,490**

Figure ES-1 shows the growth in electricity use during 2005-2025 in the baseline and high efficiency scenarios. In the baseline scenario, electricity demand grows 1.9 percent per year on average based on the most recent electricity demand forecasts from Public Service Company of New Mexico (PNM) and Southwestern Public Service Company (SPS). In the high-efficiency scenario, electricity demand growth is limited to about 0.2 percent per year on average during 2005-2025. Implementing all the electricity savings options would almost eliminate load growth.

Figure ES-1 – Electricity Consumption by Scenario

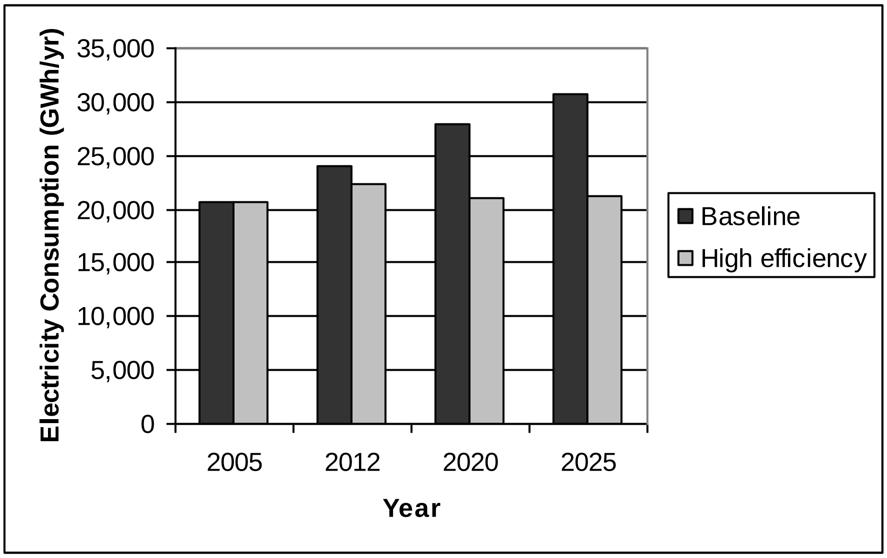


Table ES-2 shows the natural gas savings by option. The options that offer the largest gas savings potential include gas utility DSM programs, building energy codes, and the industrial challenge and recognition program. The total gas savings potential in 2020 is about 19.8 million decatherms per year, 20 percent of projected baseline gas consumption for that year in the absence of energy efficiency initiatives (excluding gas use in oil, natural gas, and electricity production and supply). On a per capita basis, total gas use falls to 33.9 decatherms per capita in 2020 in the policy scenario, nearly 23 percent below the level in 2005.

Figure ES-2 shows the growth in natural gas use during 2005-2025 in the baseline and high efficiency scenarios, assuming implementation of all natural gas savings options.

Table ES-2 – Total Natural Gas Savings Potential

	Savings Potential (million decatherms per year)		
Option	**2012**	**2020**	**2025**
Gas DSM expansion	2.0	9.9	13.8
Building code upgrades	0.7	3.5	6.3
Conservation ordinances	0.2	0.75	1.0
Low-income weatherization	0.3	1.2	1.8
Industrial challenge	0.5	2.3	3.6
Public sector initiatives	0.3	0.8	1.1
Public education	1.2	1.2	1.1
Other	0.0	0.2	0.3
TOTAL	**5.2**	**19.85**	**29.0**

The scenarios do not include natural gas use for oil and gas production or for power generation in the electric utility sector. In the baseline scenario, natural gas consumption increases 1.1 percent per year on average during 2005-2020. In the high efficiency scenario, gas consumption declines in absolute terms. By 2020, natural gas consumption is 6.5 percent below that in 2005.

Figure ES-2 – Natural Gas Consumption by Scenario

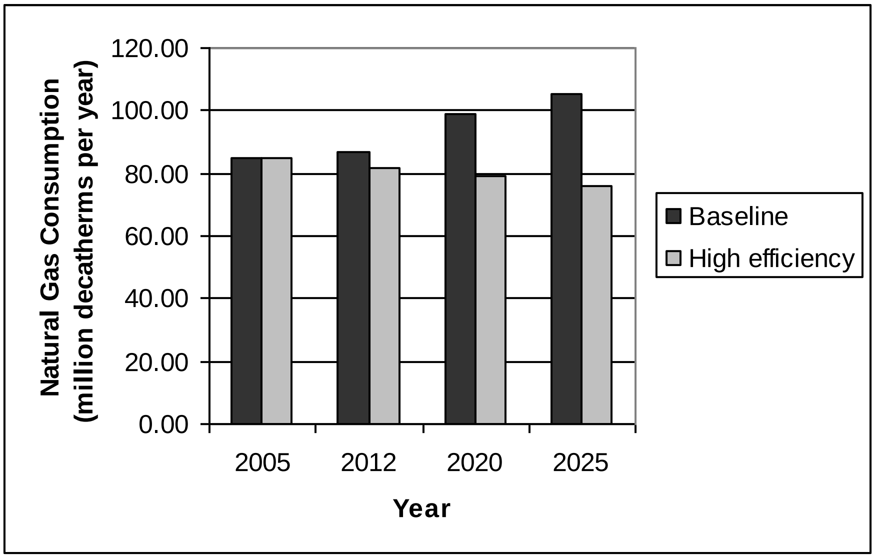


Table ES-3 shows the potential savings of gasoline from the various transportation options. The options that provide the most gasoline savings are the updated CAFE standards and measures to reduce VMT growth. The total fuel savings potential in 2020 is estimated to be about 7.4 million barrels per year, nearly 29 percent of projected gasoline consumption that year

Table ES-3 – Total Gasoline Savings Potential

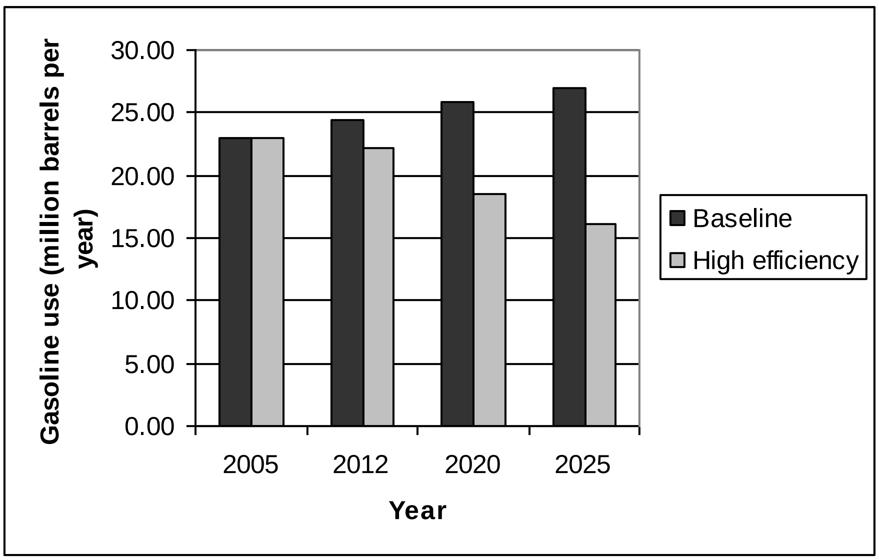
Option	Savings Potential (million barrels per year)		
	2012	**2020**	**2025**
CAFE standards	0.35	3.11	4.99
Clean car standards	0.13	0.96	1.74
Feebates	0.29	1.00	1.28
PAYD insurance	0.24	1.09	1.16
Reduce VMT growth	0.49	2.48	4.03
Enforce speed limits	0.34	0.36	0.38
Replacement tire standards	0.55	0.58	0.61
Accelerated retirement program	0.27	0.13	0
TOTAL[1]	**2.18**	**7.44**	**10.78**

[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.

in the baseline scenario. These energy savings values are conservative in that they do not include the upstream savings in petroleum refining and transport.

Figure ES-3 shows the growth in gasoline use during 2005-2025 in the baseline and high efficiency scenarios. In the baseline scenario, gasoline demand increases about 17 percent during 2005-2025. In the high efficiency scenario, gasoline consumption declines rapidly, falling 30 percent during 2005-2025 due to accelerated vehicle efficiency improvements and reductions in driving (VMT). On a per capita basis, total gasoline use in 2020 drops to 7.94 barrels per capita, 33 percent below the level in 2005.

Figure ES-3 – Gasoline Use by Scenario



We also examine the overall energy savings from all 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 using the average efficiency of power plants and average transmission and distribution losses in New Mexico. Natural gas and gasoline are converted to primary energy based on their direct energy content only. The values in the table cover only those fuel types considered in this study; we do not include other forms of energy such as diesel, jet fuel, or coal directly consumed by industry. Appendix A shows the primary energy savings associated with each option.

Table ES-4 shows that the options reduce primary energy use relative to that in the baseline scenario by about 38 trillion Btus (7.9 percent) by 2012 and about 136 trillion Btus (25.3 percent) by 2020. The savings increase after 2020 as the buildings, appliance, and vehicle stock continues to turnover, reaching 192 trillion Btus in 2025. This is equivalent to about 33 percent of baseline primary energy use by 2025.

Figure ES-4 shows primary energy use per capita in the two scenarios. In the baseline scenario, this parameter increases about 4 percent between 2005 and 2020. In the high efficiency scenario, energy use per capita declines about 7.2 percent by 2012 and 22.6 percent by 2020.

Thus Governor Richardson's goal of a 20 percent reduction in energy use per capita by 2020, relative to the level in 2005, is achieved for the forms of energy considered in this study. But the goal of reducing total energy use per capita 10 percent by 2012 is not achieved due to the limited amount of time for policies and programs to have an impact between now and 2012. Appendix B discusses the additional actions that could be taken in order to reach the 2012 goal. It is also worth noting that energy use per capita continues to decline after 2020 in the high efficiency scenario, and by 2025 is 29 percent below the level in 2005.

Table ES-4 – Primary Energy Savings Potential

	Primary Energy Consumption or Savings			
	2005	**2012**	**2020**	**2025**
Baseline Scenario (TBtu)[1]	430.4	476.5	538.9	580.4
High Efficiency Scenario (TBtu)[1]	430.4	439.0	402.5	388.0
Energy use per capita – Baseline Scenario (MBtu)[2]	223.2	224.9	231.4	236.9
Energy use per capita – High Efficiency Scenario (MBtu)[2]	223.2	207.2	172.8	158.4
Savings in High Efficiency Scenario (%)	0.0	7.9	25.3	33.1
Reduction from 2005 level in high efficiency scenario (%)	0.0	7.2	22.6	29.1

[1] The unit is trillion Btu.
[2] The unit is million Btu per capita.

Figure ES-4 – Energy Use per Capita by Scenario

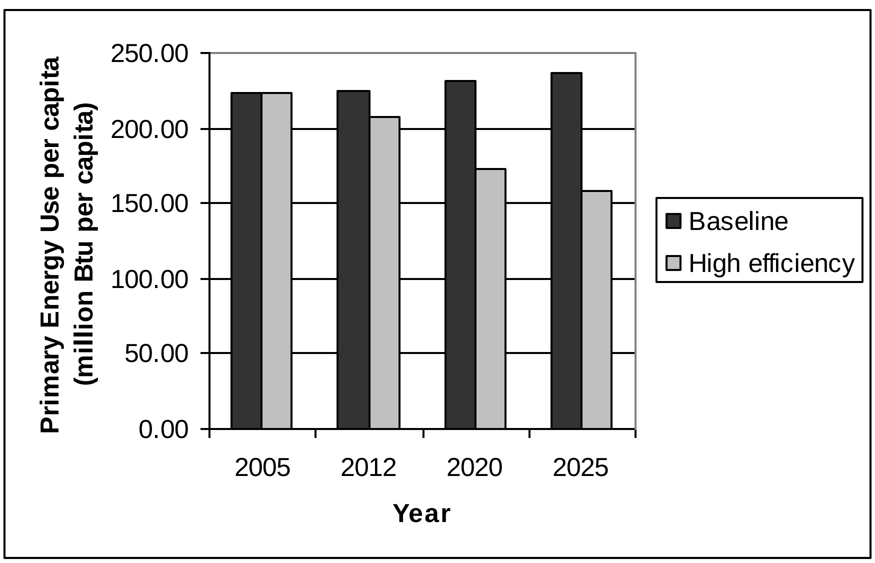
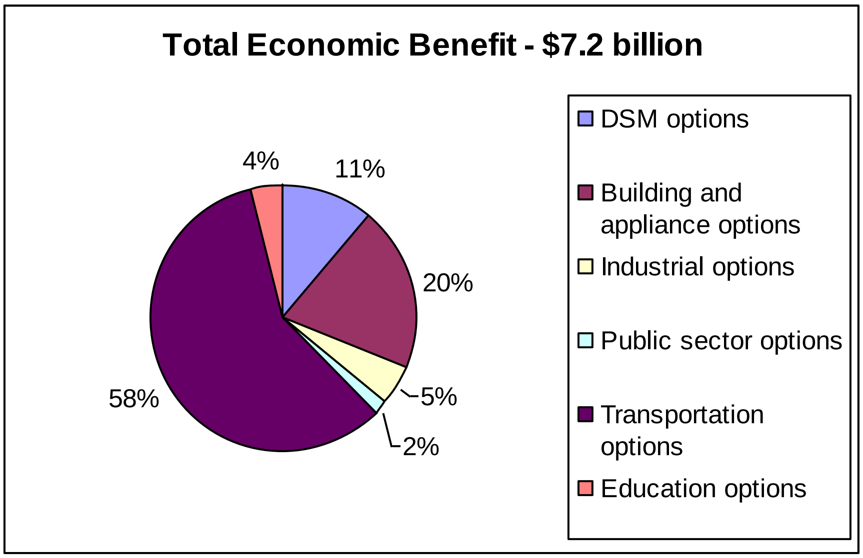


Figure ES-5 shows the estimated net economic benefits of the options. The net economic benefits are the net present value of benefits minus costs for efficiency measures installed during 2008-2020, considering the energy savings over the lifetime of the measures. We use a five percent real discount rate to discount future costs and benefits. In total, the estimated net economic benefits are about $7.2 billion (2007 dollars), equivalent to saving about $8,700 per household on average based on the projected number of households in New Mexico in 2015. We believe these estimates are conservative because energy prices, other than natural gas prices, are not assumed to rise above inflation. In addition, we do not include valuation of non-energy benefits, which in some cases could be substantial.

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

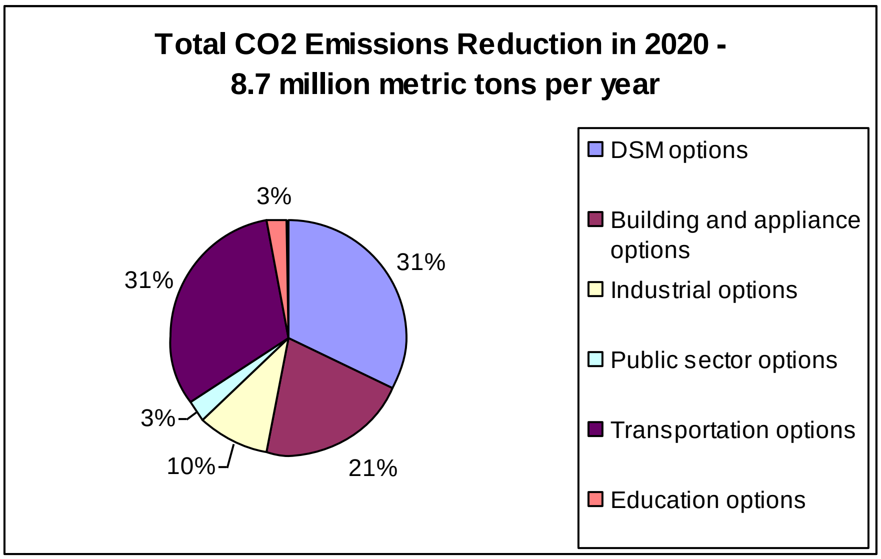


Regarding the potential cost for New Mexico's state government, expanding retrofit of low-income households and the accelerated retirement program for inefficient vehicles are the two most costly options, with costs of about $6 million and $12 million per year, respectively. In total, the incremental cost to the state is estimated to be about $36 million per year on average during 2009-2015. However, there would also be substantial economic savings for state government as a result of lower energy bills, rebates from participation in DSM programs, and less need to provide energy bill payment assistance to low-income families, public schools, etc. The net cost to the state for fully implementing the policies in this strategy might be on the order of $25 million per year on average.

Implementing the energy efficiency options would provide substantial environmental benefits. 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. We estimate that implementing all of the options as described would cut annual CO_2 emissions in New Mexico by 8.3 million metric tons in 2020 (see Figure ES-6). DSM options and transportation options each provide about 31 percent of the total, and building and appliance options about 21 percent. The estimated CO_2 emissions reduction grows to about 12.1 million metric tons per year by 2025.

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 3.65 billion gallons per year in 2020. This is equivalent to the annual water use of 60,000 typical Albuquerque citizens. There will be additional water savings from increased adoption of energy and water-conserving devices such as resource-efficient clothes washers and dishwashers.

Figure ES-6 – Carbon Dioxide Emissions Reductions in 2020 from Implementation of the Energy Efficiency Options



Priority

Among the 25 options developed in this report, we suggest that 10 be viewed as high priority by the Governor, the Legislature, the Public Regulation Commission, and other key decision makers. These options provide the greatest energy savings and consequently the bulk of the economic and environmental benefits.

- Expand Electric Utility Demand-Side Management Programs
- Adopt Decoupling or Shareholder Incentives to Stimulate Greater Utility Support for Energy Efficiency Improvements
- Expand Natural Gas Utility Energy Efficiency Programs
- Upgrade Building Energy Codes and Fund Code Training and Enforcement
- Expand Retrofit of Homes Occupied by Low-Income Families

- Undertake an Industry Challenge and Recognition Program
- Increase Energy Efficiency in the Oil and Gas Sector
- Adopt Energy Efficiency Requirements for Public Colleges and Universities and Extend the Requirements for State Agencies
- Reduce Per Capita Vehicle Use
- Implement a Broad-Based Public Education Campaign

In conclusion, New Mexico would reduce energy use substantially if it adopted the high priority energy efficiency policy options, and possibly other options, described and analyzed in this study. By 2020, electricity use would be reduced by 24 percent, natural gas use by nearly 20 percent, and gasoline use by 29 percent, all in comparison to otherwise forecasted levels of energy use that year. The ambitious energy efficiency goal set by Governor Richardson for 2020 would be achieved, but the near term goal of a 10 percent reduction in per capita energy use in 2012 would not be achieved due to the limited time for policy and program implementation prior to 2012.

Substantial benefits would result from achieving these levels of energy savings. Consumers and businesses in New Mexico could save about $7.2 billion net during the lifetime of efficiency measures implemented through 2020. Water savings would exceed 3.6 billion gallons per year by 2020. Pollutant emissions would be cut as well. Most notably, New Mexico would significantly reduce its carbon dioxide emissions, thereby contributing to the worldwide effort to limit global warming, and do so very cost effectively. Local air quality would also improve. In summary, meeting Governor Richardson's 2020 energy efficiency goal would greatly benefit New Mexico's citizens, businesses, government, and environment.

Chapter I – Introduction

Energy efficiency is a high priority for New Mexico. On November 14, 2007, Governor Bill Richardson announced the goals of reducing energy use per capita in the state 10 percent by 2012 and 20 percent by 2020, relative to energy use per capita in 2005. These goals were officially established in Executive Order 2007-053, issued by Governor Richardson on November 16, 2007.[1] 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 New Mexico one of the nation's most energy-efficient states, thereby lowering energy bills paid by consumers including low-income households, enhancing energy security and reliability, improving business profitability and competitiveness, and reducing greenhouse gas emissions.

Governor Richardson's Executive Order also establishes "Lead by Example" energy efficiency goals for Executive Branch state agencies. The goals include a 20 percent reduction in energy use per square foot below 2005 levels in all state buildings by 2015, and a 20 percent reduction in transportation fuel use per employee below 2005 levels by 2015. In addition, the Executive Order calls for an implementation plan, statewide energy efficiency report, and database.

In order to help the state examine options for achieving the energy efficiency goals, the Energy, Mineral, and Natural Resources Department (EMNRD) asked the Southwest Energy Efficiency Project (SWEEP) 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 goals, examine the feasibility of achieving the goals for each type of energy, and estimate what the economic and environmental impacts of achieving the goals would be.

The New Mexico Energy Efficiency Strategy contains 25 major policies, programs and initiatives that could be implemented in order to accelerate energy efficiency improvements in the state and achieve the goals 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. Also, we do not consider diesel fuel use and options to reduce diesel fuel use in the main part of this study because a large fraction of the freight movement and diesel consumed in New Mexico is due to freight passing through the state. However, we do provide Appendix C presenting options for increasing the efficiency of diesel (heavy truck) use.

For each option in the strategy, we first provide a background discussion that discusses precedents for the policy in both New Mexico and in other states. Then we describe the specific policy proposal, estimate the energy savings that would result by 2012, 2020 and 2025 from implementing the policy, analyze cost and cost effectiveness, estimate reductions in criteria pollutant and carbon dioxide emissions, review other environmental and social impacts, and

[1] Governor's Executive Order 2007-053. Increasing Energy Efficiency in State Government by 2015 and Statewide by 2012 and 2020. http://governor.state.nm.us/orders/2007/EO_2007_053.pdf

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 New Mexico. The Federal Energy Information Administration compiles state energy consumption information. Figure 1 shows the breakdown of primary energy consumption by energy type as of 2005, the most recent year for which data are available. 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, all petroleum products account for 38 percent, electricity for 33 percent, and natural gas for 28 percent of total primary energy consumption. This figure includes fuel feedstocks, but excludes energy that is used to produce electricity that is then exported. With respect to electricity production, coal-fired power plants accounted for 85 percent of electricity generation in the state as of 2005.

Figure 1 – New Mexico Primary Energy Use in 2005

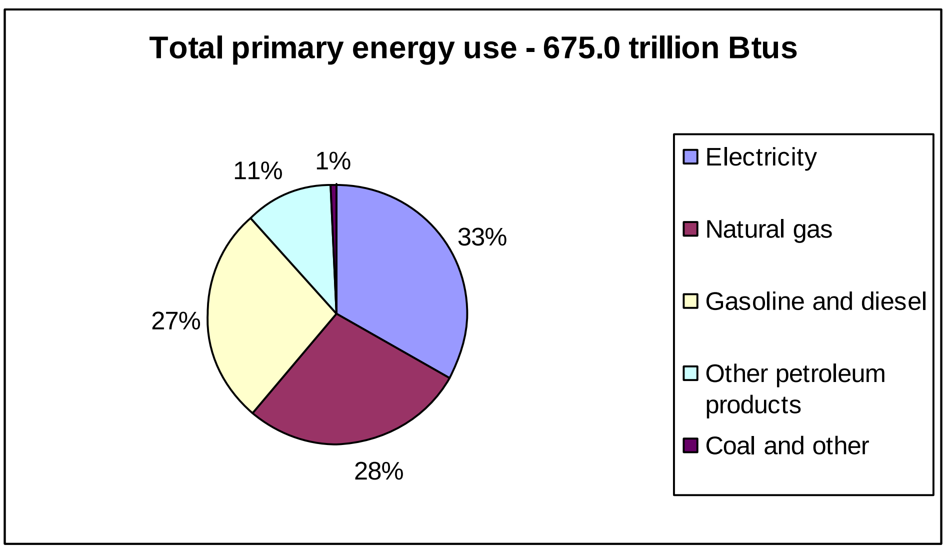
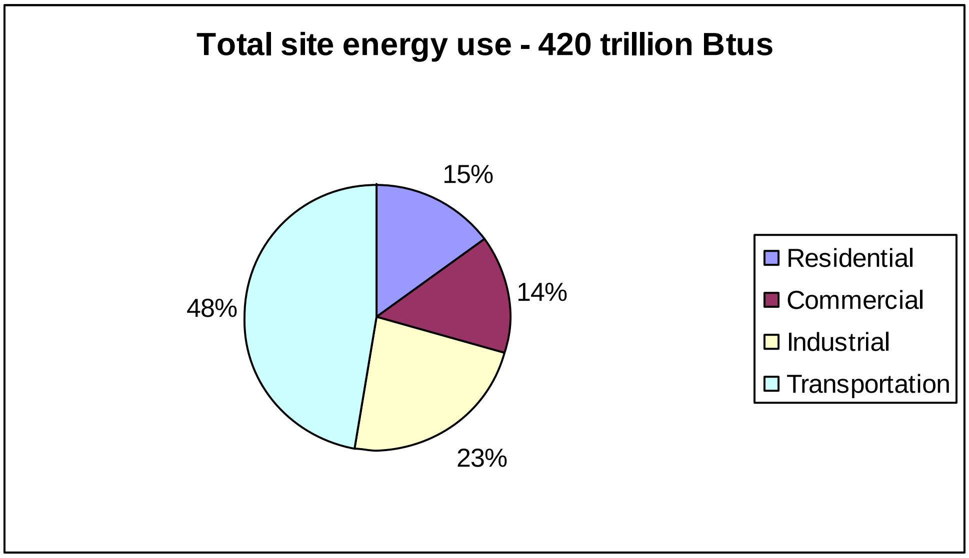


Figure 2 shows secondary or site energy consumption in the state, by sector. In this case, electricity is counted in terms of its direct energy content (site Btus) and natural gas consumption in oil and gas production and processing is excluded from the total. On this basis the transportation sector dominates, followed by the industrial sector. The residential and commercial sectors combined represent just 29 percent of total site energy use. The main energy sources of concern in this study—electricity, natural gas, and gasoline—account for 77 percent of total energy consumption in the state on a primary basis and 65 percent of total energy consumption on a secondary (site) basis.

Figure 2 – New Mexico Site Energy Use in 2005



Methodology

The methodology involves developing baseline and high efficiency scenarios for 2008 through 2025. 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. Growth projections were obtained from the Bureau of Business and Economic Research at the University of New Mexico (UNM). Our baseline energy assumptions, derived from utility forecasts and other sources, include growth in electricity consumption of 1.9 percent per year, growth in natural gas consumption of 1.2 percent per year, and growth in gasoline consumption of 0.8 percent per year during 2008-2025. Growth in gasoline consumption in the baseline scenario is relatively low in part because we assume vehicle use per capita remains constant.

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 2007 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 New Mexico significantly. In addition, they result in an absolute reduction in energy use from current levels in the case of natural gas and gasoline, but not electricity.

We include the effects of current policies and programs (for example, 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 2008 and thereafter since Governor Richardson adopted the efficiency goal near the end of 2007. We also project energy use in the baseline scenario and the energy savings from each of our options through 2025. In some cases, the energy savings are moderate by 2020 but increase significantly between 2020 and 2025.

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. For example, 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 2007 dollars with costs and benefits after 2007 discounted using a five percent annual discount rate. We included any rate increases approved in 2007 in the statewide average prices. Electricity prices are assumed to remain constant at their levels in 2007, other than increasing with inflation; that is, electricity prices are assumed to remain constant in real dollars. This is a conservative assumption given that electricity prices are rising due to increasing fuel costs, increasing construction costs, and tightening environmental standards. Natural gas prices, on the other hand, are assumed to increase 10% in addition to inflation in 2008, and 1% per year above inflation after that. This is due to the recent spike in natural gas prices and expectation that gas prices will remain high. The price of gasoline is assumed to be $4.00 per gallon as of 2008 and is held constant at this level in real dollars.

Net economic benefits are considered over the lifetime of energy efficiency measures installed during 2008-2020; that is, 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.[2] 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; that is, 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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[2] *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: Expand Electric Utility Demand-Side Management Programs (Partially Adopted)

Background

In 2005, New Mexico adopted legislation known as the Efficient Use of Energy Act (EUEA) that set the stage for implementation of demand-side management (DSM) programs by investor-owned gas and electric utilities. The legislation called for utilities to implement cost-effective energy efficiency programs for their customers, defined cost effectiveness as programs that pass the Total Resource Cost (TRC) test, established that public utilities shall be able to recover the costs for prudent DSM programs through a tariff rider, and directed the Public Regulation Commission (PRC) to remove disincentives or barriers to utility expenditures on cost-effective DSM measures.

In 2008, the Act was amended to establish energy savings requirements for electric utilities. The requirements are a minimum of 5 percent savings by 2014 and 10 percent savings by 2020, measured as a fraction of 2005 retail electricity sales.[3] The 2008 amendments also directed utilities to acquire all cost-effective energy efficiency and load management resources and directed the PRC to provide public utilities with an opportunity to earn a profit on cost-effective DSM programs such that with satisfactory performance, the programs are more attractive to utilities than supply-side resource investments.

Public Service Company of New Mexico (PNM), the main investor-owned utility in the state, received approval from the PRC to implement nine DSM programs in August 2007. The annual budget for the programs is $7.5 million, about 1.2 percent of PNM's 2006 revenues. The programs include incentives for CFLs, refrigerator recycling, ENERGY STAR new homes, commercial lighting measures, load management, and evaporative cooling. PNM estimates the programs will save about 27 GWh per year, equivalent to about 0.3 percent of retail electricity sales as of 2006.[4] More recently, PNM proposed substantially expanding its DSM programs. In particular, PNM proposed increasing its DSM budget in 2009 to $13.4 million and estimates it will achieve 58 GWh per year of electricity savings and about 51 MW of peak demand reduction form this level of DSM effort.[5] PNM also suggested it could save 350-425 GWh per year by 2014, as a result of DSM programs implemented during 2008-2014.

[3] See House Bill 305, Amendments to the Efficient Use of Energy Act. http://www.swenergy.org/news/2008-02-NM_Bill.pdf

[4] Ortiz, G. 2007. Direct Testimony and Exhibits of Gerard T. Ortiz. Case No. 07-00365-UT. Public Service Company of New Mexico, Albuquerque, NM, Jan. 31.

[5] Application for Approval of 2008 Electric Efficiency and Load Management Program Plan. Public Service Company of New Mexico, Albuquerque, NM, Sept. 15, 2008.

Southwestern Public Service Company (SPS), the second largest investor-owned utility in the state, received approval from the PRC to implement seven DSM programs in March 2008. The annual budget for the programs is $1.8 million, about 0.75 percent of PNM's 2006 revenues. The programs include incentives for CFLs, heat pump rebates, energy education and distribution of energy conservation kits, incentives for lighting and cooling efficiency measures adopted by businesses, and custom efficient program for businesses. SPS estimates the programs will save about 10.5 GWh per year (at the end-use level), equivalent to about 0.3 percent of retail electricity sales as of 2006.[6] In September 2008, SPS indicated it would propose substantially expanding its DSM programs with energy savings increasing to about 0.5 percent of sales as of 2009 and 1.0 percent of sales in 2010 and thereafter.[7]

Regarding the cost effectiveness of DSM programs, PNM estimates that its expanded 2009 programs will have a benefit-cost ratio of 1.73 under the Total Resource Cost (TRC) test. However, the estimated benefit-cost ratio is about 2.9 for energy efficiency programs and only about 1.3 for load management programs. SPS, which is only implementing energy efficiency programs, estimates that its initial set of DSM programs will have a benefit-cost ratio of 1.78.

According to the Energy Efficiency Task Force convened by the Western Governors' Association, leading electric utilities as of 2005 were investing 2-3 percent of their revenues on DSM programs and were saving the equivalent of around 0.8-1.0 percent of electricity sales each year.[8] 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.[9] 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. Among utilities in the Southwest, Nevada Power Co. and Sierra Pacific Power Co. estimate that their 2008 DSM programs will result in 260 GWh per year of electricity savings, equivalent to 0.9% of retail electricity sales as of 2006.[10] The American Council for an Energy-Efficient Economy recently reported that some utilities and third party DSM program administrators, including those in California and Vermont, are now achieving more than 1 percent savings per year.[11] Recently the New York utility commission adopted energy savings standards that seek to reduce electricity use 15 percent from projected levels by 2015, meaning savings of about 2 percent per year.[12]

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[6] Sundin, D. 2007. Direct Testimony and Exhibits of Debra L. Sundin. Case No. 07-00376-UT. Southwestern Public Service Company. Sept. 24.
[7] Load Management and Energy Efficiency. Presentation by Southwestern Public Service Company. Sept. 9, 2008.
[8] Energy Efficiency Task Force Report, Western Governors' Association, Denver, CO, p. 55. http://www.westgov.org/wga/initiatives/cdeac/Energy%20Efficiency-full.pdf.
[9] *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.
[10] H. Geller. 2008. "Update on Utility Energy Efficiency Programs in the Southwest." *Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy. Aug. 2008.
[11] M. Eldridge, et al. *Energy Efficiency: The First Fuel for a Clean Energy Future. Resources for Meeting Maryland's Electricity Needs.* Washington, DC: American Council for an Energy-Efficient Economy. Feb. http://aceee.org/pubs/e082.pdf.
[12] "Historic Energy Efficiency Program Gets Underway." Press release issued by the New York Public Service Commission. June 18, 2008. http://www3.dps.state.ny.us/pscweb/WebFileRoom.nsf/ArticlesByCategory/599B3E42019C39298525746C00710FB1/$File/pr08072.pdf?OpenElement

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.

Specific Energy Efficiency Proposal

This policy assumes that investor-owned electric utilities in the state meet and go beyond the minimum electricity savings requirements in the 2008 amendments in EUEA, in response to the legislative mandate that they acquire all cost-effective energy efficiency and load management resources. The policy also assumes that comprehensive and effective DSM programs are implemented by all utilities in New Mexico—investor-owned utilities, municipal utilities and rural electric coops. Regarding municipal utilities and rural electric co-ops, the state could offer co-funding (grants) for program development and implementation to those utilities which implement comprehensive, well-funded DSM programs.

We assume that energy savings from these programs ramps up over a six-year period (2009-2014). The assumed savings levels are 0.4 percent of retail sales in 2009, 0.7 percent in 2010, 1.0 percent in 2011, 1.1 percent in 2012, 1.2 percent savings in 2013, and 1.25 percent of projected electricity sales in 2014 and thereafter. This should allow adequate time for PNM, SPS and other utilities in the state to expand their DSM programs and maximize energy savings. It is important to include rural co-ops and municipal utilities in this effort since they account for about 32% of total electricity sales in the state.

In order to meet these assumed energy savings levels, the utilities should 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 as well as an industrial self-direction program (as required by the EUEA);
- 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 New Mexico;

[13] See Reference 9, p. 6-5. Also, see Reference 8, pp. 55-56.

- advertising and incentives to increase the availability and purchase of innovative energy-efficiency measures such as modern evaporative cooling systems, LED lights, 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 who 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 assumed savings levels, the PRC should provide performance-based financial incentives for utility shareholders (see Option 2). In addition, the state could provide some technical and financial assistance to help municipal utilities and co-ops plan and implement DSM programs, particularly for those utilities with limited DSM experience.

The energy savings levels 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 PRC. 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 assumed savings levels. 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 12 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 expanded utility DSM programs. To do so we use reference case electricity load forecasts recently made by PNM and SPS, and average these growth rates based on the relative size of the two utilities. Using this approach, the average growth rate for electricity use is 1.9 percent per year. We assume this average growth rate continues through 2025 in our baseline scenario.

In projecting energy savings, we assume the percentage energy savings levels each year listed above. In order to estimate summer peak demand reduction, we use a coefficient of 0.33 MW of peak reduction per GWh/yr of electricity savings from DSM programs. This coefficient is much lower than what PNM is projecting for its initial set of DSM programs, but as noted above these programs are heavily weighted to peak load reduction. The coefficient of 0.33 is similar to what utilities with robust energy efficiency programs, such as utilities in California, Nevada, and Colorado, are achieving. It implies that there is some emphasis on peak demand reduction within a comprehensive set of energy efficiency programs, but not a strong emphasis.

To project DSM budgets, we assume an initial energy savings to DSM program budget ratio of 4.0 kWh/yr of savings per DSM program dollar. This is approximately the average value projected by PNM and SPS for their initial set of DSM programs combined. We assume this value increases over time and reaches a maximum of 6.0 kWh/yr of savings per DSM program dollar by 2013. This is the average value for SPS's initial set of DSM programs, which are more focused on energy savings than PNM's initial programs. Also, we assume that the energy savings measures persist through 2020, but that there is a slight degradation in savings after 2020 due to some measures being retired and not replaced with equivalent or better efficiency measures.

Table 1 shows the projected DSM program budgets and resulting levels of energy savings during 2008-2025, given the assumptions listed above. Once again, these values apply to all utilities in the state. Starting with DSM programs in 2008, cumulative DSM efforts would yield about 775 GWh/yr of electricity savings by 2012, 1,700 GWh/yr by 2015, 3,380 GWh/yr of savings by 2020, and 4,640 GWh/yr of savings in 2025. The savings level in 2020 is about 78 percent greater than the level if the minimum savings requirement in the EUEA is met, but no further savings are achieved. That is, there are no additional savings by investor-owned utilities and zero savings by municipal utilities and rural electric coops.

Table 1 – Projected Electricity Savings and Corresponding DSM Budget Levels from Electric Utility DSM Programs

Year	DSM funding level (million 2007 $)	Electricity Savings from Programs each Year (GWh/yr)	Electricity Savings from Cumulative Programs (GWh/yr)	Savings from Cumulative Programs as a Fraction of Sales (%)
2008	7.4	24.8	24.8	0.11
2009	22.7	90.7	115.2	0.51
2010	36.0	161.8	277.0	1.20
2011	47.1	235.5	512.5	2.18
2012	**48.0**	**264.0**	**776.5**	**3.24**
2013	48.9	293.4	1,070	4.38
2014	51.9	311.5	1,381	5.54
2015	**52.9**	**317.4**	**1,699**	**6.69**
2016	53.9	323.4	2,022	7.82
2017	54.9	329.6	2,352	8.92
2018	56.0	335.8	2,688	10.00
2019	57.0	342.2	3,030	11.07
2020	**58.1**	**348.7**	**3,379**	**12.11**
2021	59.2	355.3	3,633	12.78
2022	60.3	362.1	3,886	13.41
2023	61.5	369.0	4,138	14.02
2024	62.7	376.0	4,390	14.59
2025	**63.9**	**383.1**	**4,641**	**15.14**

Overall, this DSM effort would save about 12 percent of New Mexico's projected electricity use in 2020 in the absence of expanded DSM programs, and 15 percent of projected electricity use in the state in 2025. The energy savings targets would not eliminate all load growth, but they would reduce load growth to a more manageable level—from about 1.9 percent to less than 1.0 percent per year once the programs ramp up.

With the assumptions explained above, the peak demand reductions reach 255 MW by 2012, 560 MW by 2015, 1,115 MW by 2020, and about 1,530 MW by 2025. Thus the assumed DSM effort would have a significant impact on peak load and the need for peaking power plants in the state. 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.

Cost and Cost Effectiveness

Implementing this policy for investor-owned utilities would cost the state government little or no money since the PRC is already involved in approving and monitoring DSM programs for these companies. 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. However, it may be desirable to have the state provide grants to motivate non-regulated utilities (munis and co-ops) to implement comprehensive and effective DSM programs. If, for example, the state paid 20 percent of the budget of DSM programs for these utilities, it would cost the state around $3-4 million per year once the DSM programs fully ramp up (assuming all municipal utilities and co-ops achieve the assumed savings levels).

Table 1 includes the estimated DSM program funding levels statewide. DSM funding ramps up from about $7 million per year in 2008 to $36 million per year by 2010, $53 million by 2015, and $58 million per year in 2020 (in 2007 dollars). At the $58 million annual funding level, utilities would be spending about 3 percent of their projected retail sales revenues on DSM programs. The proposed DSM spending level of about $21 per capita as of 2015 would place New Mexico among the top states in the nation in terms of DSM program spending per capita.[14]

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 distribution facilities over the lifetime of the efficiency measures. The projected electricity savings by 2020 is equivalent to the electricity supplied by approximately 500 MW of baseload power capacity, and the estimated peak demand reduction is over 1,100 MW. The avoided costs associated with these levels of capacity avoidance are substantial and should exceed the cost of the efficiency measures and the programs by a wide margin. Based on the experience of other utilities in the region and the work of the Energy Efficiency Task Force of

[14] Five states—California, Connecticut, Iowa, Rhode Island and Vermont—were at or above this funding level in 2007. Other states are ramping up DSM programs and are likely to exceed this level in the near future. See *U.S. Energy Efficiency Programs: A $3.7 Billion U.S. and Canadian Industry.* Boston, MA: Consortium for Energy Efficiency. 2008. http://www.cee1.org/ee-pe/2007/2007EEPReport.pdf.

the Western Governors' Association, we assume that future DSM programs in New Mexico have a benefit-cost ratio of 1.8 on average using the TRC test.[15]

Based on these assumptions, the proposed level of DSM program activity during 2008-2020 would stimulate about $800 million of investment in energy efficiency measures (discounted net present value). With an overall benefit-cost ratio of 1.8, the efficiency measures would produce $1.4 billion in gross economic benefits and $641 million in net economic benefits over their lifetime. To put the net economic benefit figure in perspective, it is equivalent to about $850 for every household in the state. Additional economic benefits result from efficiency measures installed during the 2021-2025 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 New Mexico would be about 0.5 gallons per kWh of avoided power generation.[16] Thus the policy suggested above would save approximately 1.7 billion gallons of water per year by 2020 and 2.3 billion gallons of water per year by 2025. A total of about 9.7 billion gallons of water would be saved during 2008-2020.

The DSM programs 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.[17] Table 2 shows the estimated emissions reductions in 2015, 2020, and 2025 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. Thus implementing this policy would help New Mexico to achieve its greenhouse gas emissions reduction goals. The estimated reduction in mercury emissions is relatively small in physical terms, but mercury is a highly toxic substance.

Table 2 – Estimated Emissions Reductions from Electric Utility DSM Programs

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	1,140	2,267	3,114
SO_2 (short tons)	76	152	209
NOx (short tons)	475	946	1,299
Mercury (pounds)	6.8	13.5	18.6

[15] See Reference 8, p. 52.
[16] See Reference 2, pp. 3-23 – 3-24.
[17] See Reference 2, pp. 3-18 – 3-21.

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 New Mexico and lead to homes and work places that are more comfortable. For example, sealing and insulating the building envelope and leaky HVAC ducts will improve cooling ability and reduce hot zones within a building in the summer.

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. This will benefit 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.[18] In addition, energy efficiency improvements in schools, particularly increased use of daylighting, enhances the learning environment and has been shown to produce better student performance on standardized tests.[19] Likewise, there is good evidence that use of daylighting helps to increase sales in the retail sector.[20]

Fourth, achieving the energy savings targets will lead to a net increase in employment in New Mexico. 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 targets would result in a net increase of 1,310 jobs in the state by 2015 and 2,620 jobs by 2020[21].

Political and Other Considerations

There has been substantial support for expanding utility DSM programs in New Mexico in recent years. With support from Governor Richardson, the legislature has passed two laws with this objective. The PRC has approved the electricity DSM programs proposed by PNM as well as other electric utilities in the state. Demonstrating that the programs provide economic benefits that are greater than the cost of the programs is critical for achieving this approval.

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[18] 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. "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.

[19] 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.

[20] 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.

[21] These estimates are derived from a previous study that includes analysis of employment impacts from increasing the efficiency of electricity use in New Mexico. See Reference 2, pp. 4-1 – 4-18.

Achieving the assumed energy savings levels throughout the state is likely to be more controversial. In particular, utilities and customer representatives could object to this policy. Providing utilities with financial incentives for achieving high levels of energy savings—a profit on DSM expenditures in the case of investor-owned utilities and grants from the state in the case of municipal utilities and rural co-ops—could be valuable if not essential for achieving the assumed savings levels. In addition, it may be desirable to establish a third party DSM program administrator for municipal utilities and rural electric coops if these utilities fail to implement robust DSM programs on their own. The funding for this effort could be obtained through a public benefits charge that the affected utilities would include in their electric bills.

Priority

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

Case Study 1: PNM Community CFL Exchange Program

In 2007, PNM teamed up with the Sierra Club on the *PNM Community CFL Exchange Program,*which focused on bringing energy efficiency information to residents in the Albuquerque and Santa Fe areas. The program originated from the participation of the New Mexico chapters of the Sierra Club and Interfaith Power & Light in “Step It Up,” a national grassroots program that uses CFLs to spark dialogue on global warming. PNM learned of the program and partnered with the Sierra Club to develop a targeted effort in Santa Fe and Albuquerque.

The program had two main components: (1) a school-based assembly program featuring a slideshow presentation on energy and global warming for 3rd to 5th grade students, coupled with distribution of CFLs to parents, teachers, and staff; and (2) a public outreach effort with tabling at community events, neighborhood walks and partnerships with community organizations to exchange incandescent bulbs for CFLs. PNM committed 40,000 CFL bulbs for distribution in Albuquerque and Santa Fe. Meanwhile, the Sierra Club organized volunteers and coordinated the presentations at schools and public events.

By exchanging 40,000 incandescent lamps for CFLs, New Mexico families will save about $2 million in the cost of energy and light bulbs, save about 22 million kWh over the lifetime of the CFLs, and prevent about 15,000 metric tons of carbon dioxide (CO_2) emissions. Lessons learned from the program include the importance of securing approval from top executives (that is, school district superintendents) in order to obtain buy-in from school personnel and teachers, maintaining consistent communication and messaging, and being realistic about volunteer recruitment and retention.

QUICK FACTS:

- **Total CFLs exchanged**: 40,000
- **Number of “Energy Efficiency Assemblies”:** 39
- **Total Estimated Cost Savings**: $2 million
- **Estimated Energy Savings**: 22 million kWh
- **Estimated Environmental Benefit:** 15,000 metric tons of avoided CO_2 emissions

Sierra Club volunteers distribute CFLs and explain the energy-saving benefits at the Enviro Fair on May 31, 2008 in Santa Ana Pueblo, NM.
Photo Credit: Sierra Club

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

Background

Currently utilities in New Mexico receive dollar-for-dollar cost recovery for their DSM programs through a tariff rider mechanism. A number of states, including California, Idaho, Maryland, Oregon, and Utah have adopted decoupling policies that break the link between electric or natural gas utility sales and recovery of fixed costs.[22] 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) between rate cases. It also ensures that utilities are not penalized when their customers adopt combined heat and power systems.

In 2006, PNM proposed decoupling for residential and small commercial customers as a way to remove disincentives for implementation of natural gas DSM programs. However, the New Mexico PRC rejected PNM's request on the grounds that it would insulate PNM from a large variety of business risks, not just reduced sales due to DSM programs, and for other reasons.[23]

Other states (including Arizona, Colorado, 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.[24]

The Colorado Public Utilities Commission recently adopted an incentives policy along with energy savings goals for 2009-2020 for Xcel Energy, the main investor-owned electric utility in the state.[25] The utility begins to get an incentive when it achieves at least 80% of its energy savings goal in any particular year. The incentive is a fixed amount (about $3.2 million) plus a fraction of the net economic benefits resulting from the DSM programs. The fraction increases as more energy is saved. It equals 4% of net benefits if the savings goal is achieved, 6% at 110% of the goal, 8% at 120% of the goal, and 12% at 150% of the goal. The total incentive is also capped at

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[22] 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.
[23] Final Order. Case No. 06-00210-UT. New Mexico Public Regulation Commission. June 29, 2007.
[24] See Reference 19.
[25] Decision No. C08-0560 in Docket No. 07A-420E. Denver, CO: Public Utilities Commission of the State of Colorado. http://www.dora.state.co.us/puc/DocketsDecisions/decisions/2008/C08-0560_07A-420E.doc

20% of DSM program expenditures in any one year. In this manner, the utility is given an incentive to maximize both energy savings and net economic benefits.

The amendments to the EUEA adopted by the New Mexico legislature in 2008 direct the PRC to provide utilities an opportunity to earn a profit on their cost-effective DSM programs. The PRC is currently conducting a rulemaking to establish policies to implement this legislation. In addition, SPS proposed an incentive mechanism, namely allowing the utility to keep 15% of the net economic benefits resulting from its DSM programs, as part of its initial DSM program filing in 2007. SPS claimed that this would compensate the utility for the disincentives it faced when implementing electricity DSM programs. However, the PRC rejected this proposal arguing that the original EUEA, which was in effect at the time of this docket, did not permit allowing an incentive of this type.

Specific Energy Efficiency Proposal

This policy would either: 1) adopt decoupling for investor-owned gas and electricity utilities in the state, 2) adopt performance-based incentives to encourage utilities 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. At a minimum we recommend adoption of incentives along the lines of those recently approved by the Colorado PUC for Xcel Energy, with the amount of incentive increasing as both energy savings and economic benefits increase. This would be consistent with the letter and spirit of the 2008 EUEA amendments.

Energy Savings

Adopting decoupling and/or shareholder incentives would support the expansion of DSM programs in New Mexico and achievement of the savings goals spelled out in Option 1 and Option 4. 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 investor-owned electric utilities in New Mexico. In terms of the regulatory cost (time and expense for the PRC), we believe it would be on the order of $200,000 per year. It is unclear whether the PRC would need additional funding or could implement this policy within its current budget.

There could be significant 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.[26]

Priority

We believe that this policy is very important for stimulating expansion of electricity and natural gas DSM programs in New Mexico. Furthermore, the New Mexico legislature has directed the PRC to take action along these lines as part of the 2008 amendments to the EUEA. Therefore, we recommend that it be viewed by policymakers including the PRC as a **high priority.**

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[26] *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 (Not Yet Adopted)

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 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.[27]

The WGA Energy Efficiency Task Force report notes that a number of western states 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."[28]

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 which, in general, have 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, and new "smart meters" are installed that allow the utility to change the price charged in response to a radio signal.

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.[29] The California pilot program also found that critical peak pricing had a much greater impact than TOU rates on summer peak demand.

[27] *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.
[28] See Reference 7, p. 34.
[29] *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 demand response with flat and dynamic pricing." *Proceedings of the ECEEE 2005 Summer Study*. Boulder, CO: Rocky Mountain Institute.

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.[30]

Specific Energy Efficiency Proposal

This policy would implement critical peak pricing or real-time pricing for residential customers in New Mexico 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, customers should be informed 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. Recent surveys show that about 17 percent of PNM's residential customers and 70 percent of SPS's customers have central compressor-based air conditioning (including those with heat pumps).[31] Furthermore, the adoption of refrigerated air conditioning is on the rise. For the sake of this analysis we assume that 40 percent of all households in the state use central refrigerated air conditioning by 2015. Given these assumptions, the estimated energy savings is 120 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 825,000 by 2015, the aggregate electricity savings potential from residential demand response pricing is about 39 GWh/yr by 2015. By 2020, the savings potential could grow to an estimated 44 GWh/yr. These energy savings levels are very modest, about 0.5 percent of total projected electricity consumption by residential customers. However, the peak demand reduction potential could be much more significant, on the order of 200-400 MW by 2015. Once again, this assumes that all households

[30] 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.
[31] See References 4 and 6.

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.[32] 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 New Mexico. 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, a significant reduction in power demand during peak load periods could reduce emissions on very hot days, thereby helping New Mexico meet air quality standards and improve public health. On the other hand, there could be some shifting of load from natural gas-fired power plants operating on the margin during peak periods to baseload coal-fired power plants operating on the margin during off-peak periods, thereby increasing CO_2 emissions. We were not able to analyze this issue, but we suggest it be studied further before adopting critical peak pricing or real-time pricing in New Mexico.

Adopting critical peak pricing could benefit low-income households since these households tend to have below average electricity use in general and low use of central 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 New Mexico. 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.

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

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.**

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

Background

A study regarding natural gas energy efficiency potential was completed by the consulting firm GDS Associates, Inc. for PNM in 2005.[33] The study concludes that a comprehensive and well-funded 10-year DSM effort could reduce the natural gas use of residential, commercial, and industrial customers by 12 percent at the end of the 10-year period. This is considered the maximum achievable and cost-effective savings potential. The estimated benefit-cost ratio for this overall effort is 1.85 using the Total Resource Cost (TRC) test, with a projected net benefit of $510 million for customers if the 12 percent savings target is achieved.

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.[34] 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 Utah, the 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 approved for implementation in 2007.[35] QGC spent $7.4 million on these programs in 2007 (106% of its projected budget) and achieved first year energy savings of 163,000 decatherms per year (122% of its projected energy savings). Based on these positive results, QGC proposed and received approval to increase its gas DSM budget to $10.5 million (about 1.2 percent of retail sales revenues from general service customers) in 2008. Once again, Questar is exceeding its annual savings goals and is planning to further expand its DSM programs in 2009. QGC is implementing a broad set of gas DSM programs including energy audits, incentives for home retrofit, contribution to low-income home weatherization, incentives for high efficiency furnaces, water heaters, and appliances, incentives for ENERGY STAR new homes, and incentives for gas efficiency measures used in commercial buildings.

In New Mexico, PNM began implementing a limited set of gas DSM programs in 2006. These programs included rebates on insulation and other home retrofit measures, incentives for low-cost measures such as water heater insulation, and a contribution to the state's weatherization program for low-income households. The utility spent about $1.5 million on the programs in 2006,

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[33] *The Maximum Achievable Cost Effective Potential for Gas Energy Efficiency in the Service Territory of PNM*. Final Report prepared by GDS Associates for PNM and the New Mexico Governor's Energy Efficiency Task Force, May 2005.

[34] 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

[35] Order. Docket No. 05-057-T01. Public Service Commission of Utah. January 16, 2007.

only 69% of the approved budget of $2.2 million. Following third party evaluation, PNM found that a number of the programs were not cost effective and proposed discontinuing them, but subsequently proposed starting some new programs including incentives for energy-efficient new homes and commercial gas cooking efficiency measures. Following PRC review, PNM's gas DSM effort was scaled back to five programs at an approved budget of about $1.8 million, about 0.4% of revenues (customers' bills excluding taxes).[36]

Specific Energy Efficiency Proposal

This policy would significantly expand natural gas DSM programs in New Mexico, providing more services for customers, achieving economies of scale, and yielding higher net economic benefits. Funding of programs for residential and commercial customers would be ramped up to 1.5 percent of sales revenues by 2012, and remain at this level through 2025. Programs at this funding level would be implemented by all gas utilities in the state. 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 incentives for energy-efficient space heating systems, water heaters and appliances. 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 gas utilities to increase their savings while limiting the impact of DSM programs on the rates paid by industrial customers.

We also suggest setting gas savings targets, namely to reduce sales 5 percent by 2015 and 10 percent by 2020, from DSM programs implemented starting in 2008. 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 some form of decoupling or performance-based incentive is adopted along the lines recommended in Option 2.

If gas utilities in New Mexico are unwilling or incapable of implementing robust and effective energy efficiency programs, an alternative approach would be to start a statewide heating efficiency program funded through a surcharge on natural gas sales. The program could be overseen by the Energy, Minerals and Natural Resources Department, with a contractor hired through an RFP process. It may be desirable to have the program serve homes heated with propane as well natural gas, and include a small surcharge on propane sales as well as on natural gas to help fund it. The scope could be limited to working on residential energy efficiency, or it could be expanded to serve businesses as well. The statewide program administrator would provide energy efficiency services such as audits, direct installation of low-cost efficiency measures, rebates for insulation and other measures the reduce heating requirements, and rebates on high efficiency space and water heating systems. The program could be modeled on other successful statewide efficiency programs such as Efficiency Vermont.[37]

[36] Final Order. Case No. 07-000151-UT and Case No. 07-00273-UT. New Mexico Public Regulation Commission. January 17, 2008.

[37] *Year 2007 Preliminary Results and Savings Estimate Report*. Burlington, VT: Efficiency Vermont. March 31, 2008. http://www.efficiencyvermont.com/stella/filelib/2007_Prelim_Report_FINAL.pdf.

Energy Savings

In projecting energy savings, we assume that gas utilities (or a third party program administrator) increase the effectiveness of their programs over time and by 2012 are 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.[38] Also, we assume that the energy savings measures persist through 2020 but that there is some savings degradation due to measures not being retired after 2020. Many gas saving measures, such as home insulation or high-efficiency furnaces, have lifetimes of 15 years or more.

Table 3 shows the projected DSM program budgets and resulting levels of energy savings during 2008-2025, given the assumptions listed above. These values apply to DSM programs for all customers—residential, commercial, and industrial. Starting with DSM programs in 2008, cumulative DSM efforts would yield about 4.7 million decatherms per year of gas savings in 2015, 9.9 million decatherms per year by 2020, and 13.8 million decatherms per year by 2025.

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 (%)
2008	1.8	0.03	0.03	0.03
2009	4.2	0.12	0.14	0.17
2010	8.7	0.37	0.51	0.61
2011	11.2	0.58	1.09	1.28
2012	**13.8**	**0.87**	**1.97**	**2.27**
2013	14.2	0.90	2.86	3.25
2014	14.6	0.92	3.79	4.22
2015	**15.1**	**0.95**	**4.74**	**5.20**
2016	15.5	0.98	5.71	6.17
2017	15.9	1.00	6.71	7.13
2018	16.3	1.03	7.74	8.10
2019	16.8	1.06	8.80	9.05
2020	**17.2**	**1.09**	**9.89**	**10.01**
2021	17.4	1.10	10.69	10.69
2022	17.6	1.11	11.48	11.34
2023	17.8	1.12	12.26	11.96
2024	18.0	1.14	13.03	12.55
2025	**18.2**	**1.15**	**13.79**	**13.12**

[38] See Reference 34.

Overall, this DSM effort would save about five percent of New Mexico's projected natural gas use in 2015 in the absence of DSM programs, and 10 percent of projected gas use in the state in 2020. In making these estimates, we only consider gas use by retail customers. Natural gas consumption for oil and gas production and processing is not included but is addressed in a separate option (Option 12).

Cost and Cost Effectiveness

Table 3 includes the estimated DSM program funding levels needed in order to meet the proposed energy savings levels. DSM funding ramps up from $1.8 million per year in 2008 to $15 million per year by 2015 (in 2007 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; for example, Wisconsin and Iowa are spending $8-10 per capita as of 2006.[39]

We assume that DSM programs pay for half of the cost of natural gas efficiency measures on average, leading to a total investment of $220 million in efficiency measures during 2008-2020 (discounted net present value). Based on the experience of other gas utilities with comprehensive gas DSM programs as well as the New Mexico gas DSM potential study, we assume that gas DSM programs in the state have a benefit-cost ratio of 1.8 on average using the TRC test, once such programs are well-established.[40]

Based on these assumptions, the efficiency measures installed during 2008-2020 would produce $396 million in gross economic benefits and $176 million in net economic benefits over their lifetime (discounted net present value). To put the net economic benefit figure in perspective, residential and commercial customers in New Mexico paid about $635 million for natural gas and industrial customers paid about $167 million as of 2006.

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. Other measures such as furnace tune-ups and replacement will enhance consumer safety.

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.

[39] See Reference 14. Given that New Mexico does not have a heavy space heating load, we assume that spending on gas DSM programs does not reach the level in these leading states.
[40] See References 33 and 34.

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 252,000 metric tons in 2015, 526,000 tons in 2020, and 734,000 tons in 2025.

Political and Other Considerations

Gas utilities in New Mexico (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 would be very helpful to adopt sales and revenue decoupling in order to achieve the savings targets and realize the benefits described above.

Priority

This policy would yield large natural gas savings as well as substantial economic, environmental, and social benefits. We recommend that it by viewed by the Governor, Legislature, and PRC 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 (Partially Adopted)

Background

New Mexico is a moderately high-growth state which will see approximately 100,000 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 lifecycle cost.

New Mexico has had a mandatory statewide energy code for many years. The state recently adopted the *2006 International Energy Conservation Code* (IECC) for both new residential and new commercial buildings, effective January 1, 2008. Thus, New Mexico has an up-to-date energy code "on the books." The 2009 version of the IECC includes several provisions that will increase energy efficiency to by as much as 15 percent in new homes in New Mexico. The proposed changes include new requirements for increased insulation levels and better windows, duct and envelope sealing, and removal of tradeoffs between the envelope and heating and cooling equipment.[41] New Mexico is also in the process of developing a Statewide "Green Building Standard," which would achieve additional energy savings by going well beyond the requirements of the 2006 IECC, and the newly adopted energy efficiency requirements in the 2009 IECC. Some builders such as Artistic Homes (see case study below) are routinely building new homes that exceed minimum code requirements. Recently, two national builders constructing new homes in New Mexico, Centex Homes and KB Homes, pledged that all of their new homes starting in 2009 will significantly surpass the 2006 IECC energy efficiency requirements.

New Mexico also has a small but growing network of home energy raters and inspectors, and energy modelers and auditors for commercial buildings. 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.[42] This is

[41] The International Code Council (ICC) adopted changes to the IECC at its Final Action Hearing. The adopted changes will be published in early 2009, and are available for review online at www.iccsafe.org.
[42] Personal communication with Larry Gorman, Building Energy Solutions, Inc., Placitas, NM, Oct. 4, 2008.

consistent with national research which shows significant non-compliance especially with more recent codes such as the ASHRAE 90.1-2004 commercial building code.[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] 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

We first propose that the New Mexico Green Building Standard becomes effective beginning in 2009, yielding a 20 percent reduction in energy use relative to new homes and commercial buildings meeting the 2006 IECC code. In addition, we propose 10 percent further improvements in the code every three years starting in 2012. We recommend that the state go beyond the minimum requirements of the IECC when updating its energy codes, including innovative features of codes adopted in other states if such features are shown to be cost-effective for building owners in New Mexico. 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. Additional options that states are considering include requiring home energy ratings on all new homes, and commissioning for new commercial buildings. A few state and local governments are also exploring a home energy rating requirement for all new homes, and more stringent requirements for large homes, greater than a specified size threshold (typically 2,500 square feet). Such requirements should be considered for adoption in the future in New Mexico.

Codes can allow trade-offs among building parameters as long as overall energy performance is equivalent to (or better than) that achieved by the prescriptive requirements. For residential new construction, the Home Energy Rating System (HERS) scale could be used as a performance-based compliance path, with a minimum HERS score requirement. Table 4 shows the HERS rating levels (based on the 2006 IECC) that would achieve equivalent energy savings to the proposed building energy code improvements between 2009 and 2025. A similar approach could be adopted for commercial construction, by specifying a minimum percent improvement above ASHRAE 90.1-2004. ASHRAE has published guidelines for establishing a percent above-code requirement; the performance of buildings can be verified using the DOE COMcheck tool.[46]

The code requirements, along with the other building efficiency policies recommended in this report, will help New Mexico make progress toward the energy savings targets established by

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[43] E. Richman et al. 2008. "National Commercial Construction Characteristics and Compliance with Building Energy Codes: 1999-2007." *Proceedings of the 2008 ACEEE Summer Study on Energy Efficiency in Buildings.* Washington, DC: American Council for an Energy-Efficient Economy.
[44] See Reference 8, p. 42.
[45] *Clean Energy-Environment Guide to Action*. Washington, DC: U.S. Environmental Protection Agency, April 2006. pp. 4-29 – 4-31.
[46] ASHRAE Standard 90.1-2004. Appendix G: Performance Rating Method. Available at: http://www.realread.com/prst/pageview/browse.cgi?book=1931862664.

the Architecture 2030 Challenge. However, additional policies and/or more aggressive energy codes would be required to fully meet the near-term (50 percent energy savings) and long-term targets (carbon-neutral buildings) established by the 2030 Challenge.[47]

Table 4. Proposed Energy Savings Requirements and Equivalent HERS Scores for New Residential Construction

Year	2009	2012	2020	2025
Percent savings[1]	20%	30%	50%	70%
HERS Score[2]	80	70	50	30

[1]Percent savings is relative to the 2006 IECC.
[2]HERS Scores determine the energy consumption of a home, relative to a reference home, and include heating, cooling, water heating, lighting, appliances, and onsite power generation. Each 1-point decrease in the HERS Index corresponds to a 1 percent reduction in energy consumption compared to a HERS Reference Home.

This policy would also provide funding for training of builders, contractors, and local code officials by the Green Building Bureau within the Construction Industries Division, or the Energy, Minerals and Natural Resources Department, Energy Conservation and Management Division, grants to local jurisdictions to co-fund energy-related inspections and better enforce energy codes, and funding for field studies of new building characteristics and performance. We suggest providing on the order of $400,000 per year, with approximately 40 percent of this used for training, 40 percent provided to local jurisdictions to improve code enforcement, and 20 percent for field studies. 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 New Mexico.[48] It may be possible for the state to obtain co-funding for these activities from the U.S. Department of Energy and/or from utilities.

In addition, the State Energy Program (SEP) and utilities should continue to encourage construction of highly-efficient new homes and commercial buildings that go well beyond the minimum code requirements. PNM is implementing an incentive program for new homes that meet the ENERGY STAR criteria, and has proposed a second tier with higher incentives for new homes that are about 15 percent more efficient than ENERGY STAR. PNM also provides incentives for certain energy efficiency measures installed in new commercial buildings. Energy savings from these efforts are counted separately under the utility DSM options. Likewise, the state has adopted tax credits for highly efficient new homes and commercial buildings, and the savings from this policy are counted separately.

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 2009-2020, the fraction of new homes and commercial buildings that would be affected

[47] The Architecture 2030 Challenge establishes a goal of achieving a 60% reduction in energy use in new buildings by 2010, progressing to carbon-neutral buildings by 2030. For more information, see http://www.architecture2030.org/2030_challenge/index.html.
[48] 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.

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 10,000 new housing units and nine million square feet of new or renovated commercial building floor area per year on average during 2009-2020.[49]

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. Additional 20 percent energy savings in new homes and commercial buildings are assumed in 2009 when the New Mexico Green Building Standard takes effect. We further assume that the energy code is upgraded every three years (with upgrades taking effect in 2012, 2015, 2018, etc.) and that 10 percent additional electricity and natural gas savings are realized each time the code is upgraded. We also assume that stepped up training and code enforcement results in 95 percent of new buildings complying with the code requirements.

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 Richardson 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, and other state policies, such as tax credits for energy-efficient new homes and commercial buildings.

Table 5 – 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	**2012**	**2020**	**2025**	**2012**	**2020**	**2025**
Residential	59	294	522	0.47	2.36	4.18
Commercial	92	445	787	0.25	1.19	2.09
All	152	740	1,309	0.73	3.54	6.27

Table 5 shows the resulting electricity and natural gas savings in 2012, 2020, and 2025 based on these and other assumptions. The total electricity savings are estimated to reach 740 GWh by 2020 and 1,309 GWh by 2025. Natural gas savings reach about 3.5 million decatherms by 2020 and 6 million decatherms by 2025. About 50 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 2020 is equivalent to about 4 percent of projected electricity consumption in residential and commercial buildings without efficiency initiatives, while the estimated natural gas savings in 2020 is equivalent to about 5 percent of projected gas consumption in buildings without efficiency initiatives.

[49] The estimates of new housing units were developed using U.S. Census data on new housing starts, including actual homes built in 2007 and 2008, and forecasts of population growth in New Mexico. The commercial construction rates were obtained from the New Mexico Climate Change Strategy report.

Cost and Cost Effectiveness

Regarding the cost to the state of New Mexico, we are suggesting a budget of $300,000 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 2009 IECC will cost about $1,800 on average, but will result in about $320 in annual energy bill savings, meaning a simple payback of around six 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 $517 million in investment in energy efficiency measures during 2008-2020 (discounted net present value). The resulting energy bill savings over the lifetime of these measures would equal about $1.1 billion on a present value basis, meaning a net economic benefit of about $620 million (2007 dollars). Additional net benefits result from more efficient new homes and commercial buildings constructed during 2021-2025.

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 (from electricity generation at power plants) in the state by approximately 370 million gallons in 2020 and 2.0 billion gallons during 2009-2020. Furthermore, we estimate the codes would reduce CO_2 emissions by approximately 685,000 metric tons per year by 2020 and 1.21 million metric tons per year by 2025. 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 who are more satisfied with their new homes, workers who 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, New Mexico has done a good job in adopting up-to-date model energy codes in recent years, and is in the process of adopting a "green building standard" that should go well beyond the minimum requirements of both the 2006 IECC and the newly adopted requirements in the 2009 IECC. The challenges are to train builders, contractors, and local code

[50] See Reference 7, pp. 58-59.

officials as to what is required, educate them about cost-effective ways to comply with codes, and to ensure that all or nearly all new homes and commercial buildings meet or exceed the codes. 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. Home energy raters and commissioning agents (for commercial buildings) can also play an important role in ensuring buildings are designed to meet or exceed energy code requirements.

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 as a **high priority.**

Case Study 2: Artistic Homes Builds to LEED Certification Standards

Artistic Homes is a family-owned and operated business in New Mexico that currently builds 100 percent of its homes to Silver or Gold certification as administered by the Leadership for Energy and Environmental Design (LEED) new homes program. Energy efficiency and sustainability have evolved from a concept to a fundamental strategy for this home builder. Ten years ago, the company began working with the Building Science team at the Department of Energy and the Building America program. At that time, energy savings was considered a by-product of building better homes.

In 2006, Artistic Homes began the process of revamping its business plan by designing and building LEED-certified homes. The first step was to address energy; all homes were built to a Home Energy Rating System (HERS) score of 60 or below. Then other sustainable measures were addressed by incorporating recycled building materials, site and resource conservation, improved indoor air quality, and other environmental measures in their home designs and construction practices. By October 2007, Artistic Homes pledged to build all their homes in Albuquerque, Hobbs, Roswell, Lovington and Artesia to LEED standards.

HOME FEATURES:

- **Mechanical System**: High efficiency infiltration, integrated heating and hot water system, all ducts in conditioned space and sealed with mastic.
- **Building Envelope**: Foundation slab on grade, R-5 perimeter insulation, walls are built with advanced framing techniques, R-38 blown insulation in attic/roof, windows are vinyl framed, double-glazed, argon-filled with low-E coating.
- **Materials**: Low VOC cabinetry and paint.
- **Measured Air Leakage Results**: Total envelope air exchange at 50 pascals: 598 cfm; 0.12 CFM/square foot of surface area; 2.23 ACH50.
- **Energy Results**: All homes built to HERS score of 60 or below, and a heating and cooling cost guarantee is provided to homeowners.

R-10 full perimeter slab insulation
Photo credit: Artistic Homes

LEED-certified home in Los Lunas, NM
Photo credit: Artistic Homes

Option 6: Adopt Residential Energy Conservation Ordinances to Upgrade the Energy Efficiency of Existing Homes (Not Yet Adopted)

Background

Approximately 50,000 existing homes are sold each year in New Mexico, compared to construction of about 10,000 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. The responsibility can be transferred to the home buyer, with a minimum time period given for compliance (one year from sale, for example). 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 $1,300 for single family and duplex homes, and 1 percent of the assessed value or sales price for buildings with three or more units.[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 Albuquerque, 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. Our specific

[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.

proposal is to require meeting the RECO at the time a rental property is sold or within five years of passing the ordinance, whichever comes first.

We suggest including the following energy efficiency requirements in RECOs in New Mexico. Efficiency measures already present would not need to be replaced, but the seller or property buyer 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 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 10 compact fluorescent lamps in commonly used light sockets
- Low-flow showerheads and faucet aerators
- ENERGY STAR Appliances

The State Energy Program could help local governments that adopt RECOs through training and other assistance. Utilities such as PNM and SPS could support the RECOs by offering rebates and/or low-interest financing to property owners 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, if it is continued, would facilitate the implementation of 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 New Mexico, the home energy rating (HERS) infrastructure could be used to inspect homes and apartment buildings and certify compliance.

[53] Numerous companies provide home energy ratings in New Mexico and have been certified to do so through the Residential Energy Services Network (RESNET). See http://www.natresnet.org/directory/raters.aspx for details.
[54] See Reference 51.

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

Assuming 10 percent overall energy savings on average in New Mexico to be more conservative, the savings would be about 800 kWh and 5 decatherms per year for a typical rental property. Furthermore, we assume that a RECO for rental property is enacted first in the metropolitan Albuquerque area but then extended to other cities in the state. In total we assume that RECOs affect 150,000 housing units by 2020.[56] These assumptions lead to aggregate energy savings of around 30 GWh and 200,000 decatherms of natural gas by 2012, and 120 GWh and 750,000 decatherms of natural gas per year by 2020. By 2025, assuming the impacts are extended to an additional 50,000 households, the energy savings could equal 160 GWh and 1.0 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. We do not believe there would be any cost for state government for this option.

Regarding cost to the private sector, we estimate that the cost of the required upgrades would be about $600 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 $750 on average. Assuming one-third of the affected housing units need attic insulation but two-thirds do not, the average upgrade cost is about $850 per home.

Based on the energy savings estimates provided above, a household's energy bill (gas and electric) would be reduced by about $140 per year on average, given the retail energy prices in New Mexico. This means a typical payback period of 6.1 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 $870 per household. In aggregate, this implies net economic benefits of $130 million if the policy affects 150,000 housing units during 2008-2020.

[55] See Reference 51.
[56] New Mexico had 204,000 occupied rental housing units out of a total of 678,000 occupied housing units of all types as of 2000, according to the U.S. Census Bureau.

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.

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 would reduce water consumption in the state by approximately 480 million gallons in 2020 and 2.6 billion gallons during 2008-2020.[57] Furthermore, we estimate that RECOs could reduce CO_2 emissions in New Mexico by approximately 60,000 metric tons per year by 2015; 120,000 tons per year by 2020; and 160,000 tons per year by 2025.

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 (for example, allowing extra time for compliance before any fines are levied and ensuring that property owners 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 New Mexico as a **medium priority.**

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

Option 7: Federal Lamp Efficiency Standards (Adopted)

Background

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. Many of these standards were subsequently included in the Energy Policy Act of 2005 and in the Energy Independence and Security Act (EISA) of 2007. Citizens of New Mexico will benefit once these new standards take effect.

EISA included an important provision that will lead eventually to phasing out inefficient incandescent light bulbs and replacing them across the board with compact fluorescent lamps (CFLs) or other types of efficient lamps such as LEDs. These national standards take effect in two phases. Phase one requires approximately a 30% increase in the efficiency of new light bulbs in the 2012-2014 time period; phase two requires a tripling in light bulb efficiency by 2020.[59]

Specific Energy Efficiency Proposal

We include the impacts of the federal light bulb standards in this study because the law was enacted after Governor Richardson adopted energy efficiency goals for New Mexico. This policy will lead to significant electricity savings in both residential and commercial buildings, and will help the state achieve its energy efficiency goals. We assume the new law starts to have an impact in 2011 as manufacturers modify their products in preparation for phase one of the standards. We assume the standards have a growing impact over time as the second phase nears and then takes effect in 2020.

Energy Savings

Table 6 includes estimates of electricity savings in 2012, 2020, and 2025 from the federal light bulb 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

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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] See Section 321 of the Energy Independence and Security Act of 2007. http://thomas.loc.gov/cgi-bin/query/D?c110:8:./temp/~c110UcnA3W.

average before the standards take effect. However, this policy still has a large impact on residential electricity use.[60] We estimate that it would eventually save 1,150 kWh per year per household, equivalent to about 58 percent of the total electricity use for lighting in households on average.[61] In addition to the electricity savings in homes, Table 5 includes savings from the replacement of ordinary incandescent bulbs in commercial buildings.

Table 6 – Projected Electricity Savings from Lamp Efficiency Standards

	Electricity Savings (GWh/yr)		
Sector	**2012**	**2020**	**2025**
Residential	159	885	1,091
Commercial	72	403	497
Combination	231	1,288	1,587

Overall, we estimate that this policy would cut electricity use in New Mexico by 1,288 GWh per year in 2020 with the savings growing to 1,587 GWh per year by 2020. About 70 percent of the savings result from more efficient lighting in homes and 30 percent from efficiency improvements in commercial buildings.

Cost and Cost Effectiveness

Given the cost reduction in CFLs that have occurred in recent years, energy-efficient light bulbs are very cost-effective for consumers with the energy bill savings far exceeding the increased first cost. We assume the standards eventually lead to the purchase of 35 additional CFLs per household at a cost of $3.00 per CFL, on average. However, each lamp will yield energy bill savings of approximately 7.5 times their first cost on a net present value basis. We estimate that the lamp standards will result in a net economic benefit statewide of about $524 million (discounted net present value), as a result of CFLs installed during 2011-2020. This estimate covers a 10-year period after general service lamps are replaced, and it includes savings to both households and businesses.

Environmental and Social Benefits

By reducing the amount of electricity consumed, the lamp efficiency standards will reduce water consumption by power plants. The estimated total water savings are 644 million gallons per year by 2020 and 790 billion gallons per year by 2025. During 2011-2020, the standards would reduce water consumption in the state by an estimated 3.3 billion gallons.

Table 7 shows the estimated pollutant emissions reductions in 2020 and 2025 from reduced operation of coal- and gas-fired power plants. By cutting air pollutant emissions, the

[60] We do not count the savings here from the CFLs assumed to be adopted through utility DSM programs and market forces.
[61] 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.

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 7 – Estimated Emissions Reduction from the Lamp Efficiency Standards

Pollutant	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	864	1,065
SO_2 (short tons)	58	71
NOx (short tons)	361	444
Mercury (pounds)	5.2	6.3

Political and Other Considerations

The federal light bulb standards were supported by energy efficiency advocates and lighting manufacturers. Compromises on timing and stringency were made in response to manufacturers' concerns. The initial standards are included in the law, but the U.S. Department of Energy is required to conduct a rulemaking to establish the specific standards for achieving the phase two energy savings goals. Should the federal government fail to establish adequate phase two standards in a timely manner, a "backstop standard" included in the law will take effect.

Priority

This policy is already federal law. Therefore, we do not assign it a priority.

Option 8: Expand Low-Income Home Retrofit (Not Yet Adopted)

Background

New Mexico is a relatively poor state with a large number of low-income households. According to the U.S. Census Bureau, 16.7 percent of individuals living in New Mexico were below the federal poverty level as of 2004, compared to 12.7 percent nationwide.[62] In some counties in the state, the fraction of the population living below the poverty level exceeds 25 percent. Low-income households spend a much greater portion of their income on energy than medium and high-income households. National data show that a typical low-income household spent about 10 percent of its limited income on energy as of 2001, with very low-income households spending 16 percent on energy.[63] For comparison, an average household spent only 3 percent of income on energy as of 2001.

The situation is even worse in New Mexico where incomes are below average. In addition, 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. The DOE's Weatherization Assistance Program (WAP) provides energy-efficiency improvements to low-income households (those with incomes less than 150% of federal poverty level). In New Mexico, the WAP is administered by the Mortgage Finance Agency (MFA). At the present time, the program has an annual budget of about \$5.0 million. The bulk of the funding comes from the federal government (\$3.1 million per year), with some supplemental funding provided by the state General Fund and by PNM.

Weatherization measures include sealing air leaks in the building envelope, installing insulation in ceiling, walls and floors, installing CFLs and new refrigerators where appropriate, and repairing or replacing furnaces. Education for the homeowners is also an important aspect of the program. The MFA estimates that the average energy savings per weatherized home is 30.5 million Btu per year. However, this is based on national average savings data,[64] not on New Mexico-specific analysis. A recent evaluation of PNM's gas DSM programs, which includes a contribution to the state's WAP, estimates average annual energy savings of 22 million Btu of gas and 1,557 kWh of electricity per household.[65] This is similar to the total energy savings estimate by MFA based on national data. The evaluation of PNM's gas DSM programs also

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[62] New Mexico QuickFacts. Washington, DC: U.S. Census Bureau. http://quickfacts.census.gov/qfd/states/35000.html.

[63] *2007 Buildings Energy Data Book.* Washington, DC U.S. Department of Energy. http://buildingsdatabook.eere.gov/?id=view_book.

[64] Schweitzer, M. 2005. *Estimating the National Effects of the U.S. Department of Energy's Weatherization Assistance Program with State-Level Data: A Meta-Evaluation Using Studies from 1993 to 2005.* ORNL/CON-493. Oak Ridge, TN: Oak Ridge National Laboratory. Sept. http://weatherization.ornl.gov/pdf/CON-493FINAL10-10-05.pdf.

[65] *Final Report: 2006 Evaluation, Measurement, and Verification (EM&V) of Public Service of New Mexico's Gas Energy Efficiency Programs.* Sonoma, CA: RLW Analytics, Inc. March 8, 2007.

concluded that the low-income weatherization program has a benefit-cost ratio of about 1.85 based on energy savings alone (that is, not including valuation of any non-energy benefits).

The MFA estimates that the WAP will be able to weatherize about 1,700 homes per year as of 2008. However, there are over 200,000 low-income households in the state. Current funding is not able to keep up with the demand for weatherization services, in no small part because of recent hikes in natural gas and electricity prices.

Specific Energy Efficiency Proposal

This policy would increase the number of low-income homes that are retrofit each year by approximately a factor of four once a three year ramp-up phase is completed. We propose two strategies for expanding low-income home weatherization. First, we recommend increasing the traditional WAP program to a budget of about $9 million per year, adequate to fully retrofit 3,000 homes per year. Second, we propose implementing a “WAP Light” program that would provide basic efficiency retrofits including insulation, weatherstripping, low-flow faucets and showerheads, and CFLs, but at a cost of only about $1,000 per household using a neighborhood blitz approach. This effort could be modeled on a successful home retrofit program in Houston that is achieving about 12 percent energy savings on average at a cost of only about $960 per household.[66] This is much less than the cost per household in the traditional WAP program.

In total, this effort would retrofit 4,000 homes in 2009, 5,500 homes in 2010, and 7,000 homes per year in 2011 and thereafter. Once the ramp-up is completed, we estimate a cost of about $13 million per year, $8 million more than is now being spent on home weatherization. By 2020, a total of about 80,000 low-income homes would be retrofit. This is more than the number of families that receive energy bill payment assistance each year. The $13 million annual budget could be obtained by supplementing federal funds with state funds as well as additional utility DSM monies.

Energy Savings

Table 8 includes estimates of the electricity and natural gas savings in 2012, 2020, and 2025 from each this level of low-income home weatherization. The estimates refer to homes weatherized starting in 2009, based on the per unit savings from gas DSM program evaluation sponsored by PNM, and based on the experience with the Houston neighborhood blitz program. . This overall effort would save around 86 GWh and 1.1 million decatherms of natural gas per year by 2020. By 2025, the projected energy savings reach 124 GWh and about 1.6 million decatherms per year. These savings refer to the entire WAP effort during 2009-2025, not just the expansion called for in this option. In addition, we assume that energy savings persist through 2025.[67]

[66] “City of Houston, TX Residential Energy Efficiency Retrofit Program.” Presentation made by International Energy Conservation to the Nevada DSM Collaborative Meeting, July 10, 2008.
[67] 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.

Table 8 – Projected Energy Savings from Expanding Retrofit of Homes Occupied by Low-Income Families

Electricity Savings (GWh/yr)			Natural Gas Savings (million decatherms/yr)		
2012	**2020**	**2025**	**2012**	**2020**	**2025**
25.7	86.1	123.9	0.34	1.14	1.64

Along with expanding retrofit of homes occupied by low-income families, we recommend that the state conduct its own evaluation of the energy savings occurring in a sample of households served by the WAP. This will confirm whether or not the program is cost-effective in New Mexico based on valuing energy savings alone. It also could help the MFA and its contractors identify which efficiency measures are providing the biggest "bank per buck."

Cost and Cost Effectiveness

The cost per household of the WAP is approximately $3,000, while participating households realize approximately $410 in energy savings per year[68], after the completion of weatherization improvements. Based on experience in Houston, we estimate the cost per home for the "WAP Light" service would be approximately $960. In this case, participating households realize approximately $175 in energy savings per year.[69] The cumulative cost to implement this overall effort would be about $100 million during 2009-2020 (2007 dollars, discounted net present value). The net economic benefit statewide from this home retrofit effort during 2009-2020 would be about $190 million (2007 dollars, discounted net present value), meaning a net benefit of $90 million. This estimate includes energy savings over the lifetime of measures installed through 2020, assuming measures have a 20-year life on average.

Regarding the total cost to state government, we estimate an incremental cost of around $6 million per year assuming that 75 percent of the incremental $8 million annual cost is paid from the state's General Fund. We assume the remaining $2 million per year is provided by utilities or other sources.

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. Also, there will be an increase in the number of blue collar workers engaged in home audit and retrofit. Increasing the level of retrofit funding by $8 million per year should support at least an additional 200 jobs throughout the state. In addition, there will be some reduction in pollutant emissions due to less consumption of electricity and natural gas. We estimate that this

[68] The $410 savings figure is based on estimates of electricity and natural gas energy savings per household per year and current energy prices.
[69] The $175 savings figure assumes 12 percent electricity and natural gas savings, and current energy prices.

option would reduce CO_2 emissions in New Mexico by approximately 123,000 metric tons per year by 2020 and 178,000 tons per year by 2025.

Political and Other Considerations

Efforts to increase state and/or 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 increased government and utility funding for retrofit of homes occupied by low-income families.

Priority

Even though this option yields relatively limited 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 as a **high priority.**

Case Study 3: **Padilla Household in Santa Fe**[70]

A recent success story is the weatherization of a 1900-era home occupied by an elderly man in the historic part of Santa Fe. Weatherization work was performed in early 2008 by the Los Amigos Education Resource Center. Anthony Roybal, Executive Director of Los Amigos, reported that $1,142 of energy efficiency measures were installed in the home, including insulation of R-19 in the basement, twenty-two CFLs that replaced incandescent light bulbs, weather-stripping and sealing around doors and windows, eight storm windows installed on the north side of the home, and a tuning of the boiler. A blower door test demonstrated the effectiveness of the installed measures with a drop from 35.69 cfm to 19.10 cfm. The expected energy bill savings is $579 per year. The homeowner already reported a noticeable drop in his April utility bill and an improvement in the home's comfort level.

QUICK FACTS:

- **Total cost of weatherizing the Padilla home**: $1,142
- **Estimated annual energy bill savings for the Padilla home**: $579/year
- **Estimated payback period**: 2.0 years
- **Other Benefits:** Improvement in comfort and safety levels

[70] Personal communication with Gina Martinez, New Mexico EnergySmart Program Specialist, New Mexico Mortgage Financing Authority, June 2008.

Option 9: Tax Credits for Highly-Efficient New Homes, Commercial Buildings, and Heating and Cooling Equipment (Partially Adopted)

Background

Federal tax credits are now available for highly-efficient new homes and commercial buildings. 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. Partial deductions 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.[71] The U.S. Congress extended the tax credits through the end of 2009 as part of the financial industry rescue package enacted in October, 2008.

In 2007, New Mexico adopted a state income tax credit for "sustainable buildings," that is, highly-efficient new homes and both new and existing commercial buildings.[72] To qualify for a tax credit, new homes must receive a HERS index score of 60 or lower (that is, be 40% more efficient than homes just meeting the IECC model energy code) and be certified at the Build Green Gold level or LEED-H Silver, Gold, or Platinum levels. The tax credits vary according to building size and performance, but can be substantial. For example, a 2,000 square foot home that has a HERS index of 60 and qualifies for LEED-H Silver certification would receive a $10,000 tax credit.

For commercial buildings, certification at the LEED Silver, Gold, or Platinum level is necessary in order to receive a tax credit, along with showing at least a 50% reduction in energy use compared to typical buildings in the U.S. (as determined by the U.S. Department of Energy). The energy reduction requirement increases to 60% starting in 2012. For example, a 50,000 square foot new building that qualifies at the LEED Gold level would receive a tax credit of $127,500.

The state tax credits are available through 2013 and have an annual cap of $5 million for residential credits and $5 million for commercial building credits. The tax credits have only been in effect since January 1, 2007 and relatively few homes and commercial buildings have qualified so far. But interest in the tax credits and highly energy-efficient buildings is growing, and it is projected that around 80 new homes will qualify prior to the end of 2008.[73] Likewise, a number of highly efficient new commercial buildings are under development or construction and are expected to qualify in 2009.

[71] For details, see the Tax Incentive Assistance Project web site, http://www.energytaxincentives.org/.
[72] For details on the New Mexico Sustainable Building tax credits, see http://www.emnrd.state.nm.us/ecmd/cleanenergytaxincentives/sustainablebuildingtaxcredit.htm.
[73] Personal communication with Susie Marbury, Energy, Minerals and Natural Resources Department, State of New Mexico, Sept. 26, 2008.

Specific Energy Efficiency Proposal

This policy assumes that federal tax credits for energy-efficient new homes and commercial buildings are extended through 2013, complementing the state tax credits now in place in New Mexico. We then assume both the federal and state tax credits are extended during 2014-2020, but at reduced amounts that ramp down over time and phase out by 2020 as energy-efficient, sustainable buildings become more common and their incremental first cost declines.

Tax credits along the lines proposed here would complement the utility incentives offered by PNM for ENERGY STAR new homes and for efficiency improvements in commercial buildings. The utility incentives encourage "good practice" while the tax credits are available for "best practice." Best practice is defined here as new homes or 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 adopting state tax incentives for high efficiency heating and cooling equipment including modern energy- and water-efficient evaporative cooling systems. The latter 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.[74] However, there are hurdles to establishing modern evaporative cooling systems in the marketplace, including the significantly higher first cost compared to traditional evaporative coolers. Tax credits should help to increase both the supply of and demand for modern, well-performing evaporative coolers, and help to limit the shift from evaporative cooling to refrigerated air conditioning.

Legislation proposing tax credits for high efficiency heat pumps, central air conditioners, furnaces and boilers, water heaters, and evaporative coolers was introduced in the 2008 legislative session (SB 35 and HB 216), but did not pass. The estimated fiscal note was about $900,000 in FY 2009 and the same in FY 2010. We suggest adopting tax credits along these lines in 2009.

Energy Savings

It is difficult to estimate the impact that tax incentives for highly efficient new homes, commercial buildings, and HVAC equipment would 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 2009-2012 and 10 percent of new homes built during 2013-2020 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 it should avoid double counting of energy savings among policies and programs. In addition, we assume there is a "spillover effect" and that 15 percent of

[74] *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.

homes and commercial buildings constructed during 2021-2025 are at this high performance level even though the incentives phase out in 2020.

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 7,500 homes install modern evaporative cooling systems during 2009-2020 in response to the tax credits and an additional 4,500 homes due so during 2021-2025. We also assume that each of these homes cuts their cooling electricity use by 2,150 kWh per year as a result.[75]

Table 9 shows the resulting electricity and natural gas savings in 2012, 2020 and 2025 based on these assumptions. The energy savings are modest, reaching 40 GWh and 0.19 million decatherms of natural gas per year by 2020. 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, by laying the groundwork for future utility incentive programs and/or energy code upgrades.

Table 9 – 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)		
	2012	2020	2025	2012	2020	2025
New homes	0.9	4.5	7.5	0.02	0.10	0.17
Commercial buildings	4.1	20.3	33.8	0.02	0.09	0.15
Evaporative coolers	3.2	15.2	23.3	--	--	--
Total	8.2	40.0	64.6	0.04	0.19	0.32

Cost and Cost Effectiveness

In order to estimate the potential cost to the state of New Mexico, we assume state tax credits of $2,500 per qualifying home, $1.50 per square foot of qualifying commercial floor space, and $750 per qualifying evaporative cooler. These values are lower than current tax credit amounts because we assume the credits are reduced starting in 2013 and ramp down to zero by 2020. With the participation levels assumed above, this leads to a total cost to the state in terms of forgone tax revenue of $43.3 million over 12 years (2009-2020), or about $3.6 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 $32 million.

[75] Ibid, p. 8.

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 for participants during 2009-2020 are $13.6 million for the owners of highly-efficient new homes, $16.9 million for occupants of the commercial buildings, and $15.1 million for homes adopting qualifying evaporative cooling systems. The total estimated net economic benefit is $45.6 million. These estimates are based on the incremental energy savings provided by qualifying homes, commercial buildings and evaporative coolers, not total energy savings.

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 New Mexico by approximately 27,000 metric 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.[76] Overall, the policy as a whole would result in little or no net increase in water use as the water savings from reduced power generation would offset most if not all of the increased water use in homes that install modern evaporative cooling systems.

Political and Other Considerations

Tax credits are generally popular because they provide financial support for targeted measures. Home builders and commercial property owners and managers are rewarded for performance. The downside is the cost to the state government and the fact that many worthy initiatives compete for scarce state resources. Tax credits for highly efficient new homes and for commercial buildings are already adopted; those for HVAC equipment have been proposed in the legislature but not yet adopted.

Priority

This policy would yield relatively modest energy savings and economic benefits. Also, the cost to the state is substantial. 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 New Mexico. Taking all of this into account, we recommend that the tax credits for HVAC equipment and evaporative coolers be viewed as a **medium priority.**

[76] See Reference 74, pp. 7-9.

Case Study 4: Jefferson Green Office Building

This three-story, 85,000 square foot LEED Gold-certified office building in Albuquerque was designed to use 30% less water and 45% less energy than a typical local office building. A number of features contribute to the energy savings. The exterior design combines a thick stucco wall perforated by deeply recessed window with a sleek curtain wall system. Glazing and shading strategies vary according to the orientation of each façade. A reflective, high-emissivity roof membrane helps to reduce the cooling load. The direct-indirect evaporative cooling system is energy efficient and provides an option for “free” cooling using outside air. Use of an underfloor air distribution system saves energy, allows for individual occupant control and provides flexibility for future layout changes. Operable windows provide additional individual control and fresh air. Interior light fixtures use efficient T-5 fluorescent tubes to supplement the daylight from the windows.

Water savings result from use of low-flow showers and urinals, automatic faucet sensors in restrooms, and flow restrictors on faucets. The site was designed to maintain the existing mature pine and cottonwood trees to the south of the building, and direct run off to the planted areas to promote natural water harvesting and reduce irrigation requirements. The new landscaping throughout the site is designed to use less water than a conventional landscape, and all landscape irrigation is provided by the city’s industrial wastewater line to conserve the city’s supply of potable water.

The building has met or exceeded expectations for both performance and comfort. Jefferson Green received ENERGY STAR designation based on actual performance using utility bill data from the first 18 months of occupancy. Jefferson Green’s rating of 99 places it in the top 1% of office buildings in the nation for energy efficiency. The ENERGY STAR analysis shows that the building is saving 6.3 billion Btus of energy and 858 tons of carbon dioxide emissions each year compared to an average office building of its size.

Jefferson Green achieved LEED Gold certification under LEED-CS in March 2007 and LEED-CI in June 2007, exceeding the goal of LEED Silver. This gives Jefferson Green the rare distinction of being one of very few double LEED Gold buildings in the world.

The design team and owner estimated that the building’s sustainable features added about 5% to the first cost of the project, but the extra first cost is expected to pay back in about 5 years through the energy and water savings. Annual gas and electric utility costs have averaged $0.70/sf, dramatically lower than the typical energy cost of about $2.00/sf for office buildings.

QUICK FACTS:

- **Building Size**: 85,000 sq ft
- **Expected payback period**: 5 years
- **Energy Savings**: Approximately 45% relative to mandatory energy code
- **Project Team**: Developer – R. Davis Co.; Architect – Dekker/Perich/Sabatini; Construction – Enterprise Builders

Case Study 5: **Sigler Distributing Warehouse**

Sigler Distributing, Inc. was the first commercial project to qualify for the New Mexico Sustainable Building Tax Credit. This new, 64,000 square foot building replaced a smaller existing building on the same site. When Sigler Distributing, Inc. began plans for the new building, management decided to further its commitment to green operations by seeking LEED-Silver certification and incorporating as many state-of-the-art environmental measures as possible into the new building.

Sigler estimates that the energy-efficiency measures installed in the building design only accounted for 1-2% of the overall first cost, and expect a full payback of energy-efficiency measure costs within 2-3 years. The company is eligible for a state tax credit of approximately $120,000, which helps reduce the payback period.

The building design incorporates numerous energy-efficiency measures. Sigler expects these measures to reduce energy costs by approximately 25%.

- Efficient mechanical system
    - Fan-powered variable air volume (VAV) series and parallel terminal units with hot water reheat
    - VAV air handler
    - Air-cooled chiller, which resets based on demand from 55 to 65 degrees
    - 90% efficient natural gas boilers
    - Demand control ventilation with CO_2 sensors in each VAV fan-powered box zone
- Energy efficient lighting systems
    - Extensive use of day lighting through the warehouse and second floor of office space reduces the need for lighting fixture use
    - Smart sensors on lights throughout building “learn” regular use patterns and turn off/on automatically
    - Photosensors on each individual lighting fixture in warehouse adjust the lighting intensity based on daylight availability and occupancy
    - Occupancy sensors in office and retail spaces
- Each space is equipped with the lowest wattage bulb needed
- Reflective roofing materials
- High R-value wall and roof insulation
- Electric vehicle charging stations for use by fleet and customer vehicles
- Bike racks, showers and change rooms encourage staff and customers to reduce driving

QUICK FACTS:

- **Building Size**: 64,000 sq ft
- **Building Use**: Office and retail (17,000 sq ft) and warehouse (47,000 sq ft)
- **New Mexico Sustainable Buildings Tax Credit**: Approximately $120,000
- **Expected payback period**: 2-3 years
- **Energy Savings**: Approximately 25% relative to mandatory energy code
- **Project Team**: Architect – Studio Southwest Architects, LEED Consultant – Halcom Consulting, Contractor – CI Construction

Chapter IV – Industrial Policies

Option 10: Undertake an Industry Challenge and Recognition Program to Stimulate Industrial Energy Intensity Reductions (Not Yet Adopted)

Background

New Mexico'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 31 percent of electricity use and 46 percent of natural gas use statewide (including natural gas use for electricity generation), as well as a notable amount of petroleum usage.[77] However, most of the natural gas use (about 6 percent of total gas production in the state) is consumed within the energy industry as so-called lease fuel, plant fuel, and for pipeline and distribution use. Natural gas sold to other industrial consumers accounted for about 11 percent of total natural gas use in the state as of 2005.

Manufacturing and mining contributed $15.2 billion towards the state's total economic output (gross state product) of $72 billion in 2006. Industry is moderately important in terms of employment and income generation in the state, with this sector accounting for about 7 percent of non-farm jobs but a higher fraction of non-farm wages as of 2006.[78]

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.[79] As another indication of significant energy efficiency potential in the industrial sector, the self-direction program implemented by Rocky Mountain Power in Utah 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, suggesting that there is potential for further efficiency improvements even in energy-intensive industries.

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) low 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.[80] These factors lead many companies to

[77] Energy Information Administration, New Mexico State Energy Data 2005: Consumption. http://www.eia.doe.gov/emeu/states/state.html?q_state_a=nm&q_state=NEW%20MEXICO
[78] Data compiled by the Bureau of Economic and Business Research (BBER), University of New Mexico. http://www.unm.edu/~bber/economy.htm.
[79] "Energy-Efficient Technology for Mining." Presentation by Mike Mosser, National Energy Technology Laboratory at the Utah Mining Association Annual Convention, Aug. 23, 2007.
[80] 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.

implement only those energy efficiency projects with a very rapid payback period, on the order of two years or less.

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.[81] 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.[82]

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.[83]

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.[84]

In New Mexico, the EUEA calls for industrial self-direction programs as part of the portfolio of DSM programs implemented by electric utilities. But these programs are just getting off the ground. Furthermore, there is no state or utility program promoting more efficient use of natural gas and other fuels in the industrial sector.

Specific Energy Efficiency Proposal

This policy option proposes establishing a New Mexico Industry Challenge and Recognition Program within the State's Energy Conservation and Management Division (ECMD). The Challenge and Recognition Program would include the following elements:

1. Challenge industrial firms operating in New Mexico 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

[81] 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.
[82] See http://www.energy.wsu.edu/ for details.
[83] Canadian Industry Program for Energy Conservation, 2007, accessible online: http://oee.nrcan.gc.ca/industrial/cipec.cfm?attr=24, accessed March 2007.
[84] 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.

energy intensity reduction goals, b) auditing all facilities that have not been audited say within the past three years, c) implementing all energy efficiency measures and projects with a five year payback or less within five years, and d) tracking and reporting progress annually. Likewise, the Challenge Program itself should maintain a database 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 that have made exemplary efforts to reduce energy intensity and achieve significant energy savings. The awards program could be administered by the ECMD, with 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. We recommend that: a) electric utilities establish user-friendly self-direction programs for large customers as soon as possible, and b) gas utilities in the state 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.[85] In addition, we recommend that PNM, SPS and other electric utilities expand marketing and promotion of their incentive programs to industrial customers, and that larger municipal utilities and rural co-ops also initiate such incentives.

4. Expand industrial energy efficiency training and technical assistance activities such as those provided by the Industrial Assessment Centers (IACs) funded by the U.S. Department of Energy. New Mexico is served by the IAC at Colorado State University. State funding should be provided along with co-funding from industry groups, utilities, and/or federal agencies, to expand the scope of this effort in New Mexico. 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 and natural gas. In reality there should be savings of other fuels such as petroleum products used directly by industry, but it is unclear how much cost-effective energy savings potential exists for these fuels. Electricity and natural gas represent the large majority of energy consumed by industries in New Mexico. Regarding natural gas, we restrict our analysis to fuel used outside of the oil and gas sector; that is, we exclude natural gas used for production, processing and distribution purposes within the natural gas and oil industries. Also, we do not include electricity use in oil and natural gas production and distribution since we include a separate option (Option 12) for that important

[85] 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.

sub-sector. We estimate that the oil and gas industry accounted for 19 percent of total electricity consumption by industries statewide as of 2005.

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 utility forecasts, in particular baseline growth rates of 0.5 percent per year for electricity and 1.0 percent per year for natural gas in the industrial sector on average (excluding the energy use in the oil and gas sectors).

Regarding reductions in energy intensity, we assume that this initiative would reduce industrial energy intensity by 0.25 percent starting in 2009, an additional 0.50 percent in 2010, an additional 0.75 percent in 2011, and an additional 1.0 percent per year in 2012 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.[86] These reductions in energy intensity are in addition to those already occurring and expected in the future due to ongoing technological advances, structural shifts, and other policies such as utility energy efficiency programs.[87]

The overall reduction in industrial energy intensity, shown in Table 10, reaches 2.5 percent in 2012 and 10.5 percent in 2020. These percentages are applied to the baseline forecasts of electricity and natural gas 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.

Cost and Cost Effectiveness

Regarding the cost to the state of New Mexico, 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.[88] We expect that it should be possible to obtain at least $200,000 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

[86] 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.

[87] 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 *Annual Energy Outlook 2007.* DOE/EIA-0383(2007). Washington, DC: Energy Information Administration. February.

[88] The State Energy Program (ECMD) does not have the resources or capability to implement a program along these lines at the present time, but new appropriations could be obtained as has been the case for the Clean Energy Fund.

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.[89]

Table 10 – Projected Energy Savings from the New Mexico Industry Challenge and Recognition Program

Year	Percent Reduction in Energy Intensity	Electricity savings (GWh/yr)	Natural Gas Savings (million decatherms/yr)
2009	0.25	14	0.05
2010	0.75	41	0.15
2011	1.50	82	0.30
2012	**2.50**	**137**	**0.51**
2013	3.50	193	0.72
2014	4.50	249	0.94
2015	5.50	306	1.16
2016	6.50	364	1.38
2017	7.50	422	1.61
2018	8.50	480	1.84
2019	9.50	539	2.08
2020	**10.50**	**599**	**2.32**
2021	11.5	659	2.57
2022	12.5	720	2.82
2023	13.5	782	3.07
2024	14.5	844	3.34
2025	**15.5**	**907**	**3.60**

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 $111 million in investment in energy efficiency measures during 2008-2020 (discounted net present value). The resulting energy bill savings over the lifetime of these measures would equal about $385 million on a present value basis, meaning a net economic benefit of about $274 million (2007 dollars, net present value). Additional net benefits will result from efficiency measures and projects implemented during 2021-2025.

[89] 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.

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 150 million gallons per year by 2015 and 300 million gallons per year by 2020. During 2008-2020, the Program would reduce water consumption in the state by an estimated 1.7 billion gallons.

Table 11 shows the estimated pollutant emissions reductions in 2020 and 2025 from reduced operation of coal and gas-fired power plants, as well as reduced direct natural gas use in industries. By cutting air pollutant emissions, the industry challenge and recognition program would have a beneficial effect on public health and would help the state meet its air quality goals.

Table 11 – Estimated Emissions Reductions from the New Mexico Industry Challenge and Recognition Program

Pollutant	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	525	800
SO_2 (short tons)	27	41
NOx (short tons)	168	254
Mercury (pounds)	2.4	3.6

Increasing energy efficiency in New Mexico'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.[90] 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 further 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.[91]

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

[90] See Reference 17.
[91] 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.

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 New Mexico, and has been slow to fully embrace energy efficiency. The potential for energy and cost savings in this sector is significant, with additional macroeconomic and environmental benefits as well. Also, this is the only option targeted to the industrial sector as a whole. For these reasons, we recommend it be viewed as a **high priority.**

Option 11: Remove Barriers and Provide Incentives to Stimulate Greater Adoption of Combined Heat and Power (CHP) Systems (Not Yet Adopted)

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 New Mexico energy baseline estimates T&D losses to be 9 percent of power generated in the state. On-site thermal energy is produced in furnaces and boilers 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.[92]

New Mexico has 17 operating CHP facilities with a total installed capacity of 230 MW.[93] Existing CHP systems range from 84 MW facility at the Phelps Dodge Chino Mine, a 8.5 MW system at the University of New Mexico campus, to a 60kW microturbine at the St Vincent Hospital in Santa Fe. Most of the CHP systems in New Mexico are fueled by natural gas, but some operate using coal, biomass, or distillate oil. Systems are owned and operated by end users and utilities, including Public Service Company of New Mexico.

In spite of the growth of CHP capacity in recent years, there are still many barriers inhibiting greater use of CHP systems. In New Mexico as well as many other states, these barriers include inadequate information, the fundamental differences in utility and end user economic perspectives, high transaction costs because of small projects, high financing costs because of lender unfamiliarity, difficult and costly grid interconnection procedures, high utility tariffs for standby or backup power, complex power contracting processes and payment for power production at avoided cost, concerns about potential impacts on air quality in sensitive areas, lack of recognition for emissions reductions, and lack of financial incentives to stimulate CHP system implementation.

The difficulty in bringing CHP systems on line is illustrated in part by the cancellation of a 35 MW biomass-fired CHP project planned by Western Water and Power Production and PNM. The plant was to be sited near a large greenhouse thermal load, use waste wood fuels removed

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

[93] *Installatoin Database*. (n.d.). Retrieved June 2008, from Intermountain CHP Center: http://www.intermountainchp.org/casestudies/default.htm.

from forests and rangeland, and sell power to PNM. The project has been abandoned for multiple reasons, particularly emissions and fuel uncertainties.

Net metering is one policy that can help to overcome the barriers to CHP system implementation. New Mexico is ahead of many states in net metering requirements. In January 2007, the New Mexico Public Regulation Commission (PRC) extended the availability of net metering to systems up to 80 megawatts (MW) in capacity. Net metering is available to all qualifying facilities (QFs), as defined by the Public Utilities Regulatory Policies Act (PURPA). In general, "qualifying facilities" under PURPA include renewable-energy systems and CHP systems.

Specific Energy Efficiency Proposal

Increasing the penetration of CHP into the energy supply mix in New Mexico 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 New Mexico Climate Change Advisory Group acknowledged the barriers and difficulties in their final report[94] and suggested several potential financial incentives to promote CHP development. The proposals below include suggestions which could help address these challenges.

Remove Barriers

In a recent DSM potential study conducted for PacifiCorp, researchers concluded that, "The initial, and single largest, barrier to the adoption of combined heat and power (CHP) products is the low awareness of the technology."[95] Education and outreach to potential end users and to utility providers should be a high priority. The Intermountain Combined Heat and Power Center[96] can partner with the state in these efforts.

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. In January 2007, the PRC initiated a proceeding to consider new interconnection standards and procedures for QFs with the Institute of Electrical and Electronics Engineers (IEEE) 1547 standard forming the basis of the commission's technical interconnection standard. The PRC also will consider a standard set of procedures to streamline the interconnection process between a utility and all customer-owned generation facilities. There has been a great deal of activity associated with interconnection rulemaking in the region, with considerable input and assistance from the Regulatory Assistance Project (RAP). We recommend that the State of New Mexico adopt streamlined interconnection procedures identical or similar to those adopted in other states.

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[94] New Mexico Climate Change Advisory Group. 2006. *New Mexico Climate Change Advisiory Group Final Report.* http://www.nmclimatechange.us/ewebeditpro/items/O117F10150.pdf.
(New Mexico Climate Change Advisory Group, 2006)

[95] Quantec, Summit Blue, and Nexant. 2007. *Assessment of Long-Term,System-Wide Potential for Supplemental Resources.* PacifiCorp.

[96] http://www.intermountainchp.org.

We recommend that the PRC undertake a review of rates, including those for standby or backup power promulgated by both investor and non-investor owned utilities in the state, to make sure they are not discriminatory toward CHP systems. 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.

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 New Mexico adopt output-based emissions standards based on the model standards developed by the Regulatory Assistance Project.[97] Such standards have been adopted in other western states, including Texas and California.

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.

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.

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.

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

The oil and gas production industry should be a particular target for efforts to promote CHP systems. Using flare gas or stranded gas from oil production wells for power production, waste heat recovery, and waste heat generation from production field generators and compressors, pipeline compressors and gas plant operations should be encouraged and incentivized.

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.   Financial incentives for CHP systems suggested by the New Mexico Climate Change Advisory Group included equipment subsidies, tax credits/exemptions, production tax credits and direct payments for power production/thermal use.

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. We suggest consideration of an incentive similar to the California Self Generation incentive of $600/kW.

We also 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.

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 649 MW of CHP capacity in New Mexico.[98] However, this is technical potential only. It does not take into account economic or other limitations to CHP adoption.

The Department of Energy commissioned a review and update of the CHP market potential in the West, looking at several western states including Arizona and Nevada, but not New Mexico, in 2005.[99] 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

[98] 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.
[99] *CHP Market Potential in the Western States*. Report B-REP-05-5427-013. Arlington, VA: Energy and Environmental Analysis Inc., September 2005.

study also concluded that there is significant potential for alternative, opportunity fuel based CHP systems. The assumptions include 6% of the commercial technical potential and 10% of the industrial technical potential. They also include 35 MW for the biomass power project slated to go into operation in 2009[100].

We assume it is possible to add a total of 53 MW of new CHP capacity by 2015 and 83 MW by 2020. This means increasing CHP capacity in the state by about 50 percent, relative to the current level, by 2020. We did not include what may be significant CHP potential for the oil and gas production industry; this is included in the oil and gas industry option.

Table 12 - 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)
2008	0	0	0	0
2009	0	0	0	0
2010	36	269	1.58	1.59
2011	39	286	1.58	1.69
2012	**41**	**303**	**1.68**	**1.78**
2013	44	323	1.80	1.90
2014	48	353	1.98	2.06
2015	**53**	**389**	**2.19**	**2.14**
2016	58	420	2.37	2.44
2017	63	454	2.57	2.63
2018	69	496	2.81	2.87
2019	76	547	3.11	3.15
2020	**83**	**597**	**3.40**	**3.44**

Table 12 includes estimates of electricity generation, additional on-site energy consumption, and primary energy savings from the additional CHP capacity each 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 12 shows that if CHP capacity grows as projected, the incremental electricity generation would reach 303 GWh/yr in 2012 and 597 GWh/yr in 2020. The values are equivalent to about 1.3 percent and 3.3 percent of baseline electricity use in 2012 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 1.8 trillion Btu per

[100] http://www.pnm.com/news/2006/073106_biomass.htm.

year by 2012 and 3.4 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 15 MW of CHP capacity in the commercial sector and 68 MW in the industrial sector by 2020 will cost $75 million but will result in $84 million in net economic benefits (2007 dollars) on a discounted net present value basis. Regarding the cost to the state of New Mexico, 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 avoided central power generation (typically coal-fired generation in New Mexico), 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.[101]

During 2008-2020, adding 83 MW CHP to the energy resource mix would reduce water consumption in the state by an estimated 2.0 billion gallons. The water savings in 2020 alone would be about 250 million gallons. The estimated carbon dioxide emissions reduction is about 186,000 metric tons per year by 2012 and 310,000 tons per year by 2020. The estimates above assume half the incremental CHP capacity is fueled with natural gas and half with waste materials and other “opportunity fuels.” We do not estimate the net change in criteria pollutants due to uncertainties about CHP system emissions rates.

Political and Other Considerations

CHP installations provide important benefits such as alleviating transmission and distribution constraints, energy savings, and emissions reductions. But limited experience with CHP technologies as well as regulatory and permitting barriers has slowed the adoption of CHP systems in New Mexico. In general, industrial and commercial customers support removal of these barriers, while electric utilities tend to oppose their removal. Encouraging utilities to own

[101] See Reference 94.

or co-own CHP systems, and allowing them to keep a small portion of the net economic benefits, could help to overcome the utility opposition.

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 as a **medium priority.**

Case Study 6: University of New Mexico CHP Project

The University of New Mexico (UNM) installed a 6 MW CHP system as part of a major energy infrastructure upgrade (involving heating, cooling, distribution, building controls and lighting, as well as CHP) in 2004. The system helps meet the space heating, space cooling and domestic hot water production needs for over 25,000 students and 5,000 faculty and staff.

The CHP system is powered by a Solar Turbines Taurus 70 natural gas-fired combustion turbine and provides 29,000 pounds of steam per hour. The CHP system supplies approximately 50% of the total electricity demand during the winter months, and about 30% during the summer months. It is operated on economic dispatch, meaning it is operated when relative gas and electricity prices allow the operation to be economically beneficial. In 2008, UNM was evaluating the installation of additional CHP capacity.

QUICK FACTS:

- **Year Installed**: 2004
- **Estimated Operating Efficiency**: 64%
- **Estimated Energy Savings**: 18% less fuel use than typical onsite thermal generation or purchased electricity
- **Estimated CO_2 Emissions Reduction**: 8,200 tons per year

Option 12: Increase Energy Efficiency in the Oil and Gas Sector (Not Yet Adopted)

Background

New Mexico is third in the nation in both natural gas production and proven natural gas reserves. Much of the natural gas is coal bed methane, in which New Mexico is first in production and reserves. The state is fifth in production of crude oil and forth in proven oil reserves. At the end of 2005, New Mexico had more than 750 oil and gas-related companies operating in the state. Combined with supporting industries, the oil and gas sector supports more than 23,000 jobs in the state. Total revenue from oil and gas sales was $2.6 billion dollars in 2006.[102]

Most of the oil production occurs in the Permian Basin of southeast New Mexico (94 percent in Lea and Eddy counties). Most of the natural gas production occurs in the San Juan Basin in the northwest part of the state (64 percent in San Juan and Rio Arriba counties). In 2006 there were over 21,000 oil, and 25,000 gas producing wells, as well as 433 CO_2 injection wells, 3,300 enhanced recovery injection wells, and 600 water disposal wells.[103]

The oil and gas industry in New Mexico is comprised of hundreds of operators. A relatively small number of large companies account for most of the state's production, but there are also many smaller producers. In natural gas production, the top 20 producers account for about 80 percent of total production. Concentration is less in oil production, where the top 20 companies account for about 64 percent of production.

Gas production includes everything upstream from natural gas processing plants, including drilling, wellhead equipment and gathering lines. Gas processing includes contaminant and liquids removal. Gas transmission includes high-pressure, large diameter pipeline systems and associated compressors and stations that transport pipeline-quality natural gas from the processing plant to the distribution system. Natural gas liquids from gas plants and pipeline stations are also pumped. Gas distribution includes "city gates" which take gas from the transmission system and reduce the pressure, and the system for distributing gas from the city gate to end-use consumers.

Oil production includes drilling and pumping, as well as some enhanced recovery through water flooding and or CO2 injection. Water produced in the fields may be re-injected or pumped back underground. Oil processing in the field includes gas and oil separation at the well, water removal, and as needed, heating and contaminant removal.

In 2007, there were 30 active gas processing plants in New Mexico. These plants are operated by 17 different companies. There are approximately 81 large compressor and pumping stations operated by 15 companies (compressor stations without Title V permits, which are all-electric, are not included in this total). These are predominantly compressor stations for natural

[102] New Mexico Oil Conservation Division. 2006. *Oil Conservation Division Annual Report.*
[103] Ibid.

gas pipelines, and they use natural gas as fuel. Most of the natural gas compressor stations are operated by transmission sector companies, but some are located in field gathering systems upstream from gas processing plants. A few of these sources pump natural gas liquids or other petroleum products and use diesel as fuel. There are numerous smaller compressor and pumping facilities, primarily in the production and gathering systems.

In the natural gas distribution sector in New Mexico, there are about 16 companies. However, the sector is dominated by one company, New Mexico Gas Company, a spin-off from PNM, which accounts for about 82% of distribution.[104] New Mexico has three petroleum refineries (total capacity 112,600 barrels per day) and a refinery-related facility that produces asphalt.

Industry growth is uncertain. In 2006, the New Mexico Climate Change Advisory Group concluded that production would remain at current levels through 2020.[105] The report assumes that new reserves will be found and exploited such that recent production levels of oil and gas can be maintained as older fields become depleted. This implies significant new investment in the sector which may provide opportunities for energy efficiency improvements.

Energy Use Estimates

The oil and gas production industry uses electricity, natural gas and petroleum products. The refining industry uses electricity, natural gas, and energy derived from the feed stocks. About six percent of the natural gas produced in New Mexico, approximately 97 billion cubic feet per year, is consumed in production, processing and distribution activities. This is 44 percent of all natural gas consumed in New Mexico and four times the gas consumed by industrial end users in the state.

The major electric utility provider for the Permian Basin is Xcel Energy (SPS). The major electrical provider for the San Juan Basin is the City of Farmington municipal utility. Fuel for natural gas and oil processing is provided by gas production and diesel purchases. Baseline energy use estimates for the industry are summarized in Table 13 below. Energy costs are assumed to be the same as for the industrial sector as a whole.

The natural gas use data for the gas industry are from EIA, and based on the reported gas use in lease, gas plant, and gas pipeline/distribution categories. The gas use data do not include direct natural gas/methane losses from venting, flaring, leaks etc. Electrical energy use data for the oil and gas sector at the state level are not available in the EIA database. The baseline electricity use was estimated from data provided by the two major utilities serving the sector, Xcel Energy and the City of Farmington.

[104] New Mexico Environment Department. 2006. *Oil and Gas Greenhouse Gas Emissions Reductions Final Report.* PNM was in the process of selling its natural gas distribution utility as of June 2008.
[105] New Mexico Climate Change Advisory Group. 2006. *New Mexico Climate Change Advisiory Group Final Report.* http://www.nmclimatechange.us/ewebeditpro/items/O117F10150.pdf

Table 13 – Estimates of Electricity and Natural Gas Use in the Oil and Natural Gas Sector

		Energy Use 2005			
				% of State Industrial Total	
		Electricity	Natural Gas	Electricity	Natural Gas
		million kWh	MMcf	Million kWh	MMcf
Gas Industry	Production	Unavailable	41,815	Unavailable	NA
	Processing		35,508		NA
	Transmission & Distribution		19,663		NA
	Total		96,986		
Oil Industry		Unavailable	Unavailable	Unavailable	Unavailable
Oil and Gas Production Industry Total		**1,228**	**96,986**	**19%**	

The natural gas production sector uses natural gas in production operations, gas processing, and to fuel gas compressor stations in the pipeline system   Electricity is used in drilling, gas processing, and gas compression/transport. Diesel fuel is used to power on-site generators for drilling rigs and may be burned in gas processing boilers. The oil production sector uses electricity in drilling, processing and pumping. Diesel fuel may be used for heating and to power on-site generators.

Natural gas and electricity are used in pipeline compressors and auxiliary systems such as natural gas liquids pumping. Petroleum refining uses electricity for fans, pumps and auxiliary systems. Both natural gas and petroleum products are used for thermal processes.

Specific Energy Efficiency Proposal

We found no literature on energy efficiency policy and programs targeting the oil and gas production sector. In California, Texas, and elsewhere, the industry is included in the standard industrial energy efficiency programs. One example is Southern California Edison's (SCE) industrial DSM program launched in 2006 with a $37 million budget. The program has energy savings goals of 159 GWh/yr, 30 MW summer peak reduction, and an estimated benefit-cost ratio of 2.34 using the Total Resource Cost test. The SCE industrial program focuses on developing customer commitment to sustain energy efficiency in industrial processes.

The U.S. Department of Energy's Office of Industrial Technology included petroleum refining in the Industries of the Future program and has developed an industry roadmap and various technology briefs for oil refining. However, the oil refining sector is a small part of New Mexico' oil and gas industry.

The oil and gas production industry has unique challenges due to the very remote and dispersed locations involved, the number and variety of wells, changing production rates and composition at the wells, the very high level of reliability required, and significant environmental challenges. The industry's economic requirements are similar to most other industrial users. Projects that improve production or reliability have higher priority than energy efficiency projects. Paybacks for energy efficiency projects typically need to be in the 1-2 year range, particularly since equipment is frequently moved or reconfigured.

The larger companies have ongoing energy efficiency programs and considerable internal, industry-specific expertise. Several (but not all) that we talked with indicated that utility "audits" were not particularly useful. Others would welcome outside assistance. We suggest the following strategies for improving energy efficiency in the oil and gas industry. These proposals are relatively general at this stage and require further elaboration before they can be implemented.

Regulatory Policies

Explicitly recognize the connection between energy efficiency and environmental performance in state regulation and monitoring of the industry. Consider rewarding energy and environmental performance with reduced regulatory burdens, more rapid permitting, streamlined reporting etc. Develop output-based emissions regulations which give credit for the efficiency, thermal and electric/mechanical, of generation (or compressor) systems including the common remote, fuel-fired systems used in the oil and gas fields.

As in the CHP recommendation, work to remove barriers to project implementation such as inadequate information, institutional barriers, high transaction costs because of small projects, and utility-related barriers like onerous interconnection requirements, high standby rates, exit fees, and the lack of standard-offer incentives for energy savings measures. In the oil and gas industry particularly, consider removing prohibitions on running private wires.

Combined Heat and Power

Implement the recommended CHP strategies[106] described above (Option 12) as well as in the New Mexico Climate Change Advisory Group Final Report. All oil and gas industry combined waste heat and "waste" fuel projects should be eligible for incentives and tax credits. Include power generation from flare gas and stranded gas. Consider a self-generation credit on the order of California's $600/kW. Also, consider offering a production tax credit matching New Mexico's renewable energy production tax credits.

Promote gas-fired compression with waste heat power generation on gas pipeline compressors rather than current trend toward line-powered, central-generation, electrically-driven compressors. Provide permitting facilitation/relief for high efficiency systems.

Targeted Electric Utility Demand-Side Management

The oil and gas industry is highly specialized and standard utility DSM programs are not well-suited to meet its needs. The State could lead an effort with the utilities and the industry to craft DSM programs specifically targeted to oil and gas producers and processors. Well thought out, streamlined approaches to implementing industry-specific measures could increase market

[106] Direct subsidies for purchasing/selling CHP systems given to the buyer/seller; tax credits or exemptions for purchasing/selling CHP systems given to the buyer/seller, tax credits or exemptions for operating CHP systems; feed-in tariff, which is a direct payment to CHP owners for each kWh of electricity or BTU of heat generated from a qualifying CHP system; and tax credits for each kWh or BTU generated from a qualifying CHP system.

penetration significantly. The Northwest Energy Efficiency Alliance's industrial program targeted to the food processing market is an example of this type of program.[107]

The industrial self-direction program that SPS (Xcel Energy) has begun to implement could be helpful as it would enable companies to develop energy efficiency projects on their own, and receive credits against their DSM surcharge for doing so. However, smaller companies that do not qualify for the self-direct program may benefit from targeted technical and financial assistance. DSM programs should be developed and implemented by the Farmington municipal utility as well as by SPS.

Industry-Focused Training and Information Exchange

The state could work with the oil and gas industry, industry trade allies, and utilities to provide best practices training and technical forums targeted to this sector. These forums could provide an opportunity for producers to collaborate in problem solving and link producers with vendors and trade allies. Along with the targeted electric utility DSM programs, focus on continuous energy improvement as has been done in the Northwest Energy Efficiency Alliance and the SCE programs. The state could also recognize exemplary performance and leadership. In all of these efforts, there should be linkages between energy and environmental performance.

Energy Savings

We found no literature specifically estimating the energy efficiency potential for the oil and gas production industry on a national, regional or state level. The U.S. Department of Energy published a case study on improving oil well beam pump system performance[108], and also included one oil production site in the motor systems market opportunity assessment report.[109] One study estimated a 20 percent pump system energy savings potential for the oil and gas extraction industry in Pacific Gas and Electric Company service territory.[110]

The energy efficiency measures and strategies for the oil and gas industry include many of those appropriate to the industrial sector in general. And as with other parts of the industrial sector, a systems approach is important. Electrical opportunities include controls, variable speed drives, pump system optimization, distribution system optimization, and in some cases premium efficiency motors. Combined heat and power, waste heat recovery and use of stranded gas or flare gas, can play key roles in improving the energy efficiency of the oil and gas sector in New

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[107] Northwest Energy Efficiency Alliance. 2008. http://www.nwalliance.org/ourwork/ourwork_bysector.aspx?sector=industrial.

[108] U.S. Department of Energy. 2005. *CASE STUDY - THE CHALLENGE: IMPROVING THE PERFORMANCE OF OIL WELL PUMPING UNITS.* http://www1.eere.energy.gov/industry/bestpractices/case_study_oil_well.html.

[109] Xenergy, Inc. 1998. *United States Industrial Electric Motor Systems Market Opportunities Assessment.* Washington, D.C.: U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Office of Industrial Technologies.

[110] Case, P. E. 2008. *Identifying Energy Efficiency Opportunities in Wastewater Treatment Plant Pumping Systems*. Emerging Technologies Program Application Assessment Report #0505. San Francisco, CA: Pacific Gas and Electric Company.

Mexico. Natural gas and petroleum opportunities include better insulation, boiler and heating system optimization, controls and some waste heat recovery.

The following tables summarize the data and assumptions used to estimate the energy efficiency potential for the New Mexico oil and gas industry from a "bottom up" approach. The estimates rely heavily on the industry baseline energy use estimates, on estimates of efficiency potential for various measures from other industries, and in some cases on specific experience/applications at specific sites. End-use estimates are based on experience with industrial applications, information from other utility DSM potential estimates, and information published in national studies. Given the limited data available, there is significant uncertainty in the energy efficiency potential estimates.

The natural gas savings potential for each measure was estimated from an estimate of the baseline energy use of systems to which the measure applies and a percentage savings estimate for the measures applied. For example, we assumed that 30 percent of the 35,058 billion cubic feet natural gas plant use is used in boiler/heating applications and that 1 percent of this could be saved with optimized boiler controls. The costs are based on information from case studies, demand side potential studies, and specific project experience.

Table 14 – Estimate of Natural Gas Energy Efficiency Potential

Natural Gas							
Measure	Applications	Baseline Estimate MM cf	% Savings Estimate	Savings 1,000cf	Levelized Cost $/1,000 cf	Cost $/1,000cf	Life yr
Casing head gas recovery	Oil Production wells	4181	5%	209,073	1.60	20	20
Boiler selection	Gas Processing Plants Oil Heating/Heat Treatment	10,652	1%	106,524	1.60	20	20
Boiler controls	Gas Processing Plants	10,652	2%	213,048	2.89	30	15
*Remote controls, SCADA systems	Oil & Gas Fields, monitor and Control Engines, Generators, boilers/heaters	61,478	5%	3,073,902	4.82	50	15
Compressor Engine Air/Fuel Controllers	Compressors over 660 hp						
Insulation **	Heated pipelines, Gas Processing Plants, Heated Oil Tanks, Treaters	5,517	10%	551,714	0.92	4	5
Waste heat recovery; offset thermal loads	Oil and Gas Production Generators, Compressors (Sites with thermal loads) Gas Processing Plants	10,652	2%	213,048	4.81	60	20
Total				4,367,310			

For the electrical savings estimates we again established a baseline for systems where the measure is applicable and used average savings estimates for each measure. For example, the baseline for electrical distribution system optimization is 100 percent of the sector electrical use while the motor system baseline is 90 percent of the total. Given that electrical compressors are becoming more common and that the gas processing industry probably uses electricity for other systems, we assumed that gas plants use 25 percent of the electricity in the sector and that 60 percent of that is pumping. For the oil and gas fields, we assumed that 80 percent of the electricity is used for pumping. Energy savings estimates are again based on limited sector data, industrial systems data and some specific project experience. Costs are based on data published for the measures, with a premium in consideration of the remote, dispersed nature of the industry and the difficulty in implementation.

Table 15 - Estimate of Electricity Energy Efficiency Potential

Electricity						
		Baseline MWh	Savings		Cost	life
Measure	Applications	Baseline MWh	%	kWh/yr	$/kWh	yr
Controls	SCADA, Oil& Gas Production, Gas Plants	921,075	10%	92,107,500	0.08	10
	Oil wells	307,025	12%	36,843,000	0.05	5
Pump System Optimization	Gas Plants	184,215	15%	27,632,250	0.02	15
	Oil & Gas Fields	736,860	12%	88,423,200	0.02	10
Motor sizing and efficiency	Oil & Gas Fields, Gas Plants	1,105,290	2%	22,105,800	0.02	15
Electrical Distribution System Optimization		1,228,100	3%	36,843,000	0.05	15
Total				**303,954,750**		

The potential estimates for combined heat and power/waste heat recovery are actually estimates for improvement of the overall efficiency of specific operations. They result in power generation from wasted heat and either directly displacing grid power or adding to the power supply and displacing centralized power generation. The estimates are based on the size and number of installations where a particular system is feasible. For example, the number of large gas fired-turbine compressor stations in the state was estimated from EIA data.[111]

Information on the size and number of engines, turbines and gas flares was provided by the Air Quality Bureau, New Mexico Environment Department. We assume that 25 to30 percent of the total permitted systems, engines/turbines, could be sources for waste heat power, assumed they operate 4,000 hr/yr, and use performance information for waste heat generation systems (kW generated per horsepower of compressor capacity) to calculate the potential electricity generation.

For individual well site equipment (heaters and internal combustion engines), we did not assume any CHP potential for a number of reasons. First, the engines are generally small and are fired with low-Btu field gas. Second, there is generally no electrical grid system in place to supply electricity to, although the electric grid is slowly expanding into oil and gas fields. Also, the winter typically takes its toll on these remote facilities with fluid freezes, creating concerns over winter time field operations.

For centralized compressor stations, the engines are generally larger in size, and in about 50 percent of applications some form of electricity and the electrical grid is present. Hence, some

[111] Energy Information Administration, Office of Oil and Gas. 2007. *Natural Gas Compressor Stations on the Interstate Pipeline Network*. Nov.

application of organic rankine cycle power units might have some merit. We expect that any waste heat recovery would go towards electrical generation. These facilities are generally unmanned so concerns about weather effects still apply, although some of these stations have buildings in place to protect the units. Also, some of these stations have dehydration in place to remove moisture in the gas so the quality of the gas is improved over that at remote well sites.

Gas treatment and processing plants generally employ very large engines and turbines so there is definitely some merit in consider adding organic rankine cycle power units. The CHP system economics shown below (type, power generation, operating and capital costs, etc.) are derived from a report specifically on CHP opportunities on interstate gas pipelines.[112] Costs for smaller waste heat and heat recovery generators are from industry sources.[113] Data on city gate pressure reduction stations were not available. However, we believe there may be CHP potential in these applications, so a placeholder is included for future assessment.

In summary, we estimate a natural gas savings potential of about 4.4 billion cubic feet, equivalent to about 4.5 percent of total gas use in oil and gas production, processing, and distribution. We estimate a total electricity savings potential of about 340 GWh, equivalent to about 25 percent of total electricity use in the oil and gas sector. Regarding CHP, we believe there is at least 20 MW of CHP potential at pipeline compressor stations and at gas plants, as well as additional CHP potential in smaller applications. But given the uncertainty in these estimates, we do not include them in the overall energy savings analysis.

Naturally not all the energy savings potential can be captured immediately. Efficiency projects in the industrial sector, including the oil and gas industry, typically take 1-3 years for identification, analysis, funding, design and construction and commissioning. Energy efficiency policies and programs should be maintained for at least a decade in order to maximize their impact.

Cost and Cost Effectiveness

There is relatively little information available on the cost and cost effectiveness of energy efficiency measures for the oil and gas production and processing industry. As shown in Table 14, we estimate that most of the natural gas savings can be achieved at a levelized cost of saved energy ranging from less than $1.00 per thousand cubic feet to $5.00 per thousand cubic feet. This is considerably less than the price of natural gas today either at the wholesale (commodity) or retail level. And as shown in Table 15, we believe that most of the electricity savings can be achieved at a cost of saved energy of $0.05/kWh or less, again well below the marginal cost of electricity generation and supply today.

The cost to the state for implementing this option should be relatively minor, on the order of $100,000 per year for training and facilitating information exchange.

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[112] Hedman, B. A. 2008. *Waste Energy Recovery Opportunities for Interstate Natural Gas Pipelines.* Interstate Natural Gas Association of America (INGAA).
[113] Electra therm. (n.d.). *Products*. Retrieved June 19, 2008, from Electratherm http://www.electratherm.com/products.html

Table 16 - Estimate of Combined Heat and Power (CHP) Potential

											Operating Cost		Capital Cost		Total Cost
Application		**Source**	**Size**	**Generator (kW)**	**Generation Technology**	**Power Use**	**Resource estimate[1] (hp)**	**Generation from recovered waste heat (MW)**	**Operating (hr/yr)**	**Potential Electricity Production (MWh/yr)**	**Heat/fuel ($/kWh)**	**O&M ($/kWh)**	**($/kW)**	**Capital Charge[2] ($/kWh)**	**($/kWh)**
Pipeline Compressor Stations, Gas Plants	Engine	Exhaust Gas 500-1200 F	1,000 - 3,500 hp (each)		Organic Rankine Cycle High temp	Displace grid, displace generator, or sell	72,304	5	5,200	27,690	0.005	0.002	2,500	0.031	0.038
	Turbine[3]	Exhaust Gas 850-1100 F	13,000 - 38,000 hp (station)	3,000 - 6,500	Organic Rankine Cycle Low temp	Sell	88,800	18	5,200	92,560	0.005	0.002	2,500	0.036	0.043
On-site Generators		Exhaust Gas 400-800 F	7,000 - 122,000 cfm	20 - 1,500	Organic Rankine Cycle Low temp	Displace grid, displace generator, or sell	86,400	17	4,000	66,400	0	0.004	4,000	0.049	0.053
		Coolant 200 F	100 - 2,000 gpm	30 - 500	Organic Rankine Cycle Low temp	Displace grid, displace generator or sell	310,328	17	4,000	67,100	0	0.004	4,000	0.049	0.053
Well head/ gathering system compressors		Exhaust Gas 500-1200 F	7,000 - 122,000 cfm	20 - 1,500	Organic Rankine Cycle Low temp	Displace grid, displace generator or sell	too small				0	0.004	4,000	0.049	0.053
		Coolant 200 F	100 - 2,000 gpm	30 - 500	Organic Rankine Cycle Low temp	Displace grid, displace generator or sell	too small				0	0.004	4,000	0.049	0.053
Gas Flaring, Stranded Gas[4]		Low Btu gas		60 - 600	Micro turbine	Displace grid, displace generator or sell	359,259			26,600	0	0.017	2,200	0.027	0.044
City Gate Pressure Reduction		290-600 psig		30 - 1,450	Turbo expander	Displace grid or sell					0	0.002	4,000	0.049	0.051

[1] Resource estimate based on installation data with assumptions of 25 to 30% of installed equipment in service.
[2] Assumes 20 year life, 8% interest rate, and 100% financing.
[3] Hedman 2008 (see reference 112).
[4] Flare resource estimate assumes 10% of flare gas available for power generation.

Environmental and Social Benefits

There can be environmental benefits from energy efficiency and CHP projects in the oil and gas industry. For example, capturing gas that is vented or flared and using it for energy production reduces air pollutant emissions. Better control systems can reduce pollutant emissions and increase reliability, as well as provide energy savings.

Political and Other Considerations

The oil and gas sector is an important industry in New Mexico. The industry should support the proposals outlined above as long as the policies and programs are well-designed and address the needs and issues that oil and gas producers and processors face. Utilities should support this option too as it will help them meet their energy efficiency goals (see Option 1 above).

Priority

Given the importance of this sector, we recommend that this option be viewed as a **high priority.**

Chapter V – Public Sector Policies

Option 13: Adopt Energy Efficiency Requirements for Public Colleges and Universities and Extend the Requirements for State Buildings (Partially Adopted)

Background

State-owned or leased Executive Branch agency buildings consumed about 118 GWh of electricity and 0.43 million decatherms of natural gas as of 2005.[114] Governor Richardson's Energy Efficiency Executive Order calls for state agencies to "Lead by Example," and mandates that Executive Branch state agencies reduce their total energy use per square foot of floor 20 percent by 2015, relative to energy use per square foot in 2005.[115] The General Services Department was directed to develop an implementation plan for this directive.

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.[116] 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.[117]

Limited capital and 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.[118] For example, performance contracting and use of ESCOs has been an important strategy for upgrading public sector energy efficiency in Colorado.[119, 120]

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[114] New Mexico State Government Reducing Energy Use in Buildings – Twenty-Percent Reduction by 2015. Draft July 11, 2008.
[115] See Reference 1.
[116] Executive Order: *Strengthening Federal Environmental, Energy, and Transportation Management*, January 24 2007. http://www.whitehouse.gov/news/releases/2007/01/20070124-2.html. The Executive Order also has requirements for state-owned vehicles, but they are not addressed here.
[117] *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.
[118] 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.
[119] 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.
[120] 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.

Specific Energy Efficiency Proposal

This policy assumes compliance with the energy intensity reduction requirements in the 2007 Executive Order. In addition, we propose adopting the same requirements for public colleges and universities as well as non-Executive Branch state buildings, and requiring an additional 10 percent reduction in energy use per square foot of floor area for all agencies and higher education facilities during 2016-2025. Public colleges and universities are not covered under the current Executive Order. Furthermore, we suggest requiring state agencies and higher education institutions to purchase ENERGY STAR products. The additional energy efficiency requirements could be established either through an Executive Order or through legislation.

In order to achieve the requirements and go beyond them post-2015, 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 New Mexico's electric and natural gas companies.[121]

3. Issuing clean energy revenue bonds to finance energy efficiency projects in state facilities under the authority provided by the Energy Efficiency and Renewable Energy Bonding Act.

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

5. ENERGY STAR product purchase requirements.

6. 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.[122]

7. 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.

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

[121] Note that energy savings resulting from utility DSM programs were not analyzed in this option.
[122] 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.

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

Energy Savings

Table 17 presents our estimates of energy savings in state facilities from meeting the recommended efficiency requirements. In making these estimates we assume that other state buildings and higher education buildings in the public sector (that is, not privately owned universities and colleges) also meet the energy savings requirements in the Governor's Executive Order. We estimate that doing so would result in electricity savings of 57 GWh and natural gas savings of 0.19 million decatherms per year in 2015. The savings grow to 78 GWh and 0.25 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.

Table 17 – 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 $)
2008	5	0.02	0.6
2009	10	0.04	1.2
2010	15	0.05	1.8
2011	22	0.08	2.6
2012	**29**	**0.10**	**3.4**
2013	38	0.13	4.4
2014	47	0.16	5.4
2015	**57**	**0.19**	**6.5**
2016	61	0.20	7.0
2017	65	0.21	7.5
2018	69	0.23	8.0
2019	73	0.24	8.4
2020	**78**	**0.25**	**9.0**
2021	83	0.26	9.5
2022	87	0.27	10.1
2023	92	0.29	10.6
2024	97	0.30	11.2
2025	**103**	**0.31**	**11.8**

1 - Undiscounted values.

Cost and Cost Effectiveness

We estimate that the State agency energy efficiency requirements would cut energy costs by about $6.5 million in 2015, $9 million in 2020, and $12 million in 2025 (undiscounted values). Assuming an average payback period of seven years, $45 million would be invested in energy efficiency measures during 2008-2020 to meet the energy intensity requirements; that is, $4 million per year on average (discounted net present value). Assuming an average measure lifetime of 20 years, the net economic benefit associated with efficiency measures installed during 2008-2020 would be $36 million (discounted net present value basis).

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 18 shows the estimated emissions reductions in 2015, 2020, and 2025. The reductions provide environmental benefits including reduced contribution to global warming due to lower CO_2 emissions, improved air quality, and reduced regional haze that impacts New Mexico's scenic areas.

Political and Other Considerations

With the adoption of Governor Richardson's Executive Order on energy efficiency and the success of energy intensity reduction requirements for federal agencies, the state is well-positioned to truly "lead by example" on energy efficiency. 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. Many colleges and universities in New Mexico are voluntarily embracing energy efficiency and sustainability goals.[123]

Table 18 – Estimated Emissions Reductions from State Agency Energy Efficiency Improvements

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	48	66	86
SO_2 (short tons)	2.6	3.5	4.6
NOx (short tons)	16.0	21.8	28.8
Mercury (pounds)	0.2	0.3	0.4

[123] As of November 2008, signatories to the American University Presidents Climate Commitment include the University of New Mexico, New Mexico State University, Northern New Mexico College, Central New Mexico Community College, and Santa Fe Community College. http://www.presidentsclimatecommitment.org.

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. Given that Governor Richardson already issued an Executive Order with mandatory energy intensity reduction requirements for Executive Branch state agencies, we view extending the requirements to other state buildings and to public colleges and universities as a **high priority**.

Case Study 7: New Mexico Villagra Building

The Villagra Building is owned by the State of New Mexico and is home to the office of the New Mexico Attorney General. The building, originally built in 1934 as the Public Welfare Department, was the first building constructed with New Deal money in New Mexico and is listed in the State Register of Cultural Properties.

In 2004, a complete retrofit of the existing building was undertaken in conjunction with a new addition to the complex. The retrofit of Villagra Building was the first project in New Mexico to achieve LEED Gold level certification. The building design incorporates many energy efficiency measures:

- HVAC System
    - Four-pipe fan coil HVAC system has Energy Recovery Units which capture waste hear from ventilation system
    - Variable speed drives on ventilation system
    - Occupancy sensors turn off heating or cooling when a room is unoccupied
    - "Economizer" mode available to use 100% outside air when temperature and humidity permits this
    - Direct Digital Control system controls room temperature and ventilation and responds to CO2 sensors to modulate air supply
    - High efficiency boiler
- Lighting
    - Daylighting system includes auto-dimming feature when daylight is sufficient
    - Occupant sensors switch off lights when a room is unoccupied
- Building Envelope
    - R-30 roof achieved by adding insulation to top floor ceiling interior
    - R-11 insulation added to exterior concrete walls
    - Original 1934 double hung single glazed windows' thermal performance was enhanced with high-tech ceramic film while retaining historic character

QUICK FACTS:

- **Retrofit certification level**: LEED-CI Gold
- **Energy performance**: 31% better than ASHRAE 90.1-2004
- **Carbon dioxide emissions reduction**: 58,000 lbs per year

Option 14: Support Energy Efficiency Improvements by Local Governments and K-12 Schools (Partially Adopted)

Background

Municipal governments and school districts in New Mexico have taken a number of steps to increase energy efficiency and their lower energy bills. The City of Albuquerque, under the leadership of Mayor Martin Chavez, has retrofitted a number of its buildings. Albuquerque is also constructing energy-efficient new buildings that qualify as LEED buildings. In 2006, Albuquerque adopted a policy to set aside 3% of bond revenues for energy efficiency and renewable energy projects.[124]

The state has started a Clean Energy Fund which provides co-funding for energy efficiency and renewable energy projects implemented by local governments, school districts and Indian Tribes. Using this Fund, the state has provided co-funding of over $670,000 for energy efficiency projects as of June, 2008. Most of these projects are lighting efficiency upgrades in public schools.

A revolving loan fund (RLF) is another mechanism that can provide needed capital to local governments and school districts for energy efficiency projects. In 2007, Utah established a $5 million RLF for energy efficiency projects implemented in K-12 schools.[125] New Mexico has adopted legislation, the Energy Efficiency and Renewable Energy Bonding Act, which enables the New Mexico Finance Authority to issue revenue bonds in order to finance energy efficiency projects in state and public school facilities. However, the rules guiding this activity have yet to be issued.

Energy service companies (ESCOs) also provide funding for energy efficiency projects in the public sector while guaranteeing energy savings. The public sector market accounted for over 80 percent of the $2.5 billion in energy efficiency projects implemented by ESCOs in 2006.[126] 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 achieve at least 15 percent energy savings in New Mexico's local government and K-12 schools by 2020. This goal could be accomplished through:

1. Requiring local governments and K-12 school districts to adopt and meet energy savings goals modeled on the energy efficiency requirements now in place for state agencies, as a condition for receiving state funds;

[124] For details of Albuquerque's green building efforts, see http://www.cabq.gov/albuquerquegreen/green-goals/green-building.
[125] House Bill 351, Revolving Loan Fund for Certain Energy Efficient Projects, Rep. R. Barrus, http://le.utah.gov/~2007/htmdoc/hbillhtm/HB0351.htm.
[126] See Reference 115.

2. Expanding the Clean Energy Fund in order to provide additional financial support to local governments and school districts;

3. Completing the rules and issuing clean energy revenue bonds to finance energy efficiency projects in public schools under the authority provided by the Energy Efficiency and Renewable Energy Bonding Act; and

4. Hiring 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. A combination of "carrots and sticks" would be used to achieve the savings goals.

Table 19 – 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 $)
2009	14	0.04	1.5
2010	28	0.08	3.0
2011	42	0.12	4.6
2012	**58**	**0.16**	**6.2**
2013	73	0.20	7.9
2014	90	0.25	9.6
2015	**107**	**0.29**	**11.5**
2016	124	0.33	13.4
2017	142	0.38	15.3
2018	161	0.43	17.3
2019	181	0.47	19.4
2020	**201**	**0.52**	**21.6**
2021	222	0.57	23.9
2022	243	0.62	26.2
2023	266	0.67	28.6
2024	289	0.72	31.1
2025	**312**	**0.77**	**33.6**

1 - Undiscounted values.

Energy Savings

We assume that public schools and local government buildings account for about 12 percent of total electricity and natural gas use by commercial buildings in New Mexico. In evaluating this option, we assume that 1.25 percent of projected energy consumption in local governments and K-12 schools is saved each year, on average, during 2009-2020. As shown in Table 19, this assumption results in 160,000 decatherms of natural gas and 58 GWh of electricity savings per year by 2012. The savings grow to 520,000 decatherms of natural gas and 201 GWh of electricity per year by 2020. The energy savings are in addition to savings resulting from utility DSM programs and energy codes.

Cost and Cost Effectiveness

The cost to the State for implementing this option through 2020 is approximately $22 million, or about $2 million per year on average. This includes appropriations of $20 million for either the Clean Energy Fund or for Clean Energy Revenue Bonds, along with a new state position to support implementation of the policy. We estimate that approximately $10-15 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 20% of this, or $2-3 million per year, be provided by the Clean Energy Fund or via revenue bonds. Financing for additional efficiency projects could come from ESCOs, municipal bonds, or other funds available to local governments and school districts.

We assume that projects will have an average payback period of seven years, based on the experience of energy efficiency projects implemented by ESCOs throughout the country.[127] The value of the energy savings statewide reaches over $11 million in 2015 and nearly $22 million in 2020 (undiscounted). Assuming efficiency measures have a 20-year lifetime on average, the net economic benefits from efficiency projects implemented during 2009-2020 is $84 million (discounted net present value).

Environmental and Social Benefits

Table 20 shows the estimated emissions reductions in 2015, 2020, and 2025. The environmental benefits from these emissions reductions include reduced contribution to global warming, improved air quality, and reduced regional haze.

Table 20 – Estimated Emissions Reduction in Local Government and K-12 Schools

Pollutant	Avoided Emissions in 2015	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	87	163	250
SO_2 (short tons)	4.8	9.0	14.0
NOx (short tons)	30.0	56.3	87.4
Mercury (pounds)	0.4	0.8	1.2

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 (for example, hire more teachers or spend more on other public sector efforts). Additionally, well-designed, energy-efficient school buildings improve the learning environment and student

[127] 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, August.

performance. In particular, high-quality daylighting in schools is associated with students achieving higher scores on standardized tests, as measured through sophisticated statistical analyses.[128]

Political and Other Considerations

School districts and local governments may not support this policy if energy savings is a prerequisite for receiving state funds. On the other hand, stakeholders such as contractors and ESCOs should support it. Another obstacle is likely to be the additional appropriation for the Clean Energy Fund or Clean Energy Revenue Bonds. In case expanding the Clean Energy Fund or issuing revenue bonds 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 and local funds. Also, the savings requirements could be relaxed if additional financial support from the state is not provided.

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 funding by the state government could be problematic. We recommend that this option be viewed as a **medium priority**.

[128] 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.

Case Study 8: Roswell Independent School District

Roswell Independent School District began an ambitious energy efficiency program in 2004. The school district made the decision to work aggressively to reduce energy costs (the second largest budget line item in the district) in order to provide more money for teacher salaries and student supplies. The Superintendent of Schools set the direction and goals for the program, and provided substantial leadership and funding to implement the program.

The school district contracted with Energy Education, Inc. to design and assist in the implementation of the plan. To date, 46 months into the program, the school district has already realized almost $1 million in energy cost savings and forecasts net savings of over $2.8 million by 2014. Total program cost, including equipment, installation and consultants, was about $500,000.

The district wide program covers the 23 schools and 7 other buildings (administration, warehouses, etc.) owned by the School District. In the first two years of the program, many energy savings measures and policies have been implemented:

- Energy management and control systems
- Replacement of boiler and chillers with rooftop HVAC units allowing zonal heating and cooling control
- Delamping overlit areas
- Power management software installed on all computers
- Water heater temperature turn-down
- "Energy Cap" software used for analysis of electric and gas bills to help determine most important areas of focus.

QUICK FACTS:

- **Program start date:** September 2004
- **Program consultant:** Energy Education, Inc.
- **Program cost:** $500,000
- **Energy cost savings to date (as of August 2008):** $929,000

Option 15: Implement Energy Efficiency Education in K-12 Schools (Partially Adopted)

Background

Educating New Mexico'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 actions taken at home, 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 (NEED) 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.*[129]

In New Mexico, BP is partnering with the NEED Project to support energy education in public schools. This effort, known as "A+ for Energy" was launched in 2007 and provides curriculum materials, teacher training, and other creative activities focused on energy and conservation education in K-12 classrooms.[130] While this voluntary effort is noteworthy, 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.

In addition, the utility SPS is implementing the LivingWise program as part of the initial set of DSM programs approved in 2008. This program combines classroom activities with distribution of energy conservation kits. SPS estimates the program will have a benefit-cost ratio of 2.33.[131] If the program is successful, it should be replicated by other utilities in the state as part of DSM programs as well as energy education efforts.

Specific Energy Efficiency Proposal

This proposal consists of five recommendations to expand energy education in New Mexico's schools. These recommendations overlap and dovetail with other policy options presented, most notably Option 1 and Option 23.

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 science and other curriculum taught in many grades.

[129] National Energy Education Development Project, 2006 Annual Report, accessible online: http://www.need.org/needpdf/NEEDAnnualReport.pdf (accessed March 2007).
[130] For more information on this program, see http://findarticles.com/p/articles/mi_m5CNK/is_2007_Jan_11/ai_n24998857/print?tag=artBody;col1
[131] See Reference 5.

2. Allocate $200,000 per year for two years to develop and implement an energy efficiency education program for New Mexico's public schools. Free or low-cost materials and teacher training programs are available from organizations such as the National Energy Foundation (NEF) and Alliance To Save Energy (ASE).

3. Direct the New Mexico Public Education Department (PED) to incorporate energy efficiency modules into the state's core curriculum. Partnerships with key organizations (such as NEF and ASE), state agencies (such as ECMD), and utilities could help to ensure that Utah's teachers have adequate resources to effectively implement this directive.

4. Implement the LivingWise program throughout the state as part of utility DSM programs if the initial program sponsored by SPS proves to be practical and cost effective.

5. Establish an ongoing funding mechanism that will ensure the program's viability into the future. The PED could require that a percentage of the money saved through energy efficiency projects in school districts (say 5 percent) be dedicated to curriculum development and teacher training. Alternatively, a portion of the Clean Energy Fund could be dedicated to energy efficiency and conservation education 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 23.

Cost and Cost Effectiveness

Given that energy efficiency curriculum has already been created and successfully implemented in other states, the cost to tailor this model curriculum to meet the needs of New Mexico's public schools would be relatively minimal. We estimate that approximately $400,000 ($200,000 per year for two years) would be needed to create a New Mexico-specific curriculum and begin implementing the curriculum.

The overall cost-benefit ratio of educating New Mexico'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.

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 16: Increase Fuel Economy Standards for Cars and Light Trucks (Adopted)

Background

A federal program of Corporate Average Fuel Economy (CAFE) standards for cars and light trucks was established in 1975, resulting in a rapid rise in fuel economy until 1987-1988. New vehicle fuel economy then declined gradually as vehicles grew larger and more powerful, and efforts to keep raising the standards stalled. In recent years, high fuel prices, energy security concerns, and greater awareness of global warming led to a renewed sense of urgency regarding car and light truck fuel economy. The stalemate on raising CAFE standards was finally broken in federal energy legislation enacted at the end of 2007. The legislation included a major increase in the CAFE standards, as described below.

Specific Energy Efficiency Proposal

The 2007 Energy Independence and Security Act (EISA), enacted in December 2007, established a CAFE standard of 35 miles per gallon for cars and light trucks combined by 2020, a 40 percent increase over today's fuel economy standard. Each manufacturer will need to meet an average fuel economy requirement that reflects the mix of vehicles it sells. Fuel economy targets for smaller vehicles will be more stringent that those for larger vehicles. This policy will significantly reduce gasoline use in all states, including New Mexico.

Gasoline savings in New Mexico, which can be attributed to the increase in fuel economy standards to 35mpg by 2020, are shown in Table 21. Gasoline savings amount to 3,113 barrels per year by 2020 under the new CAFE regulations, a 10.7 percent savings over gasoline consumption projected under business-as-usual conditions. Gasoline savings grow to 4,992 barrels per year by 2025, a 16.6 percent reduction compared to gasoline consumption in our baseline scenario.

Cost and Cost Effectiveness

The economic costs and benefits of the increase in CAFE standards are subsumed in the next option, Clean Car Standards, where we analyze the costs and benefits of the combined measures. For this analysis, we assume that the retail price of gasoline remains level at $4 per gallon (in constant 2007 dollars). Continuing high gasoline prices will have a significant impact on the average number of miles driven per household. In our base case scenario we assume that the number of vehicle-miles traveled (VMT) per capita will remain constant, a substantial departure from past trends. That is, we assume that VMT growth during 2007-2020 is limited to the roughly 18 percent population growth forecast for New Mexico during this period. This assumption about VMT growth affects the energy savings and cost effectiveness of the increase in CAFE standards.

Table 21 –Fuel Savings in New Mexico due to 2007 CAFE Standards Amendments

Year	Percent Gasoline savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (billion Btu per year)
2010	0.2	42	218
2011	0.6	152	790
2012	**1.3**	**346**	**1,807**
2013	2.2	620	3,231
2014	3.3	921	4,804
2015	**4.2**	**1,188**	**6,197**
2016	5.3	1,499	7,818
2017	6.5	1,851	9,653
2018	7.8	2,240	11,681
2019	9.2	2,662	13,881
2020	**10.7**	**3,113**	**16,235**
2021	12.1	3,540	18,463
2022	13.4	3,944	20,569
2023	14.6	4,321	22,536
2024	15.6	4,670	24,355
2025	**16.6**	**4,992**	**26,035**

Environmental and Social Benefits

Total avoided CO_2 emissions follow from the fuel savings given that each gallon of gasoline consumed produces 19.3 pounds CO_2.[132] Thus the updated CAFE standards should reduce CO2 emissions in New Mexico by about 1.14 million metric tons in 2020 and 1.83 million metric tons in 2025. 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. We do not include these emissions reductions in the totals as they may occur outside the state. However, the global greenhouse gas reduction benefits are 27 percent higher than the figures above indicate.

Political and Other Considerations

The auto industry initially supported the 2007 energy legislation including the strengthened fuel efficiency standards. In April 2008, the National Highway Traffic Safety Administration (NHTSA) proposed the first set of specific requirements under the new legislation. The draft rules call for a 4.5 percent annual increase in the standards during 2011-2015, raising the standards for cars to 35.7 mpg and for light trucks to 28.6 mpg by 2015. These values in combination are about 26 percent higher than current fuel economy standards for cars and light trucks combined. Energy efficiency advocates support the NHTSA proposal, but the U.S. auto industry claimed the proposal was too aggressive and would harm U.S. auto

[132] Based on fuel carbon content in M. Wang "GREET 1.6", Argonne National Laboratory, Argonne, IL. http://www.transportation.anl.gov/modeling_simulation/GREET/publications.html.

manufacturers.[133] NHTSA is expected to publish final fuel economic requirements for 2011-2015 in the near future.

Priority

This policy is already federal law. Therefore, we do not assign it a priority.

[133] "UCS Says Auto Industry Backing Away from CAFE Commitment." Union of Concerned Scientists, Cambridge, MA, July 3, 2008. http://enewsusa.blogspot.com/2008/07/ucs-says-auto-industry-backing-away.html

Option 17: Adopt Clean Car Standards for New Cars and Light Trucks (Partially Adopted)

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.[134] Fourteen states have adopted Clean Car Standards 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: Arizona, California, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Rhode Island, Vermont, and Washington. 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. 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. In fact, the Clean Car Standards would improve the efficiency of vehicles in New Mexico beyond what is required to meet the new CAFE standards.

States adopting Clean Car Standards 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 Standards discussed here.

New Mexico's implementation of the program will 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 New Mexico previously followed. Phase-in of the current rounds of both the federal program ("Tier 2") and the California program ("LEV II") 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.

Specific Energy Efficiency Proposal

New Mexico's adoption of Clean Car Standards means that new vehicles sold in the state by each manufacturer would need to meet, on average, the requirements shown in Table 22 for GHG

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

emissions. The standards divide vehicles into two categories; larger vehicles are allowed higher emissions than smaller vehicles.

Table 22 – Clean Car Standards for Greenhouse Gas Emissions, 2009-2020

	Year	CO_2-equivalent emissions standard (g/mi)	
		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
Long-term (not yet adopted)	2017	195	310
	2018	185	285
	2019	180	270
	2020	175	265

Source: California Air Resources Board[135]

Despite the recent passage of higher light-duty CAFE standards, many consumers and policymakers are still eager to see the more stringent California emissions criteria implemented nationwide. In addition to increasing efficiency faster in the near term than the new CAFE standards do, the Clean Car Standards will continue to rise after 2016. California has indicated its intention of extending the GHG standards to levels that would raise average fuel economy to at least 40 mpg by 2020.[136] The option as proposed for New Mexico will require manufacturers to meet the additional long-term emission standards for vehicle model years 2017-2020 shown in Table 22.

Energy Savings

Table 23 shows the energy savings from the Clean Car Standards, assuming that the updated CAFE standards (Option 16) are met and that we are only considering the incremental savings from the more stringent Clean Car Standards here. In addition, we assume that manufacturers will meet the greenhouse gas emissions requirements of the Clean Car Standards entirely by adding efficiency technologies to their vehicles. Table 23 shows that the Clean Car Standards will result in nearly 1.0 million barrels per year of gasoline savings by 2020 and about 1.7 million barrels per year by 2025. In the absence of the updated CAFE standards, the energy savings from the Clean Car Standards would be about four times greater.

[135] Fact Sheet: Climate Change Emissions Control Regulation. Available at http://www.arb.ca.gov/cc/factsheets/cc_newfs.pdf.
[136] Comparison of Greenhouse Gas Reductions under CAFÉ Standards and ARB Regulations Adopted Pursuant to AB1493, CARB 2008

Table 23 – Light-Duty Vehicle Fuel Savings in New Mexico from Adoption of Clean Car Standards

Year	Percent Gasoline savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (billion Btu per year)
2011	0.2	50	263
2012	**0.6**	**129**	**669**
2013	1.0	160	836
2014	1.2	193	1,008
2015	**1.5**	**247**	**1,287**
2016	1.8	302	1,574
2017	2.5	425	2,216
2018	3.3	603	3,147
2019	4.2	784	4,089
2020	**5.0**	**965**	**5,031**
2021	5.8	1,138	5,935
2022	6.5	1,303	6,794
2023	7.2	1,459	7,607
2024	7.9	1,606	8,375
2025	**8.4**	**1,745**	**9,098**

Cost and Cost-Effectiveness

The analysis of the cost for meeting the Clean Car Standards is based on an analysis of existing and emerging vehicle efficiency technologies that could be applied cost-effectively to new vehicles. The assessment assumed that the distribution of vehicles among size classes will not be affected by implementation of the standards. As noted above, the cost effectiveness analysis presented here covers fuel economy improvements due to both the updated CAFE standards and the state-sponsored Clean Car Standards, in combination.

In California, 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 $277-367 by 2012 and about $1,000 by 2016. We extrapolate these costs to $1,500 by 2020. Using these cost estimates and using vehicle sales projections for New Mexico from Moody's Economy.com, we estimate that the Clean Car Standards (in combination with the updated CAFE standards) will lead to an investment in vehicle efficiency totaling $606 million in the period 2009-2020, on a discounted net present value basis in 2007 dollars.

The resulting savings in fuel costs over the lifetime of these vehicles (on average 15 years) would equal about $3.7 billion on a net present value basis, given our assumption that gasoline prices remain at $4 per gallon. This results in a net economic benefit of $3.1 billion (2007 dollars) over the life of the vehicles purchased in 2009-2020. Here, fuel savings exclude state gasoline tax (18.9 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. Additional net benefits result from more efficient new vehicles purchased from 2020 onwards. In fact, the bulk of the savings occur after 2020, because the standard reaches its maximum in 2020 and the new, efficient vehicles penetrate the vehicle stock gradually over the following fifteen years.

Environmental and Social Benefits

The Clean Car Standards require reductions in vehicle greenhouse gas emissions. Carbon dioxide is the primary GHG associated with vehicles. Total avoided CO_2 emissions follow from the fuel savings given that each gallon of gasoline consumed produces 19.3 pounds CO_2.[137] Emissions of CO_2 are reduced by 353,000 metric tons in 2020 and 640,000 metric tons in 2025, considering the incremental fuel savings from the Clean Car Standards after the impact of updated CAFE standards are taken into account. As noted above, there is another 5.2 pounds CO_2-equivalent of “upstream” emissions in the production and distribution each gallon of the fuel, which we do not include in the totals. Thus, total global greenhouse gas reduction benefits are 27 percent higher than the figures above indicate.

Because adoption of the Clean Car Standards would include adoption of California’s 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.[138] Similar benefits in New Mexico would mean a reduction of about 1,774 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 Standards for greenhouse gases.

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 California vehicle standards. New Mexico is in attainment for the EPA’s CO and NOx standards, but has non-attainment designations for PM_{10}.[139]

Political and Other Considerations

New Mexico voted to adopt the Clean Car Standards in November 2007, but the path to implementation has been fraught with difficulties. Auto dealers and manufacturers challenged the Clean Car Standards, as set by California and adopted by thirteen other states, in federal court on the grounds that CAFE standards preempt state actions to regulate vehicle emissions of greenhouse gases. The court found that California had the right to set such standards. However, California’s request for a waiver from EPA allowing the adoption of air pollution standards more stringent than federal standards was denied in February of 2008, bringing the implementation

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137 Based on fuel carbon content in M. Wang “GREET 1.6”, Argonne National Laboratory, Argonne, IL.
138 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.
139 http://www.epa.gov/oar/oaqps/greenbk/ancl3.html.

process to a stand-still. The EPA waiver denial was followed by a lawsuit on the part of affected states that has yet to be resolved.

Priority

Because this option has already been adopted in New Mexico, we do not assign it a priority. We note however that the benefits shown here depend upon continuing improvement in the Clean Car Standards beyond 2016, which have not yet been adopted.

Option 18: Adopt Incentives to Stimulate Purchase of More Efficient Cars and Light Trucks (Not Yet Adopted)

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. 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. 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, including New Mexico.

A comprehensive, market-based approach to promoting vehicle efficiency is a "feebate," a system of surcharges and rebates based on vehicle fuel economy and applied 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," so that the implementing entity incurs no net cost or revenue. An advantage of feebates over fuel economy standards 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, but none of these programs reached the implementation stage, for a variety of legal and political reasons. In its last two legislative sessions and in a regulatory context, California has once again been considering a feebate program, based this time on greenhouse gas emissions. Both France and Canada now have feebates in place and have reported positive effects on car manufacturing and purchasing decisions.[140]

Specific Energy Efficiency Proposal

This policy would establish a feebate program for new cars and light trucks sold in New Mexico. The simplest form for a feebate 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 (the feebate "rate" in dollars per gallon consumed relative to the baseline).

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.[141] Under this feebate, a vehicle with a fuel economy of 35 miles per gallon, for example, would receive a rebate of

$$\$1,000 \times (100/21 - 100/35) = \$1,900$$

[140] See http://www.lowcvp.org.uk/news/985/french-government-declares-car-feebates-system-a-success/ and http://www.theglobeandmail.com/servlet/story/LAC.20071210.RAUTOS10/TPStory/Business.

[141] According to the EPA, the national average on-road ("adjusted") new vehicle fuel economy for 2007 was 20.6 miles per gallon. See http://www.epa.gov/otaq/cert/mpg/fetrends/420r08015.pdf.

Similarly, a vehicle with a fuel economy of 15 miles per gallon would pay a fee of $1,900. These examples fall toward the ends of the fuel economy spectrum; most vehicles would receive a rebate or fee of under $1,500.

The feebate would go into effect in 2009. 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.

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 in the U.S. 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.[142] 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 (that is, 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 might 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 program could still improve efficiency because in the absence of a manufacturer response consumers will have substantial incentive to switch to more efficient existing 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.[143] 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 New Mexico 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 New Mexico-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.

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[142] 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.

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

The model also predicts that if New Mexico 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 7.6 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 this increase in new vehicle fuel economy due to a multi-state program on the entire vehicle stock gives the results shown in Table 24.

Table 24 - Savings from a Multi-State Feebate Program

Year	Percent Gasoline savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (billion Btu per year)
2009	0.2	48	249
2010	0.5	109	571
2011	0.8	184	960
2012	**1.2**	**289**	**1,507**
2013	1.6	390	2,036
2014	2.0	492	2,565
2015	**2.3**	**589**	**3,071**
2016	2.7	680	3,545
2017	3.0	767	4,002
2018	3.3	851	4,440
2019	3.6	929	4,846
2020	**3.9**	**1,002**	**5,227**
2021	4.1	1,069	5,576
2022	4.3	1,130	5,893
2023	4.5	1,186	6,183
2024	4.6	1,236	6,447
2025	**4.8**	**1,282**	**6,688**

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 New Mexico joins 25 percent of the U.S. vehicle market in adopting a feebate, the cost of this added vehicle efficiency totals $242 million in the period 2009-2020, on a present value basis.

The resulting savings in fuel costs (again, exclusive of state tax) over the 15-year life of these vehicles would be $1.2 billion (present value). Net economic benefits of the feebate would then be $865 million (2007 dollars) over the life of the vehicles purchased in 2009-2020.

Additional net benefits, not reflected here, result from more efficient new vehicles purchased during 2021-2025.

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 411,000 metric tons per year by 2020 and 527,000 metric tons per year by 2025.

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 lower 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 NOx and PM emissions. On balance, it seems likely that average emissions of regulated pollutants are likely to decline as a result of a feebate. But ensuring this outcome would require adding an emissions-based criterion to the feebate, something we have not done here.

Political and Other Considerations

A feebate would be a useful complement to Clean Car Standards (Option 17). Auto manufacturers assert that standards for fuel economy and greenhouse gas emissions distort the market, given the limited role these matters have played in consumers' vehicle choices in recent years. Feebates help to align consumer interests with more stringent vehicle standards.

In addition, given the legal and regulatory obstacles that have arisen to the implementation of Clean Car Standards as described above, feebates can provide an interim alternative to ensure continued progress toward cleaner vehicles as those obstacles are resolved. States that have already adopted the Clean Car Standards comprise over 25 percent of the U.S. vehicle market, consistent with the multi-state feebate scenario discussed above.

The legality of state feebates has been challenged in the past. The U.S. Department of Transportation advised Maryland that the feebate the state adopted in 1992 was in violation of federal law, based partly on preemption of federal fuel economy standards and on vehicle labeling requirements. It seems likely that feebates could be designed to avoid these conflicts today, however, especially given the option of defining the program in terms of vehicles' greenhouse gas emissions, rather than fuel economy.

As a market-based, self-funding measure, a feebate may also appeal to some 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. In addition, increasing the number of vehicle classes will reduce the fuel economy gains from the feebate, though in the multi-state feebate scenario, the reduction in energy savings will be small.

Other departures from the simple feebate structure discussed above may be advanced as a feebate program is publicly vetted. In other states, exempting work trucks has been proposed, for instance. Rather than changing the structure to accommodate concerns of various interest groups, we suggest that mitigation measures outside of the basic structure be considered to offset any inequitable outcomes.

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 19: Adopt Pay-As-You-Drive Auto Insurance (Not Yet Adopted)

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; that is, 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. Converting fixed insurance costs to variable costs through PAYD insurance could reduce vehicle use by 10-12 percent, according to some analysts.[144]

The 2005 federal transportation funding law, known as "SAFETEA-LU," includes a $3-million-per-year set-aside for experimental, market-based incentive programs like PAYD insurance. Several states have already applied for funding.[145]

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 Insurance offers a mileage-based discount in Arizona, Indiana, Illinois, and Pennsylvania. 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. A new company, known as MileMeter, provides mileage-based insurance in Texas and is interested in doing the same in other states.[146] 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.[147]

Specific Energy Efficiency Proposal

This policy would phase in PAYD insurance in New Mexico, starting with a pilot program. For three years beginning in 2009, New Mexico 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 80 percent or more of the pre-program policy cost is scaled by

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[144] 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**.**
[145] Environmental Defense, *Pay-As-You-Drive Auto Insurance.* http://www.environmentaldefense.org/article.cfm?contentid=2205.
[146] See https://www.milemeter.com.
[147] 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).

the ratio of annual miles driven in the covered vehicle to average annual miles driven. The incentive is necessary so long as PAYD is optional, because 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.

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 (that is, 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 medium-term elasticity of driving with respect to gasoline price; that is, over 5-10 years, we assume there is a 1 percent reduction in driving for a 5 percent increase in gasoline price.[148] At $4.00 per gallon, gasoline for an automobile having the average on-road fuel economy of 20.3 miles-per-gallon costs 19.7 cents per mile.[149] The cost of the average insurance policy in New Mexico in 2005 was $727, and we assume vehicles in New Mexico are driven 12,000 miles per year on average.[150] This means an average insurance cost of 6.1 cents per mile.

If 80 percent of the cost of the insurance premium were charged on a per-mile basis, the average cost per mile would then be 4.8 cents per mile, about 24 percent of the per-mile cost of fuel. This would have an effect comparable to a 24 percent increase in fuel price. The assumed price elasticity of travel of -0.2 implies a corresponding reduction in driving of 4.3 percent.

The program proposed here begins with a 3-year pilot program subsidized by the state, for which we set goals of 2,000 PAYD policies in 2009, 10,000 policies in 2010, and 20,000 policies in 2011. A mandatory program would then be phased in over the next ten years, resulting in a 4.3 percent reduction in car and light truck energy use by 2020. Table 25 presents the projected impacts by year.

148 See, for example, 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.
149 *Annual Energy Outlook 2008*. Energy Information Administration, Washington, DC. Table A-7. http://www.eia.doe.gov/oiaf/aeo/pdf/tables.pdf.
150 Insurance rates from Bureau of Labor Statistic http://data.bls.gov.

Table 25 – Estimated Impacts of a Mileage-Based Pay-As-You-Drive Insurance Program

Year	Percent Reduction in VMT	Gasoline Savings (thousand barrels/year	Gasoline savings (billion Btu/year)
2009	0.01	3	16
2010	0.06	15	79
2011	0.13	30	159
2012	**1.00**	**244**	**1,274**
2013	1.40	345	1,800
2014	1.80	448	2,336
2015	**2.20**	**551**	**2,876**
2016	2.60	656	3,419
2017	3.00	761	3,971
2018	3.40	869	4,531
2019	3.80	978	5,100
2020	**4.20**	**1,089**	**5,681**
2021	4.30	1,124	5,860
2022	4.30	1,132	5,902
2023	4.30	1,140	5,946
2024	4.30	1,149	5,993
2025	**4.30**	**1,159**	**6,043**

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 2009, $1.8 million in 2010, and $3.5 million in 2011 assuming the goals are met. The total present value of these costs (2007 dollars) is $5.7 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 2020, although one could argue that once the policy is fully established, it continues to provide the full benefit of a 4 percent fuel cost reduction for every year thereafter. PAYD policies written during 2008-2020 would save $593 million. Net benefits are therefore $587 million. We do not attempt to quantify savings to the state on 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 a few 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. Reductions in CO_2 follow directly from gasoline savings, yielding 447 thousand tons in 2020 and 476 thousand tons in 2025. For criteria pollutants as well, emissions reductions will be roughly proportional to the reduction in miles driven. New Mexico's 2002 emissions inventory shows light-duty emissions of 15,032 tons per year of NOx and 40,294 tons of hydrocarbons. Using extrapolations of NOx and hydrocarbons that reflect the decline in tailpipe emissions due to the federal Tier 2 Program, we arrived at estimates for light-duty NOx and hydrocarbon emission for the state in 2020 and 2025. Multiplying by the percent reduction in vehicle miles traveled brought about by PAYD insurance yields the emissions reduction estimates in Table 26.

Table 26 – Estimated Emissions Reduction from Pay-As-You-Drive Insurance

Pollutant	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	447	476
Hydrocarbons (short tons)	497	356
NOx (short tons)	137	91

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.[151] 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 here.[152]

Some stakeholders express concerns that rural and/or poorer people would be disadvantaged by the adoption of PAYD insurance in New Mexico. On a national level, low-income drivers actually drive less on average than do high-income drivers. In 2001, households (with vehicles) that earned $75,000 per year or more drove 31,900 miles on average, while those that earned $25,000-$35,000 drove 19,300 miles on average.[153] Thus PAYD insurance would be more equitable, on average, than the current means of setting insurance rates, and could reduce the number of uninsured motorists. Whether or not these national statistics apply in New Mexico warrants further investigation.

In individual cases, 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. With regard to the issue of high driving rates in

[151] 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.
[152] *Texas Mileage Study: Relationship Between Annual Mileage and Insurance Losses*. Progressive Insurance. December, 2005. http://www.nctcog.org/trans/air/programs/payd/PhaseI.pdf.
[153] *Household Vehicles Energy Use: Data Tables*. Energy Information Administration. www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/tablefiles/page_a02.html

rural areas, it should be noted that insurance rates under PAYD could be determined by miles driven relative to other drivers in the same region, rather than relative to state averages.

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 embraced the concept. 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.

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.

An alternative approach to reducing VMT through monetary incentives would be increasing the state gas tax. New Mexico's gas tax stands at 18.9 cents per gallon. As noted above, PAYD insurance would in effect increase the variable cost of driving by 4.8 cents per mile. Achieving the same result by raising the gas tax would require an increase of nearly $1 per gallon , which would not be popular with the general public.[154] Also, a gas tax increase, unlike PAYD insurance, would increase the tax burden in aggregate unless offset by reductions in other taxes such as income tax.

Priority

PAYD insurance and other transportation pricing measures are important strategies for reducing vehicle fuel use and helping to meet the Governor's energy efficiency goals. PAYD would also provide ancillary benefits, including less traffic congestion, fewer vehicle accidents, and greater equity with respect to insurance premiums. In recognition of the resistance often met by pricing proposals, we recommend implementation of this policy as a **medium priority.**

[154] A gas tax increase of $1 per gallon would in fact reduce fuel consumption by more than a PAYD policy, 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 20: Reduce Vehicle-Miles Traveled through Improved Transportation and Land Use Planning (Not Yet Adopted)

Background

New Mexico's population is expected to grow at an average rate of about 1.3 percent per year between 2007 and 2020, about the same as the U.S. as a whole.[155] In 2004, based on economic and other conditions at the time, the New Mexico Department of Transportation (DOT) predicted that VMT would grow by 55% between 2002 and 2025—growth largely spurred by the dispersion of new development and rising incomes, among other factors.[156] In reality, however, the recent rise in gasoline price has led to an overall reduction in driving, reversing VMT trends observed in the last 20 years. VMT growth is now likely to be lower than the rate of 1.95 percent per year forecasted by the DOT in 2004. We assume here that the per-gallon price of gasoline remains at $4 a gallon (in 2007 dollars), and as a result that VMT per capita remains constant in the baseline scenario. This would imply that VMT growth would be limited to the 17.7 percent population growth anticipated for New Mexico between 2007 and 2020.

Even with the slowing of VMT growth due to high and rising fuel prices, further reductions in VMT are possible and desirable in the medium-to-long term. The integration of land use and transportation planning is essential to reducing growth in vehicle-miles traveled. Research has shown that the amount of travel done by households could be greatly reduced through application of "smart growth" principles, which include prioritizing compact, mixed use development and ensuring access to major destinations via walking, biking, and public transit.[157] In the context of high and rising gas prices, many people are eager to take advantage of existing alternatives to driving but find themselves limited by the lack of appropriate public transportation, or housing close to existing amenities and transit options. While land use planning is primarily a function of local governments, the state has a significant role to play in the creation of infrastructure that will enable a further reduction in VMT growth by 2020.

New Mexico is taking some steps to reduce VMT growth, such as the Rail Runner train planned for the Albuquerque-Santa Fe corridor (see Case Study below). Other states are taking strong initiatives to reduce VMT growth. For example, Massachusetts has a suite of programs to promote smart growth, including a Smart Growth Zoning Incentive, which offers municipalities several thousand dollars per residential unit built in any transit-accessible area that has been rezoned to increase density. The Commonwealth Capital program, initiated in 2005, applies several smart growth criteria to municipalities' applications for state funding.

In California, smart growth strategies have been identified as a major component of the state's plans to implement AB32, which requires a 25 percent reduction in greenhouse gas emissions

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[155] Bureau of Business and Economic Research, University of New Mexico

[156] *New Mexico 2025: Statewide Multimodal Transportation Plan*, New Mexico Department of Transportation

[157] Holtzclaw, J., R. Clear, H. Dittmar, D. Goldstein, and P. Haas. 2002. "Location Efficiency: Neighborhood and Socio-Economic Characteristics Determine Auto Ownership and Use: Studies in Chicago, Los Angeles and San Francisco." *Transportation Planning and Technology*, 25 (1). www.tandf.co.uk/journals/online/0308-1060.html.

by 2020. Recently, California passed SB 375, requiring that the Air Resources Board (CARB), in consultation with the Metropolitan Planning Organizations, set regional goals for greenhouse gas emissions from vehicles. Regional transportation plans will need to incorporate a Sustainable Communities Strategy to reflect those goals.[158]

States can also promote reductions in VMT growth in a variety of other ways as well. These include providing funding for infrastructure and incentives for travel by transit, bicycling and walking, as well as incentives to help large employers to form Transportation Management Organizations that encourage telecommuting, four-day work weeks, ridesharing and the expansion of van and carpool programs. States can also "lead by example," ensuring that state facilities are convenient to transit and other modes of travel.

In this section, we define an option in terms of a target for gradually reducing VMT growth statewide over time. This option is not meant to substitute for the many policies, programs and projects that can and should be used at the state and local levels to achieve such a goal. Setting such an target is however a very step to ensure that other efforts to integrate transportation and land use planning and improve transportation alternatives will achieve the desired results, including reductions on energy use.

Specific Energy Efficiency Proposal

This policy proposes that the state use its funding and support programs to reduce VMT per capita in New Mexico by 1 percent annually, beginning in 2011. While local and regional governments would determine how to moderate VMT growth, the state could ensure that the growth goal was met by allocating its resources to projects consistent with transportation plans developed by Metropolitan and Regional Planning Organizations to meet the VMT per capita targets. This represents a significant change in how the State Legislature currently funds transportation improvement projects.

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 reducing growth in VMT. This may affect school and water/wastewater projects, for example.

As part of this proposal, we recommend that the state provide $500,000 per year to local and regional planning organizations for analysis and plan development required to achieve the VMT reduction goals. Funds could be used for a variety of purposes including evaluation of alternatives to car-oriented modes of travel, developing programs to promote public transit use, biking, and pedestrian travel, and promoting transit-oriented development and the LEED for Neighborhood Development approach which fosters Smart Growth.[159]

[158] SB 375 Senate Bill Analysis. http://info.sen.ca.gov/pub/07-08/bill/sen/sb_0351-0400/sb_375_cfa_20080818_153416_asm_comm.html.
[159] LEED for Neighborhood Development. U.S. Green Building Council, Washington, DC. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148.

Energy Savings

We calculate energy savings from implementing our proposal by reducing VMT per capita by 1 percent annually starting in 2011. As show in Table 27, the reduction in VMT and hence energy savings reaches about 2 percent in 2012, 10 percent in 2020 and 15 percent in 2025, relative to the baseline scenario projections.

Table 27 – Savings from Reducing Vehicle Use Per Capita

Year	Percent Reduction in VMT Per Capita	Gasoline Savings (thousand barrels per year)	Gasoline Savings (billion Btu per year)
2009	0.0	0	0
2010	0.0	0	0
2011	1.0	242	1,263
2012	**2.0**	**486**	**2,536**
2013	3.0	732	3,820
2014	4.0	981	5,115
2015	**5.0**	**1,229**	**6,407**
2016	6.0	1,476	7,696
2017	7.0	1,724	8,991
2018	8.0	1,974	10,295
2019	9.0	2,226	11,607
2020	**10.0**	**2,480**	**12,934**
2021	11.0	2,733	14,253
2022	12.0	2,988	15,584
2023	13.0	3,246	16,926
2024	14.0	3,505	18,281
2025	**15.0**	**3,768**	**19,653**

Cost and Cost-Effectiveness

Smart growth can produce substantial cost savings in a wide range of categories.[160] 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 an analysis of different projects and programs that would allow New Mexico to meet these VMT reduction goals, which we do not undertake here.

We recommend that the state provide $500,000 per year to local and regional planning authorities to support achievement of the VMT reduction goals. This results in a cost to the state of $4 million (2007 dollars) during 2009-2020 on a discounted net present value basis. The reduction in fuel costs from reduction of VMT per capita by 1 percent per year and implementation of this policy through 2020, total $3.03 billion (2007 dollars).

[160] See, for example, Transit Cooperative Research Program Report 74, *Costs of Sprawl – 2000.*

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 28 were estimated using the same approach described in the PAYD discussion above.

Table 28 – Estimated Emissions Reduction from Reducing the VMT Growth Rate

Pollutant	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	1,018	1,547
Hydrocarbons (short tons)	1,183	1,242
NOx (short tons)	326	319

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. A modest reduction in VMT can have a major impact on road congestion and trip times during peak driving periods.

Political and Other Considerations

Smart growth and alternatives to driving are crucial components of energy efficiency planning for the transportation sector. Even in a growing state like New Mexico, 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

Due to the potential for large energy savings shown here, as well as the substantial non-energy benefits, we recommend that policy makers view this option as a **high priority.**

Case Study 9: Rail Runner and Transit-Oriented Development

New Mexico's commuter train service, the Rail Runner Express, began operation in 2006 in the Albuquerque area to meet the growing transportation needs of 50 percent of the state's population. With growing congestion on and near I-25, New Mexico is expanding commuter rail service and transit-oriented development (TOD) around train stations. The Mid-Region Council of Governments (MRCOG) is managing these programs on behalf of the State's Department of Transportation.

TOD is an approach to station-area planning that focuses on how land, transportation, and buildings are used and developed in the area within walking distance of a transit center. TOD promotes many of the characteristics of traditional small town centers including:

- Mixed Uses – where residential, commercial, parks and public areas are located near each other
- Housing Choice – a variety of housing options of different sizes, layouts and prices, providing options for local residents
- Local Scale and Style – site and building design and scale that reflect the context of the area and foster a high level of activity and strong community identity
- Compact neighborhood – creates a safe and enjoyable environment for walking and biking but allows all types of transportation.

The MRCOG plan proposes the creation of two districts: the Mixed-Use Core and the Station Area. The Mixed-Use Core is the area immediately surrounding the station and includes 2-3 story buildings with a mix of retail and housing to create activity throughout the day in order to support local businesses and keep streets safe and attractive. The Station Area is the transition zone between the Mixed-Use Core and the existing neighborhoods/communities to maintain a seamless continuity between the old and new.

MRCOG is assisting local governments to identify how the Rail Runner can help meet their current and future goals. Three plans have been developed so far for Bernalillo, Los Lunas, and Bernalillo County/Sunport in Albuquerque's South Valley.

Case Study 10: **Oshara Village**

Oshara Village is a mixed use, walkable community now under construction in the Santa Fe Community College District that brings together five components of a community: living, working, shopping, gathering and education. Designed to balance human needs with ecological imperatives, while not compromising quality, comfort or value, Oshara Village will feature 1,100 homes and a million square feet of commercial space. A ribbon-cutting ceremony took place in May 2008 to celebrate the completion of the first 40 energy-efficient homes.

Home builders must adhere to an “Oshara Pledge” that requires certain above-code features such as recycled insulation with R-21 in walls and R-50 in ceiling, reclaimed water for irrigation, programmable thermostats, compact fluorescent lighting, and ENERGY STAR appliances.

The New Village Institute analyzed the energy use in a typical Oshara Village home compared to a conventional home built to state codes, as well as the anticipated driving habits of an Oshara Village resident compared to an average New Mexico resident. The Oshara home used 52 percent less energy and the Oshara resident used 61 percent less energy for driving. Overall energy savings range from 54-59 percent, avoiding about 12 metric tons of CO_2 emissions annually. More information is available at http://www.osharavillage.com.

QUICK FACTS:

- **Features:** Affordable/subsidized housing, bus transit, civic buildings & parks, green buildings, mixed use development, sustainable infrastructure.
- **Home energy savings**: approximately 52%
- **Transportation energy savings**: approximately 61%
- **CO_2 emissions avoided**: 12 metric tons, based on total energy savings
- **Other benefits:** Integrate exercise into daily life; saves money; more free time for Oshara Village residents

Option 21: Improve Enforcement of Highway Speed Limits (Not Yet Adopted)

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.[161] 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.[162] Thus, slowing high-speed driving would improve the real-world efficiencies of cars and light trucks. This could be accomplished by reducing the maximum speed limit for all vehicles or by better enforcing the existing speed limits.

New Mexico Senate Bill 720, considered in the 2006 legislative sessions, proposed a maximum state speed limit of 65 miles per hour for all motor vehicles.[163] However, the maximum speed limit in New Mexico remains 75 miles per hour on rural interstates and 55 miles per hour on public highways. No recent bills have further addressed the issue.

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 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.

Energy Savings

A commonly recommended practice is to set speed limits at the 85th percentile of driving that occurs on the roadway. In reality, surveys have shown that, on highways, 50 percent of vehicles typically exceed the speed limit. Virtually all vehicles are within 10 mph of the speed limit, however.[164]

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 New Mexico, 69 percent of all driving is on highways. This leads to an estimate of energy savings of 2.8 percent if all vehicles exceeding the limit slowed down to comply with the speed limit. If we assume the enforcement program leads to a 50 percent reduction in speeding, estimated energy savings would be as shown in Table 29.

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[161] "Drive more efficiently." U.S.DOE and U.S. EPA, http://www.fueleconomy.gov/feg/driveHabits.shtml.
[162] *Transportation Energy Data Book*, 2006. Oak Ridge National Laboratory.
[163] Senate Bill 720, 47th Legislature – State of New Mexico – Second Session, 2006.
[164] *Design Speed, Operating Speed, and Posted Speed Practice.* National Cooperative Highway Research Program Report 504. Transportation Research Board, 2003.

Table 29 – Estimated Benefits of Improved Speed Limit Enforcement

Year	Percent Fuel Savings	Gasoline Savings (thousand barrels per year)	Total Fuel Savings (billion Btu per year)
2009	1.4	333	1,735
2010	1.4	336	1,753
2011	1.4	339	1,769
2012	**1.4**	**342**	**1,784**
2013	1.4	345	1,800
2014	1.4	348	1,817
2015	**1.4**	**351**	**1,830**
2016	1.4	353	1,841
2017	1.4	355	1,853
2018	1.4	358	1,866
2019	1.4	360	1,879
2020	**1.4**	**363**	**1,894**
2021	1.4	366	1,907
2022	1.4	368	1,920
2023	1.4	371	1,935
2024	1.4	374	1,950
2025	**1.4**	**377**	**1,966**

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 somewhat less fuel, because the 1.4 percent savings would apply to a smaller total fuel usage. If the Clean Car Standards, PAYD insurance, and smart growth policies were in place, for example, gasoline savings from light duty speed limit enforcement would be 319,000 barrels per year in 2012 258,000 barrels per year in 2020 and 225,000 barrels per year in 2025.

<u>Cost and Cost-Effectiveness</u>

The use of speed detection and management devices, together with an education program, could minimize the cost to the state for this effort, by limiting the role of public safety personnel in enforcement. It could be paid for in full or in part from additional revenue from speeding fines.

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 2020 would be $519 million (2007 value), with all savings generated by 2020.

<u>Environmental and Social Benefits</u>

Emissions of CO_2 would be reduced by 149,000 tons in 2020 and 155,000 tons in 2025. Criteria pollutant emissions are regulated on a grams-per-mile 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.[165] The 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 often difficult politically, better enforcing current law should be less controversial, and may be politically viable primarily on the basis of enhanced public safety. 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.

Priority

This policy is not likely to be popular with the majority of the public and also will result in relatively limited fuel savings. Therefore we recommend it be viewed as a **low priority**.

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

Option 22: Require Energy-Efficient Replacement Tires for Light-Duty Vehicles (Not Yet Adopted)

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 (those sold with a new vehicle) typically have lower rolling resistance than aftermarket tires, because energy-efficient tires help manufacturers comply with CAFE 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.[166] The National Academy of Science issued a National Tire Efficiency Study that reached similar conclusions in 2006.[167]

Specific Energy Efficiency Proposal

Starting in 2010, the state would require that replacement tires sold in New Mexico 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.[168] 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 30 shows the resulting gasoline and energy savings. We estimate the gasoline savings would reach 584,000 barrels per year by 2020.

Cost and Cost-Effectiveness

The extra cost of a low-rolling-resistance tire is small, roughly \$1 to \$2 per tire.[169] If replacement tires were purchased for one-quarter of light-duty vehicles registered in New Mexico each year beginning in 2010, the extra cost of low rolling resistance tires through 2020 would be \$13 million (2007 value). Fuel savings from the tires purchased over this eleven-year

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[166] *California State Fuel-Efficient Tire Report*, California Energy Commission 600-03-001F, January 2003.
[167] National Research Council. 2006. "Tires and Passenger Vehicle Fuel Economy." Transportation Research Board Special Report 286.
[168] See Reference 166.
[169] See Reference 167.

period would continue through 2023; total fuel savings (present value) for the years 2010-2023 would be $675 million, leading to net savings of $659 million.

Table 30 – Savings from Fuel-Efficient Replacement Tires

Year	Percent Gasoline Savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (billion Btu per year)
2010	0.75	180	939
2011	1.50	363	1,895
2012	**2.25**	**550**	**2,868**
2013	2.25	555	2,894
2014	2.25	560	2,920
2015	**2.25**	**564**	**2,941**
2016	2.25	567	2,959
2017	2.25	571	2,978
2018	2.25	575	2,998
2019	2.25	579	3,020
2020	**2.25**	**584**	**3,043**
2021	2.25	588	3,064
2022	2.25	592	3,086
2023	2.25	596	3,109
2024	2.25	601	3,134
2025	**2.25**	**606**	**3,160**

<u>Environmental and Social Benefits</u>

The reduction in CO_2 emissions from requiring low rolling resistance replacement tires would be 240,000 tons in 2020 and 249,000 tons in 2025. We assume that, with no change in emissions control, a vehicle's tailpipe emissions of regulated pollutants will also decline in proportion to the reduction in fuel consumption. Reductions are shown in Table 13.

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.

Table 31 – Estimated Emissions Reduction from Energy-Efficient Replacement Tires

Pollutant	Avoided Emissions in 2020	Avoided Emissions in 2025
Carbon dioxide (thousand metric tons)	240	249
Hydrocarbons (short tons)	266	186
NOx (short tons)	73	48

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, while low rolling resistance tires are already produced, it could be difficult to ensure their availability if New Mexico were the only state to require them. The proposal may be more feasible if other states were to adopt similar policies at the same time that New Mexico 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.[170] 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. New Mexico may prefer that other states adopt identical or similar measures in order to ensure the availability of low rolling resistance tires, so we suggest this policy be assigned **medium priority**.

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

Option 23: Accelerated Retirement of Inefficient Cars and Light Trucks

Background

Policies that improve light-duty fuel economy through technology improvements, such as the Clean Car Standards and the feebate program discussed above, are directed at new vehicles, because efficiency technologies typically cannot be retrofitted onto existing vehicles. Consequently, the benefits of these policies are fully realized only after many years, given that the vehicle fleet takes about fifteen years to turn over.

A program that could accelerate the retirement of inefficient vehicles and ensure their replacement by efficient vehicles is therefore a good complement to efficiency measures focused on the new vehicle market. This is especially true at a time like the present, at which high fuel prices are a hardship for the driving public and have caused many car buyers to regret their purchase decisions.

States have promoted early vehicle retirement for years as a means of reducing tailpipe emissions. California and Texas, among other states, currently have in place programs to provide monetary incentives for owners of older vehicles to scrap their vehicles. Vehicle emissions standards have become much more stringent over the past three decades and vehicles' emissions performance deteriorates over time, so the oldest vehicles usually emit many times more pollution than newer ones, and retiring them is an effective means of reducing emissions.

Vehicles having low fuel economy, unlike high emitters, are quite likely to be of recent vintage. Average new vehicle fuel economy reached its peak in the U.S. in 1987-1988, and subsequently declined as SUVs' share of vehicle purchases soared in the 1990s. Thus, an accelerated retirement program to raise fuel economy cannot be aimed simply at the oldest vehicles, but must rather define the target vehicle population explicitly in terms of poor fuel economy. Moreover, retiring an inefficient vehicle brings fuel savings only if its replacement has higher fuel economy.

Specific Energy Efficiency Proposal

We propose a statewide Accelerated Retirement Program for Inefficient Vehicles. The program would provide an incentive for the voluntary retirement of fuel-inefficient vehicles from the current pool of about 1.6 million passenger vehicles registered to private and commercial owners in New Mexico. It would operate for four years, 2009-2012, to take advantage of increased priority drivers are placing on fuel economy in the face of high fuel prices. To be eligible vehicles would need to be in drivable condition and currently registered in New Mexico, and have had a fuel economy rating of 15 miles per gallon or less when new. A list of such vehicles would be posted by the state to facilitate promotion and implementation.

Owners of vehicles presented for destruction (crushing, shredding) would receive a voucher from the New Mexico Treasurer's Office redeemable upon the purchase of a new or used vehicle having fuel economy of at least 30 miles per gallon. Such vouchers would be eligible for redemption by auto dealers for three years from the date of issuance. Vouchers presented at the time of purchase would be collected by the vehicle dealer and redeemed by the dealer at full value from the Treasury. The vouchers would not be considered income for tax purposes, but would lower the owner's basis in the vehicle.

During the first year of the program (2009), we suggest vouchers of the amounts shown in Table 32.

Table 32 – Value of Vouchers Offered to Retire Inefficient Light-duty Vehicles

Model Years	Voucher Amount
2005 and later	$4,500
2002 through 2004	$3,000
1999 through 2001	$1,500
1998 and earlier	$500

In each subsequent year of program operation (2010, 2011 and 2012), the model years indicated above would be advanced by one year. In any year, participating operators of vehicle destruction equipment will be eligible for a non-refundable tax credit of $50 per eligible vehicle.

Energy Savings

Of the 1.6 million cars and light trucks registered in New Mexico, approximately 100,000 are over three years old and have a fuel economy in the range of 10 to 15 miles per gallon. These vehicles, mostly larger SUVs and pickups, have experienced substantial depreciation in the used vehicle market over the past few years, especially in recent months. Tens of thousands of SUVs and pickups are involved in reportable accidents in New Mexico each year, most of which are property-damage only crashes. Thus, in addition to the owners facing the expense of routine maintenance, many SUV and pickup truck owners each year are faced with decisions about costly repairs. These are likely candidates for accelerated retirement under this program.

Vehicles achieving at most 15 miles per gallon would be replaced by vehicles achieving at least 30 miles per gallon. Assuming an average of 12,000 miles per year, each voucher would result in a savings of 400 gallons per year. Further assuming a program participation rate of 7,000 vehicles per year, savings of motor fuel should reach approximately 11.2 million gallons (267 thousand barrels) per year by the final year of the program. The energy savings are shown in Table 33.

We also assume that the average vehicle retired by the program is six years old and that it would have remained on the road for an additional ten years in the absence of the accelerated retirement program. Thus fuel savings begin to decline in 2019 and fall to zero in 2022.

Table 33 – Light-duty Vehicle Fuel Savings in New Mexico from Adoption of an Accelerated Retirement Program for Inefficient Vehicles

Year	Percent Gasoline savings	Gasoline Savings (thousand barrels per year)	Gasoline Savings (billion Btu per year)
2009	0.28	67	348
2010	0.56	133	695
2011	0.83	200	1,043
2012	**1.09**	**267**	**1,391**
2013	1.08	267	1,391
2014	1.07	267	1,391
2015	**1.06**	**267**	**1,391**
2016	1.06	267	1,391
2017	1.05	267	1,391
2018	1.04	267	1,391
2019	0.78	200	1,043
2020	**0.51**	**133**	**695**
2021	0.26	67	348
2022	0	0	0
2023	0	0	0
2024	0	0	0
2025	**0**	**0**	**0**

<u>Cost and Cost-Effectiveness</u>

Assuming 7,000 vouchers are issued each year at an average value of $3,000, together with a $50 credit for each vehicle crushed or shredded, the total cost of the program would be approximately $85 million. However, because voucher costs would not be incurred until vouchers are redeemed for the purchase of replacement vehicles, and because each voucher has a three-year life, some “float” would take place and effectively spread the total program cost over seven years. The average over this period would be $12 million per year. Total fuel savings (2007 value) for the years 2009-2021 would be $292 million, leading to net savings of $215 million.

<u>Environmental and Social Benefits</u>

Because most vehicles scrapped under the program will be several years old, they will predate the current federal tailpipe emissions standards (Tier 2). These standards are bringing about a dramatic reduction in emissions of NOx and VOCs in new vehicles. Consequently, the accelerated retirement program will result in substantial pollution reductions for each vehicle replaced by a new vehicle, though we do not attempt to quantify those reductions here.

The Accelerated Retirement program could provide assistance to low-to-moderate income households that would like to reduce high gasoline costs by replacing an inefficient vehicle with a more efficient vehicle. At the values we propose, voucher values will in many cases exceed the trade-in value of the inefficient vehicle. When the efficient vehicle purchased under the program is a used vehicle, savings on fuel could exceed monthly car loan payments.

Political and Other Considerations

While costs to the state of the Accelerated Retirement program are high, the idea is likely to attract support from a wide variety of parties, including vehicle manufacturers, auto dealers, and groups seeking relief from high gas prices.

Priority

Savings from the Accelerated Retirement program are fairly modest, but begin to accrue immediately and could provide some relief from high fuel prices to low-to-moderate income households. We recommend that this policy be given **medium priority**.

Chapter VII – Cross-Cutting Policies

Option 24: Implement a Broad-Based Public Education Campaign (Not Yet Adopted)

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 will support the increased adoption of energy-efficient products and building practices.

Currently, New Mexico 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 New Mexicans 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. PowerForward is sponsored by the Utah Department of Environmental Quality and Utah's electric utilities and has an annual budget of about $60,000.[171] 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.).[172] The principal modes of communication for these alerts are email announcements, website updates, and daily news updates.

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 around $600,000 per year. Continuing this funding through 2015 would require a total of $4.2 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, and should be designed to withstand changes in political leadership. The campaign could include the following strategies:

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[171] Power Forward, URL: http://www.powerforward.utah.gov/about.htm.
[172] Personal communication with Glade Sowards, Energy Program Coordinator, Utah Division of Air Quality, Department of Environmental Quality. March 9, 2007.

- Deliver a consistent message from a broad array of leaders, including elected officials such as the Governor and mayors, utility executives, and community leaders;
- Provide simple action items for consumers, explaining specific steps they can take to become more energy efficient;
- Build upon existing partnerships, state, and utility efforts, and involve all ethnic groups in New Mexico;
- 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 (ENERGY STAR), where applicable;
- Develop a clear, recognizable image and brand name/slogan;
- 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 reductions in demand. 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.[173]

It is assumed that a general energy efficiency education campaign in New Mexico 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 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 34 shows the estimated energy savings in 2012, 2020, and 2025 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; that is, savings are estimated using a lower base level of energy consumption. In this second scenario, the savings reach 282 GWh of electricity and 1.2 million decatherms of natural gas per year by 2020.

[173] 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.

Table 34 – Projected Electricity and Natural Gas Savings from a Broad-based Energy Efficiency Education Campaign

Scenario	Electricity Savings (GWh per year)			Natural Gas Savings (million decatherms per year)		
	2012	2020	2025	2012	2020	2025
Base case energy use forecast	327	380	418	1.3	1.5	1.6
Adjusted energy use forecast	305	282	280	1.2	1.2	1.1

Cost and Cost Effectiveness

The overall cost of developing and implementing a multi-year energy efficiency and conservation education program would be approximately $4.2 million through 2015, and $7.2 million through 2020 ($600,000 per year). We estimate annual energy bill savings of about $45 million in 2012 and $42 million in 2020 in the adjusted energy use scenario. The total energy bill savings during 2008-2020 under this scenario is about $300 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. Thus, if this level of savings is achieved or even if half the assumed level of savings is achieved, the effort would be extremely cost effective.

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 35 estimates the emissions reductions for the two energy savings scenarios outlined above.

Table 35 – Estimated Emissions Reduction from a Broad-based Energy Efficiency Education Campaign

Pollutant	Avoided Emissions (base case energy savings)		Avoided Emissions (adjusted energy savings)	
	2020	2025	2020	2025
CO_2 (thousand metric tons)	335	366	253	248
SO_2 (short tons)	17.1	18.8	12.7	12.7
NOx (short tons)	106.42	117.0	79.0	79.2
Mercury (pounds)	1.5	1.7	1.1	1.1

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 be viewed as a **high priority.**

Option 25: Increase Energy Efficiency Expertise through Training and Certification (Not Yet Adopted)

Background

Investments in energy efficiency not only save energy and money, but also create new economic development and new job opportunities. Currently in New Mexico 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, energy professionals are often 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 New Mexico 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 Albuquerque and Santa Fe metropolitan areas. In rural areas and towns with small populations, it is very challenging to attract trade allies that promote and market 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 Eugene, 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.[174] 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 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.[175]

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[174] 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

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

The Building Operators 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.[176]

In New Mexico, the Center for Community Sustainability at Santa Fe Community College offers a degree program—a Certificate in Environmental Technologies—as well as noncredit courses on energy and water efficiency issues, including courses in green building, home design, and energy rating.[177] But in general, there are very limited opportunities for energy efficiency-related training in New Mexico at the present time. At one time there was an energy management certificate program at the University of New Mexico (UNM), but it was discontinued.[178]

As New Mexico moves towards the goals of a 10 percent reduction in energy use per capita by 2012 and a 20 percent reduction by 2020, 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 New Mexico's universities, community colleges, and technical schools. We recommend a total budget of approximately $300,000 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.

Energy Savings

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.

Cost and Cost Effectiveness

Given that energy efficiency curriculum has already been created and successfully implemented elsewhere, the cost to tailor these curriculum to the needs of New Mexico would be minimal. Regarding training itself, we suggest funding one university and one community college or vocational school to run an energy efficiency training program along the lines

[176] 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.
[177] For more details, see http://www.sfccnm.edu/sfcc/pages/1283.html
[178] Personal communication with Jack McGowan, Energy Control Inc., Albuquerque, NM, July 8, 2008.

discussed above, and implementing the BOC program. Combined, the cost should be on the order of $300,000 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.

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 New Mexico'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 25 policy options presented above offer a wide range of benefits to the state of New Mexico including energy savings, economic benefits, water savings, and reduced pollutant emissions. In total, the options provide primary energy savings of 136 trillion Btus (25 percent relative to projected energy use in the baseline scenario) by 2020 and an estimated net economic benefit of about $7.2 billion over the lifetime of efficiency measures installed during 2008-2020. Below we summarize those benefits and review our recommended high priority policies.

Energy Savings

Table 36 shows electricity savings in 2012, 2020, and 2025, 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 are expanded electricity DSM programs, building energy codes, and lamp efficiency standards. The total electricity savings potential in 2012 is 1,750 GWh per year, which represents a 7.3 percent reduction from projected baseline electricity consumption that year. The total electricity savings potential in 2020 is 6,793 GWh per year, which represents a 24 percent reduction from projected baseline electricity consumption that year.

On a per capita basis, total electricity use in 2012 in the policy scenario is 10,499 kWh per capita, just 2 percent below the level of 10,703 kWh in 2005. Total electricity use in the policy scenario is 9,061 kWh per capita in 2020, 15 percent below the level in 2005. Thus the electricity saving options are not sufficient to meet Governor Richardson's energy efficiency goals, due mainly to anticipated growth in electricity use per capita in the absence of new energy efficiency initiatives (that is, in the baseline scenario). 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.

Table 36 – Total Electricity Savings Potential

Option	Savings Potential (GWh/yr)		
	2012	**2020**	**2025**
Electricity DSM expansion	776	3,379	4,641
Building code upgrades	152	740	1,310
Lamp standards	231	1,288	1,587
Industrial challenge	137	599	907
Public sector initiatives	87	259	415
Public education	305	282	280
Other	62	246	350
TOTAL	**1,750**	**6,793**	**9,490**

In addition to substantial electricity savings, implementing the options listed in Table 36 would also greatly reduce peak power demand. PNM's DSM programs in particular emphasize air conditioning load control and demand response, 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.

Figure 3 shows the growth in electricity use during 2005-2025 in the baseline and high-efficiency scenarios, assuming implementation of all electricity savings options. In the baseline scenario, electricity demand grows 1.9 percent per year on average, based on PNM's and SPS's most recent electricity demand forecasts. In the high-efficiency scenario, electricity demand growth is limited to about 0.2 percent per year on average during 2005-2025. Thus, implementing all of the electricity savings options would almost entirely eliminate load growth projected in the absence of new energy efficiency initiatives.

Figure 3 – Electricity Consumption by Scenario

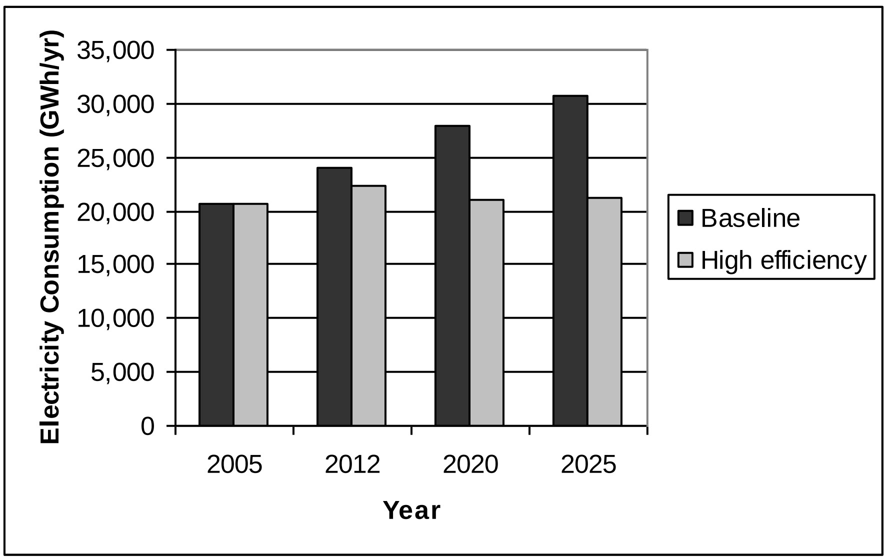


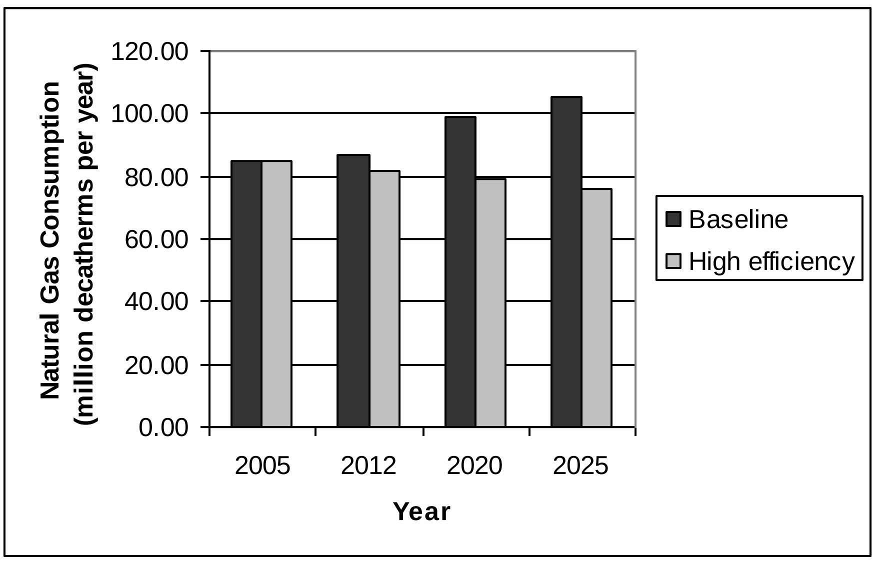
Table 37 shows the natural gas savings by option. These options were also analyzed to avoid double counting of savings, so the savings are additive. The options that offer the largest gas savings potential include gas utility DSM programs, building energy codes, and the industrial challenge and recognition program. The total gas savings potential in 2012 is about 5.2 million decatherms per year, 6 percent of projected baseline gas consumption for that year in the absence of energy efficiency initiatives (excluding gas use in oil, natural gas, and electricity production). The total gas savings potential in 2020 is about 19.8 million decatherms per year, 20 percent of projected baseline gas consumption for that year in the absence of energy efficiency initiatives (excluding gas use in oil, natural gas, and electricity production and supply).

Figure 4 shows the growth in natural gas use during 2005-2025 in the baseline and high efficiency scenarios, assuming implementation of all natural gas savings options. The scenarios do not include natural gas use for oil and gas production or for power generation in the electric utility sector. In the baseline scenario, natural gas consumption increases 1.1 percent per year on average during 2005-2020. In the high efficiency scenario, gas consumption declines in absolute terms. By 2020, total natural gas consumption is 6.5 percent below that in 2005.

Table 37 – Total Natural Gas Savings Potential

Option	Savings Potential (million decatherms per year)		
	2012	**2020**	**2025**
Gas DSM expansion	2.0	9.9	13.8
Building code upgrades	0.7	3.5	6.3
Conservation ordinances	0.2	0.75	1.0
Low-income weatherization	0.3	1.2	1.8
Industrial challenge	0.5	2.3	3.6
Public sector initiatives	0.3	0.8	1.1
Public education	1.2	1.2	1.1
Other	0.0	0.2	0.3
TOTAL	**5.2**	**19.85**	**29.0**

Figure 4 – Natural Gas Consumption by Scenario



On a per capita basis, total natural gas use in 2012 in the policy scenario is 38.5 decatherms per capita, 12.3 percent below the level of 43.9 decatherms in 2005. Total gas use falls to 33.9 decatherms per capita in 2020 in the policy scenario, nearly 23 percent below the level in 2005. Thus the natural gas savings options are adequate to meet Governor Richardson's energy efficiency goals.

Table 38 shows potential gasoline savings from the various transportation options. The total savings are adjusted to avoid double counting of savings when options are implemented in combination. The options that provide the most gasoline savings are the updated CAFE standards and measures to reduce VMT growth. The total fuel savings potential in 2020 is estimated to be about 7.4 million barrels per year, nearly 29 percent of projected gasoline 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.

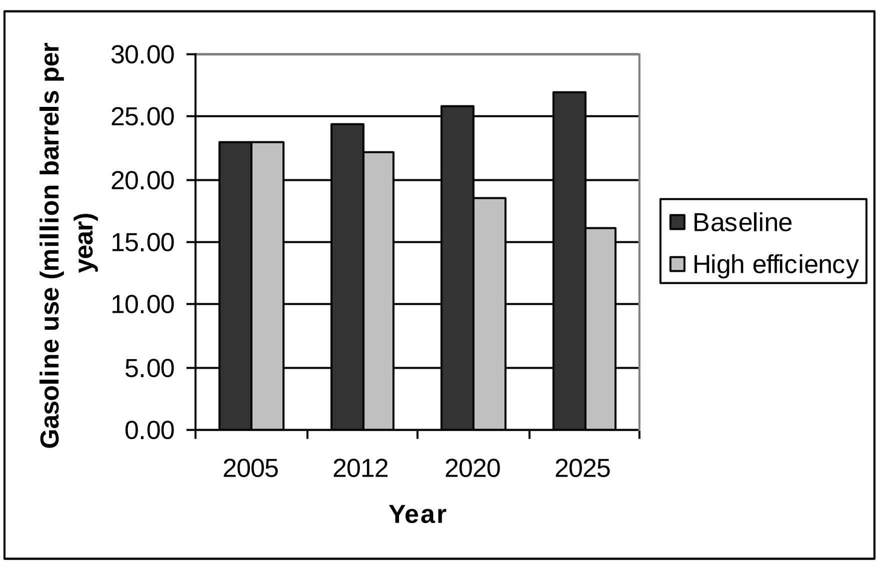
Table 38 – Total Gasoline Savings Potential

Option	Savings Potential (million barrels per year)		
	2012	**2020**	**2025**
CAFE standards	0.35	3.11	4.99
Clean car standards	0.13	0.96	1.74
Feebates	0.29	1.00	1.28
PAYD insurance	0.24	1.09	1.16
Reduce VMT growth	0.49	2.48	4.03
Enforce speed limits	0.34	0.36	0.38
Replacement tire standards	0.55	0.58	0.61
Accelerated retirement program	0.27	0.13	0
TOTAL[1]	**2.18**	**7.44**	**10.78**

[1] The totals do not equal the sum of the values in the columns in order to adjust for interactive effects of the options.

Figure 5 shows the growth in gasoline use during 2005-2025 in the baseline and high efficiency scenarios. In the baseline scenario, gasoline consumption increases about 17 percent during 2005-2025. In the high efficiency scenario, gasoline consumption falls 30 percent during 2005-2025. The substantial reduction is due to the combination of strong vehicle efficiency improvements and reductions in driving (VMT). On a per capita basis, total gasoline use in 2020 drops to 7.94 barrels per capita, 33 percent below the level in 2005. Thus, the gasoline efficiency options are more than adequate to meet Governor Richardson's 2020 energy efficiency goal.

Figure 5 – Gasoline 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 (Table 39). 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 New Mexico. Natural gas and gasoline are converted to primary energy units based on their direct energy content only. The values in the table cover only those fuel types considered in this study; that is, we do not include other forms of energy such as diesel, jet fuel, or coal directly consumed by industry. The primary energy savings shown in Table 39 includes the savings from the CHP option but not the oil and gas sector initiative. Appendix A shows the primary energy savings associated with each option.

Table 39 shows that the options reduce primary energy use relative to that in the baseline scenario by about 38 trillion Btus (7.9 percent) by 2012 and about 136 trillion Btus (25.3 percent) by 2020. The savings increase after 2020 as the buildings, appliance and vehicle stock continues to turnover, reaching 192 trillion Btus in 2025. This is equivalent to about 33 percent of baseline primary energy use in 2025.

Figure 6 shows primary energy use per capita in the two scenarios. In the baseline scenario, this parameter increases about 4 percent between 2005 and 2020. In the high efficiency scenario, energy use per capita declines about 7.2 percent by 2012 and 22.6 percent by 2020. Thus Governor Richardson's goal of a 20 percent reduction in energy use per capita by 2020, relative to the level in 2005, is achieved for the forms of energy considered in this study. But the goal of a 10% reduction in total energy use per capita by 2012 is not achieved due to the limited amount of time for policies and programs to have an impact between now and 2012. Appendix B discusses the additional actions that could be taken in order to reach the 2012 goal. It is also worth noting that energy use per capita continues to decline after 2020 in the high efficiency scenario, and by 2025 is 29 percent below the level in 2005.

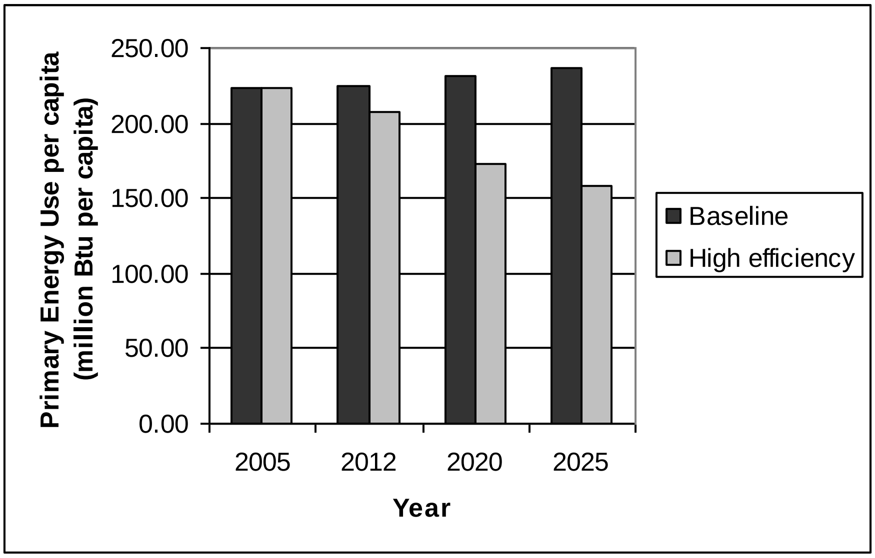
Table 39 – Primary Energy Savings Potential

	Primary Energy Consumption or Savings			
	2005	**2012**	**2020**	**2025**
Baseline Scenario (TBtu)[1]	430.4	476.5	538.9	580.4
High Efficiency Scenario (TBtu)[1]	430.4	439.0	402.5	388.0
Energy use per capita – Baseline Scenario (MBtu)[2]	223.2	224.9	231.4	236.9
Energy use per capita – High Efficiency Scenario (MBtu)[2]	223.2	207.2	172.8	158.4
Savings in High Efficiency Scenario (%)	0.0	7.9	25.3	33.1
Reduction from 2005 level in high efficiency scenario (%)	0.0	7.2	22.6	29.1

[1] The unit is trillion Btu.

[2] The unit is million Btu per capita.

Figure 6 – Energy Use per Capita by Scenario



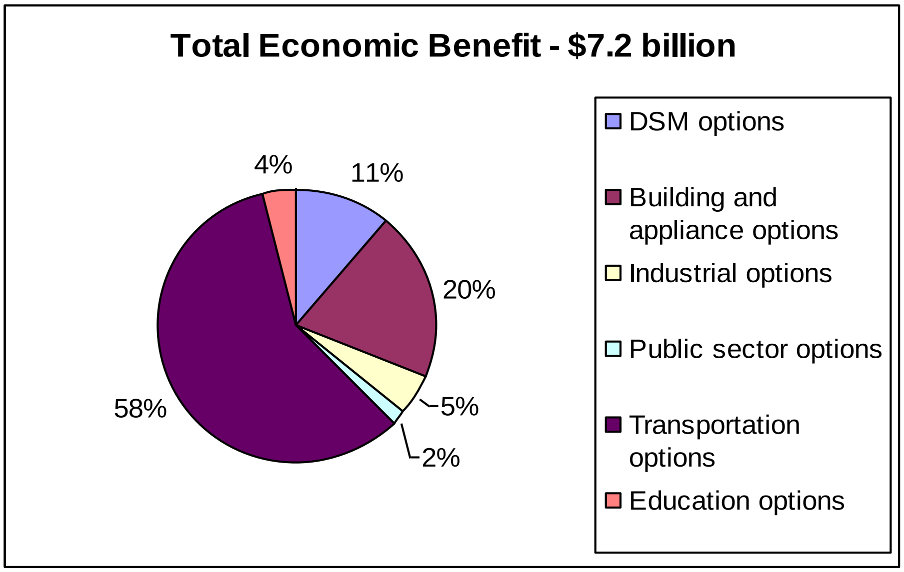
Economic Costs and Benefits

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 2008-2020, 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. Also, no net economic benefit is assumed for VMT reduction due to the uncertainties with respect to costs to achieve the targeted VMT reduction levels.

In total, estimated net economic benefits are about $7.2 billion. This is equivalent to saving about $8,700 per household on average, considering the projected number of households in New Mexico as of 2015.[179] Approximately 58 percent of the economic benefits result from the transportation options, 20 percent from the building and appliance options, 11 percent from the DSM options, and 11 percent from all the remaining options. We believe these estimates are conservative because energy prices, other than natural gas 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.

[179] The projected number of households in New Mexico in 2015 is 825,000 based on projections by the Bureau of Business and Economic Research (BBER), University of New Mexico. The savings per household includes savings realized by businesses.

Figure 7 – Net Economic Benefit of Energy Efficiency Options



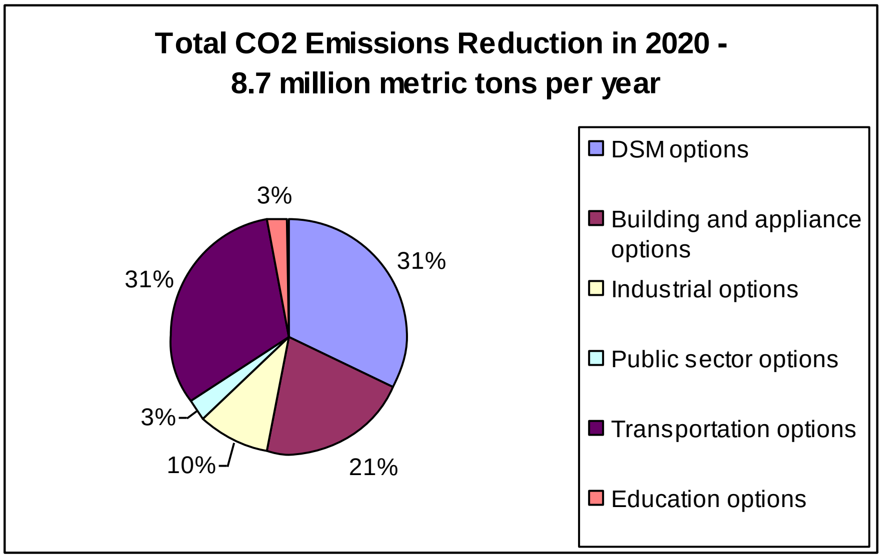
It should be noted that economic benefits have not been quantified for a few of the options, although these are expected to be minor and largely covered by the options where energy savings and economic benefits have been quantified. In addition, further economic benefits will result from efficiency measures adopted after 2020, assuming the policies and programs remain in effect.

Regarding the potential cost for New Mexico's state government, expanding retrofit of low-income households and the accelerated retirement program for inefficient vehicles are the two most costly options, with costs of about $6 million and $12 million per year, respectively. Upgrading energy efficiency in state and higher education facilities, co-funding for energy efficiency programs implemented by municipal utilities and rural electric co-ops, and tax credits for highly efficient new buildings and HVAC equipment would also carry a substantial price tag for the state. In total, the incremental cost to the state is estimated to be about $36 million per year on average during 2009-2015. However, there would also be substantial economic savings for state government as a result of lower energy bills, rebates from participation in DSM programs, and less need to provide energy bill payment assistance to low-income families, public schools, etc. The net cost to the state for fully implementing the policies in this strategy might be on the order of $25 million per year on average.

<u>Environmental Benefits</u>

Implementing the energy efficiency options would provide substantial environmental benefits within and beyond the state of New Mexico. 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 2020 by option cluster. Of the total of 8.7 million metric tons of avoided CO_2 emissions that year, DSM options and transportation options both provide about 31 percent of the total, and building and appliance options about 21 percent. Estimated CO_2 emissions reductions grow to about 12.1 million metric tons per year by 2025.

Figure 8 – Carbon Dioxide Emissions Reductions in 2020 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 3.65 billion gallons per year in 2020. This is equivalent to the annual water use of 60,000 typical Albuquerque citizens.[180] Furthermore, there will be additional water savings from increased adoption of energy and water-conserving devices such as resource-efficient clothes washers and dishwashers.

Priority

Among the 25 options developed in this report, we suggest that 10 be viewed as high priority by the Governor, the Legislature, the Public Regulation 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:

- Expand Electric Utility Demand-Side Management Programs
- Adopt Decoupling or Shareholder Incentives to Stimulate Greater Utility Support for Energy Efficiency Improvements

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[180] Residential water consumption in Albuquerque averaged 167 gallons/person/day as of 2007. See Albuquerque Bernalillo County Water Utility Authority Water Conservation Statistics. http://www.abcwua.org/content/view/342/555/

- Expand Natural Gas Utility Energy Efficiency Programs
- Upgrade Building Energy Codes and Fund Code Training and Enforcement
- Expand Retrofit of Homes Occupied by Low-Income Families
- Undertake an Industry Challenge and Recognition Program
- Increase Energy Efficiency in the Oil and Gas Sector
- Adopt Energy Efficiency Requirements for Public Colleges and Universities and Extend the Requirements for State Agencies
- Reduce Per Capita Vehicle Use
- Implement a Broad-Based Public Education Campaign

In conclusion, New Mexico would reduce energy use substantially if it adopts the high priority energy efficiency policy options, and possibly other options, described and analyzed in this study. By 2020, electricity use could be reduced by 24 percent, natural gas use by nearly 20 percent, and gasoline use by 29 percent, all in comparison to otherwise forecasted levels of energy use that year. The ambitious energy efficiency goal set by Governor Richardson for 2020 would be achieved, but the near-term goal of a 10 percent reduction in per capita energy use in 2012 would not be achieved due to the limited time for policy and program implementation prior to 2012.

Substantial benefits would result from achieving these levels of energy savings. Consumers and businesses in New Mexico could save about $7.2 billion net during the lifetime of efficiency measures implemented through 2020. Water savings would exceed 3.6 billion gallons per year by 2020. Pollutant emissions would be cut as well. Most notably, New Mexico would significantly reduce its carbon dioxide emissions, thereby contributing to the worldwide effort to limit global warming, and do so very cost effectively. Local air quality would also improve. In summary, meeting Governor Richardson’s 2020 energy efficiency goal would greatly benefit New Mexico’s citizens, businesses, government and environment.

Appendix A: Primary Energy Savings by Option[1]

Option	Savings Potential (trillion Btu/yr)		
	2012	**2020**	**2025**
Electricity DSM expansion	8.5	36.8	50.6
Decoupling and/or shareholder incentives	--	--	--
Innovative electricity rates	0.4	0.5	0.5
Gas DSM expansion	2.0	9.9	13.8
Building code upgrades	2.4	11.6	20.6
RECOs	0.5	2.1	2.7
Lamp efficiency standards	2.5	14.0	17.3
Low-income home retrofit	0.6	2.1	3.0
Building and HVAC tax credits	0.1	0.6	1.0
Industrial challenge and recognition	2.0	8.8	13.5
CHP option	1.8	3.4	3.4
Oil and gas sector option	--	--	--
State government initiative	0.4	1.1	1.4
Local government and K-12 schools option	0.8	2.7	4.2
Energy efficiency education in schools	--	--	--
Updated CAFE standards	1.5	12.5	19.9
Clean car standards	0.6	3.9	6.9
Feebates	1.2	4.0	5.1
Pay-as-you-drive insurance	1.0	4.4	4.6
Reduce VMT per capita	2.1	10.0	16.1
Better enforce speed limits	1.5	1.4	1.5
Replacement tire efficiency standards	2.4	2.3	2.4
Accelerated vehicle retirement program	1.2	0.5	0
Public education campaign	4.5	4.3	4.2
Training initiative	--	--	--
TOTAL	**38.0**	**136.9**	**192.7**

[1] In this table, energy savings for the transportation options are adjusted to take into account the overlap among options.

Appendix B: What Would it Take to Achieve Governor Richardson's Near-Term Energy Efficiency Goal?

Based on the assumptions made, the 25 options presented in this Strategy achieve slightly more than a 7 percent reduction in energy use per capita by 2012, relative to the level in 2005. Thus the policies are not capable of achieving Governor Richardson's near-term goal of reducing energy use per capita 10 percent by 2012. The main reason for this is that there is insufficient time for many of the policies to have a major impact on energy use in the state.

It is possible to strengthen the policies, or add additional policies, in order to realize roughly 3 percent additional reduction in energy use by 2012 and thereby achieve the Governor's near-term goal. This means obtaining another 13.3 trillion Btu (TBtu) of primary energy savings by 2012 in addition to the 37.5 TBtu of energy savings estimated for the options in the Strategy. It will not be easy to achieve this additional energy savings, but it is possible to envision how the additional savings could be achieved. The following 10 modifications to the options presented in this Strategy are one way to achieve the additional energy savings. It is possible that addition of other initiatives, or different combinations of modifications to the options already in the Strategy, could lead to the same result.

1) **Achieve 4 percent electricity savings from electric utility DSM programs by 2012 rather than 3.2 percent savings**. This means ramping up DSM programs statewide faster than suggested in Option 1. Doing so would increase primary energy savings in 2012 by about 2.0 TBtu.

2) **Achieve 4 percent natural gas savings from gas utility DSM programs by 2012 rather than 2.3 percent savings**. This means ramping up gas DSM programs faster than suggested in Option 4. Doing so would increase primary energy savings in 2012 by about 1.5 TBtu.

3) **Increase the stringency of building energy codes by 30 percent in 2009 rather than 20 percent.** This would lead to about 1.5 times as much energy savings from building energy codes in the near term compared to that achieved by Option 5. Doing so would increase primary energy savings in 2012 by about 1.2 TBtu.

4) **Accelerate the retrofit of low-income households.** If we double the budget for retrofitting low-income households during 2009-2012 relative to that proposed in Option 8, we would increase primary energy savings in 2012 by about 0.6 TBtu.

5) **Achieve 3.5 percent energy savings from the Industrial Challenge and Recognition program by 2012 rather than 2.5 percent savings**. This means obtaining more participants and stimulating greater action to increase energy efficiency among participants, relative to that assumed in Option 10. Doing so would increase primary energy savings in 2012 by about 0.8 TBtu.

6) **Double the additional CHP capacity installed by 2012 to about 80 MW.** This means considerably accelerating the adoption of new CHP systems in the state, relative to that

assumed in Option 11. Doing so would increase primary energy savings in 2012 by about 1.8 TBtu.

7) **Faster phase-in of Pay-As-You-Drive insurance.** If we accelerated the phase-in by two years relative to that proposed in Option 19, we would increase primary energy savings in 2012 by about 0.9 TBtu.

8) **Start the 1 percent annual reduction in VMT per capita one year earlier.** If we start the 1 percent annual reduction in 2010 rather 2011, the primary energy savings in 2012 would increase by about 1.1 TBtu.

9) **Double the size of the accelerated vehicle retirement program.** If we pay for the early retirement of 56,000 vehicles during 2009-2012 rather than 28,000 vehicles as proposed in Option 23, the primary energy savings in 2012 would increase by about 1.2 TBtu.

10) **Increase the effectiveness of the public education campaign so that it achieves 3 percent annual energy savings rather than 2 percent savings**. This means ramping up advertising and other activities in order to increase awareness and action on the part of consumers. Doing so would increase primary energy savings in 2012 by about 2.2 TBtu.

Appendix C: Improving the Efficiency of Heavy-Duty Trucks and the Goods Movement System

Background

Heavy commercial trucks are responsible for 20 percent of all vehicle-miles traveled in New Mexico.[181] Tractor-trailers dominate heavy-duty fuel use due to their high annual mileage and relatively low fuel economy. Many tractor-trailers traveling New Mexico highways are out-of-state trucks. Trucks are responsible for about 71 percent, and rail 28 percent, of interstate and intrastate freight movement in New Mexico as of 2002.[182] Regarding all freight movement, 35 percent of the tonnage and 67 percent of the value of freight transport as of 2002 was for through movement; that is, freight movement that neither originated nor terminated in the state.[183]

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 currently 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 and transmission enhancements, and weight reduction.[184]

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 100 percent in ten years. FedEx has committed to the 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

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[181] New Mexico 2025: Statewide Multimodal Transportation Plan

[182] NMDOT Commodity Flow Analysis. Technical Memorandum prepared by Cambridge Systematics for the New Mexico Department of Transportation. Jan. 2008

[183] Ibid.

[184] 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.

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

Specific Energy Efficiency Proposal

Our first policy proposal is to establish a low-interest loan program, beginning in 2009, 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. The 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 also 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 average cost of capital.

Our second proposal is for another low-interest loan program, this one for the electrification of truck stops in New Mexico 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 New Mexico cannot control the 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.

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 which 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.

A significant number of all heavy-heavy truck miles driven by New Mexico-registered trucks are driven by long-distance trucks (that is, 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 New Mexico trucks fitting this description is 700; of these we estimate that 20 percent already have anti-idling technology, leaving 560 trucks eligible to acquire auxiliary power units.[185] 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.[186]

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 1,200 such trucks registered in New Mexico. 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 eligible trucks by 2012. This results in a 0.31 percent reduction in fuel consumption in the entire truck stock.

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 qualifying for loans will double over the period 2012 to 2017 (Table B-1).

Table B-1 – Savings from Low-Interest Loans for Heavy Truck Efficiency Improvements

Year	Percent Diesel Savings	Diesel Savings (thousand barrels per year)	Diesel Savings (billion Btu per year)
2009	0.08	11	61
2010	0.15	20	127
2011	0.23	34	197
2012	**0.31**	**47**	**271**
2013	0.37	58	337
2014	0.43	70	407
2015	**0.49**	**83**	**481**
2016	0.55	97	560
2017	0.61	111	644
2018	0.61	115	667
2019	0.61	119	690
2020	**0.61**	**123**	**714**
2021	0.61	127	739
2022	0.61	132	765
2023	0.61	137	792
2024	0.61	141	820
2025	**0.61**	**146**	**848**

[185] Based on queries of the *2002 Vehicle Inventory and Use Survey*, U.S. Census Bureau. http://www.census.gov/svsd/www/vius/2002.html.
[186] 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.

We next estimate the fuel savings resulting from the loan program for truck stop electrification. There are approximately 60 truck stops in New Mexico.[187] If ten truck stops install TSE each year from 2010 through 2014, and the average installation size is 25 spaces, there will be 1,475 spaces available by 2014.[188] Idling of a heavy-heavy truck consumes about one gallon per hour.[189] Assuming each space is used for two 6-hour periods per day, fuel savings would be as shown in Table 13. The power requirement of the truck while using the TSE system is approximately 2.1 kW.[190] Table B-2 shows net energy savings of the program by year.

Table B-2 – Savings from Truck Stop Electrification

Year	Diesel Savings (thousand barrels per year)	Electricity Consumed (GWh per year)	Net Savings (billion Btu per year)
2010	31	3	132
2011	62	5	264
2012	**92**	**8**	**396**
2013	123	11	528
2014	154	14	660
2015	**154**	**14**	**660**
2016	154	14	660
2017	154	14	660
2018	154	14	660
2019	154	14	660
2020	**154**	**14**	**660**
2021	154	14	660
2022	154	14	660
2023	154	14	660
2024	154	14	660
2025	**154**	**14**	**660**

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

Regarding overall cost, the typical SmartWay upgrade kit costs $16,500.[191] 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

[187] See, for example, http://www.aitaonline.com/TS/NM.html.
[188] We estimate this is slightly less than half of all commercial truck stop spaces in New Mexico.
[189] F.Stodolsky et al. 2000. "Analysis of technology options to reduce the fuel consumption of idling trucks," Center for Transportation Research, Argonne National Laboratory.
[190] N. Lutsey. 2003. "Fuel Cells for Auxiliary Power in Trucks: Requirements, Benefits, and Marketability," Institute for Transportation Studies, University of California, Davis.
[191] U.S. EPA "Innovative Financing – Frequently Asked Questions," http://epa.gov/smartway/documents/420f07027.htm.

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 2020, fuel cost savings out to 2030 total $114 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 2020 would be about $57 million, giving a net savings of $57 million during 2009-2030.

The cost of truck stop electrification is about $15,000 per space for an off-board system.[192] We assume all 1,475 spaces are converted prior to 2020. Net cost savings, including capital costs, fuel savings, and electricity costs at 6.6 cents per kilowatt hour, are $258 million (2007 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 59,000 metric tons in 2020 and 70,000 tons in 2025. Heavy-duty trucks are a major contributor to total New Mexico highway emissions of NO_x) and PM 2.5 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 64,000 metric tons in both 2020 and 2025. Based on U.S. EPA estimates on the emissions of idling trucks,[193] the program would reduce NO_x by 961 tons in 2020 and 2025.

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.

In addition to the potential diesel fuel savings from this option, there will be fuel savings from improved speed limit enforcement on highways (Option 21). Table B-3 shows the diesel

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[192] Electric Power Research Institute, "Truck Stop Electrification: A Cost-Effective Solution to Reducing Truck Idling." December 2004.

[193] 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.

savings that result from improved speed limit enforcement. For a complete discussion of the proposal and associated costs and benefits, please refer to Option 21.

Table B-3 – Estimated Heavy-Duty Benefits from Improved Speed Limit Enforcement

Year	Percent Fuel Savings	Diesel Savings (thousand barrels per year)	Total Fuel Savings (billion Btu per year)
2009	1.4	192	1,116
2010	1.4	199	1,155
2011	1.4	206	1,195
2012	**1.4**	**213**	**1,237**
2013	1.4	221	1,280
2014	1.4	229	1,325
2015	**1.4**	**236**	**1,371**
2016	1.4	245	1,419
2017	1.4	253	1,469
2018	1.4	262	1,521
2019	1.4	271	1,574
2020	**1.4**	**281**	**1,629**
2021	1.4	291	1,686
2022	1.4	301	1,745
2023	1.4	311	1,806
2024	1.4	322	1,869
2025	**1.4**	**334**	**1,935**

Appendix D: Acronyms, Abbreviations and Definitions

Acronyms and Abbreviations

AC	air conditioning, or alternating current
ADRS	Automated Demand Response System
APU	auxiliary power unit
ASE	Alliance to Save Energy
ASHRAE	The American Society of Heating, Refrigerating and Air-Conditioning Engineers
BBER	Bureau of Business and Economic Research
BOC	Building Operators Certification
Btu	British thermal unit
CAFE	Corporate Average Fuel Economy
CARB	California Air Resources Board
CFL	compact fluorescent lamp
cfm	cubic feet per minute
CHP	combined heat and power
CIPEC	Canadian Industry Program for Energy Conservation
CO	carbon monoxide
CO_2	carbon dioxide
Coops	rural electric cooperatives
DSM	demand-side management
DOE	(United States) Department of Energy
DOT	(New Mexico) Department of Transportation
ECMD	Energy Conservation and Management Division
EIA	Energy Information Administration
EISA	Energy Independence and Security Act
EMNRD	Energy, Mineral and Natural Resources Department
ESCO	energy service company
ESPP	energy smart pricing program
EUEA	Efficient Use of Energy Act
GHG	greenhouse gas
GW	Gigawatt
GWh	Gigawatt-hour
HC	hydrocarbons
HCHO	formaldehyde
HERS	Home Energy Rating System
HVAC	heating, ventilation, air-conditioning and cooling
IECC	International Energy Conservation Code
IAC	Industrial Assessment Center
IEEE	Institute of Electrical and Electronics Engineers

kW	kilowatt
kWh	kilowatt-hour
LEED	Leadership in Energy and Environmental Design
LEV II	Low Emission Vehicle II program
LPG	liquefied petroleum gas
MFA	Mortgage Finance Agency
mph	miles per hour
MRCOG	Mid-Region Council of Governments
Munis	municipal electric utilities
MBtu	million Btu
MW	Megawatt
MWh	Megawatt-hour
NEED	National Energy Education Development
NEF	National Energy Foundation
NEMS	National Energy Modeling System
NHTSA	National Highway Traffic Safety Administration
NMOG	non-methane organic gas
NOx	nitrogen oxides
O&M	operation and maintenance
OE	original equipment
PAYD	pay-as-you-drive insurance
PED	Public Education Department
PM	particulate matter
PNM	Public Service Company of New Mexico
PRC	Public Regulatory Commission
PURPA	Public Utilities Regulatory Policy Act
QF	qualifying facility
RAP	Regulatory Assistance Project
RECO	residential energy conservation ordinance
RESNET	Residential Energy Services Network
RFP	request for proposal
RLF	revolving loan fund
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SCE	Southern California Edison
SEP	State Energy Program
SO_2	sulfur dioxide
SPS	Southwest Public Service Co.
SWEEP	Southwest Energy Efficiency Project
T&D	transmission and distribution
TBtu	trillion Btu
TOD	transit-oriented development
TOU	time-of-use

TRC	total resource cost
TSE	truck stop electrification
UNM	University of New Mexico
VMT	vehicle-miles traveled
WAP	Weatherization Assistance Program
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.

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