A CHOICE OF TWO PATHS:
ENERGY SAVINGS FROM PENDING FEDERAL ENERGY LEGISLATION

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April 2005

Report Number E051

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EXECUTIVE SUMMARY

The United States faces a fork in the road in regard to energy policy. For the past five years, the U.S. Congress and the present Administration have been working on comprehensive energy legislation. Legislation passed both Houses of Congress in both 2002 and 2003, but could never be finalized due to a variety of contentious issues. In 2003, House-Senate conferees concluded an agreement, but the agreement could not summon the 60 votes needed for passage in the Senate. In 2005, Congress will be trying again.

In seeking to develop legislation, members of Congress need to decide whether they are prepared to make the compromises needed to enact broadly supported legislation that will truly address our nation's energy problems, or whether they will instead continue to work on legislation that puts "band-aids" on our nation's energy problems, while leaving the tough choices for the future.

The House-Senate conference report developed in 2003 (U.S. Congress 2003), by most accounts, would have had only a modest impact on U.S. energy demand and supplies. The 2003 conference report was full of many little provisions that were of concern to various narrow interests. The bill contained only a few broad provisions with widespread support. Several Senators have been talking lately about the need to take a fresh look at issues and to try to make the bill more comprehensive and truly bipartisan.

In trying to craft a more effective and broadly supported bill, one of the key issues Representatives and Senators must face is the role of energy efficiency resources. Previous American Council for an Energy-Efficient Economy (ACEEE) studies have found that the adoption of a comprehensive set of policies could reduce U.S. energy demand in 2020 by 26% relative to the U.S. Energy Information Administration (EIA) reference case forecast. Such savings were projected to save consumers about $600 billion through 2020 and reduce oil imports in 2020 by about 40% relative to the EIA reference case.

However, the 2003 conference report barely made a down-payment toward achieving these savings. As we discuss later in this report, with a little political will, the United States could increase the energy savings achieved under the bill by about a factor of four. These energy efficiency savings alone would not solve our energy problems, but they would certainly make a large dent.

In this report we do not address all elements of a comprehensive energy bill. Instead, we concentrate on what we believe should be the foundation of any energy plan or energy bill—using energy as efficiently and cost-effectively as possible. This report focuses on three policy option packages: the energy efficiency provisions in two current energy bills and one "enhanced" policy package:

- Those in the 2003 House-Senate Conference Report (commonly referred to by its bill number—H.R. 6) (U.S. Congress 2003);
- Those in a bill just introduced by Senator Lamar Alexander (R-TN) entitled *the Natural Gas Price Reduction Act of 2005* (S. 726, 2005); and

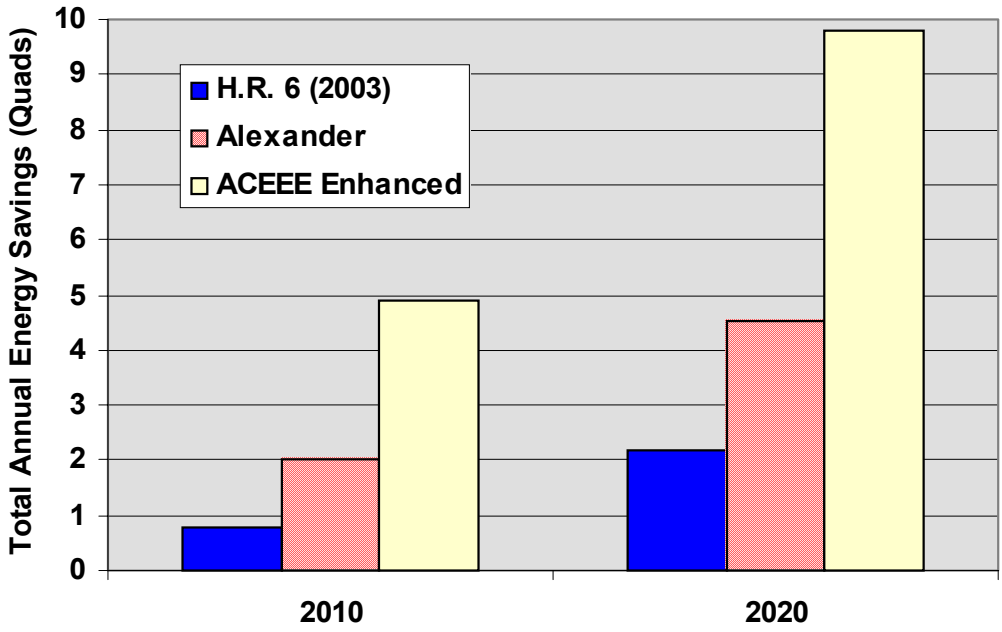
- An enhanced legislative package that includes the best efficiency provisions of H.R. 6 and S. 726, plus selected additional efficiency provisions that would significantly increase energy savings.

First we review the policy option packages. Then we estimate the energy savings from each of these packages in 2010, in 2020, and on a cumulative basis over the 2006–2010 and 2006–2020 periods. As part of this analysis, we look at overall U.S. energy savings, as well as electricity savings (both electricity use and peak demand savings), natural gas savings, oil savings, and reductions in carbon dioxide emissions. Our methodology and key assumptions are discussed in the body of the report. In the final section, we put these analysis results in a broader context and draw some conclusions. The intent of this effort is to provide objective information to policy makers as they shape what ultimately goes into legislation and also to provide information to a broader public about the benefits and costs of investing in energy efficiency resources so they can judge how well the policy makers have done.

Results

The national impacts of the three policy packages are contrasted in Figure ES-1 through ES-5 and in the paragraphs that follow.

Figure ES-1. National Annual Energy Savings from Legislative Energy Efficiency Packages in 2010 and 2020



House-Senate 2003 Conference Report (H.R. 6)

Overall, we estimate that last year's H.R. 6 would reduce U.S. energy use by about 0.7% in 2010 and 1.7% in 2020 (see Figure ES-2). Percentage gas savings would be higher (4.5% in 2020) due to the reductions in gas used to generate electricity while percentage oil savings would be lower (0.5% in 2020) since the bill has few provisions to address oil use

(see Figure ES-3). The biggest savings would be due to tax incentives (1.0 quad in 2020) and appliance standards and labeling (0.7 quad in 2020) (see Figure ES-4). On a cumulative basis, the bill would reduce natural gas use about 1.6% over the 2006–2010 period (see Figure ES-5), which would apply some downward pressure on prices. However, the bill would fall short of the 4–5% reduction needed to achieve 20% or greater reduction in natural gas prices. On the other hand, by reducing energy use, the bill would provide direct reductions in energy costs of about $19 billion over the 2006–2010 period and $144 billion over the 2006–2020 period.

Figure ES-2. Percentage Reduction in U.S. Energy Use from Legislative Energy Efficiency Packages in 2010 and 2020

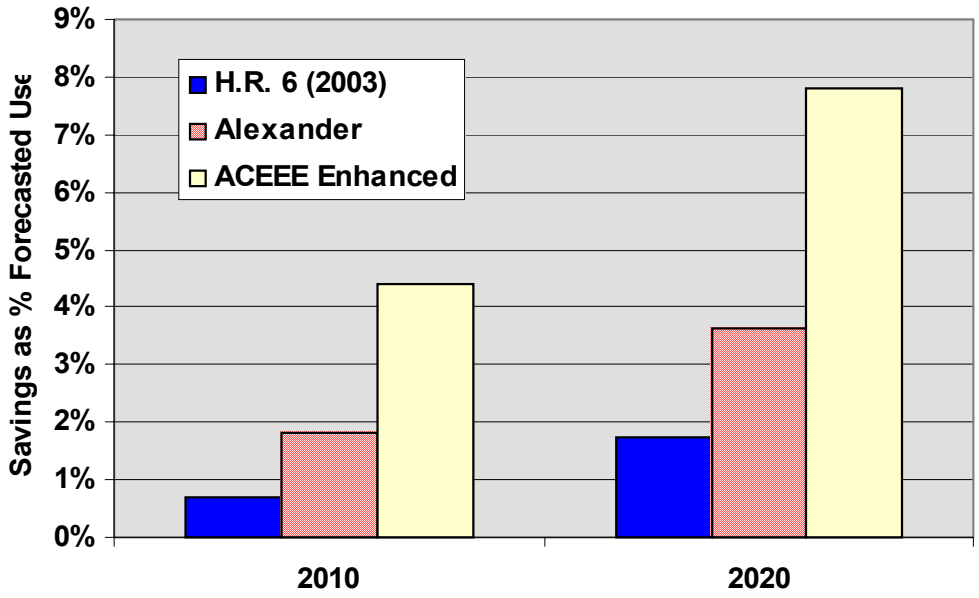


Figure ES-3. Annual Peak Demand Savings from Legislative Energy Efficiency Packages

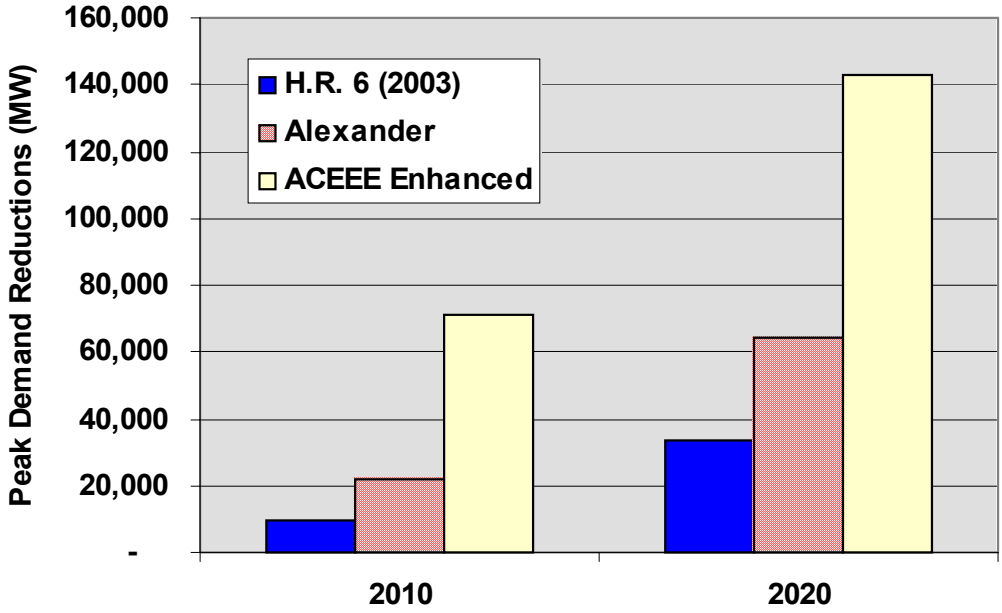


Figure ES-4. Distribution of H.R. 6 Energy Savings in 2020 with Energy Savings by Policy (Quads)

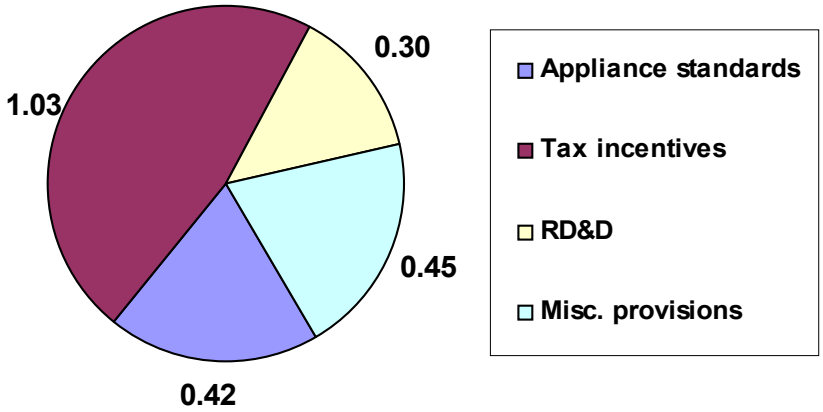
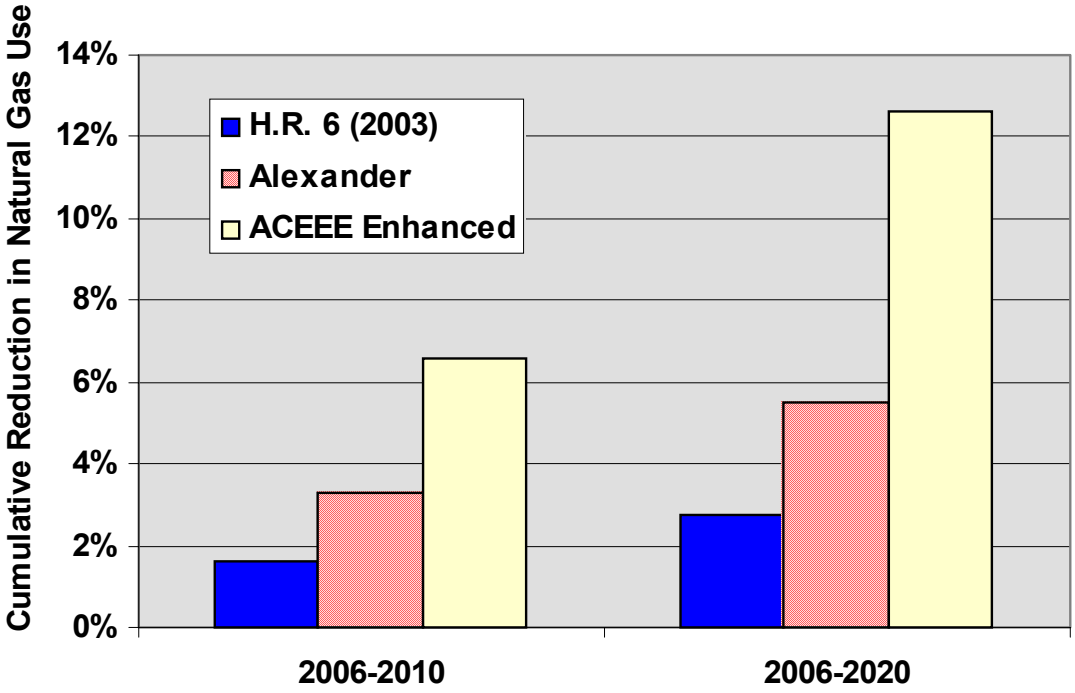


Figure ES-5. Cumulative Reductions in U.S. Natural Gas Use from Legislative Energy Efficiency Packages



Alexander Bill (S. 726)

Overall, we estimate this bill would reduce U.S. energy use by about 2.0% in 2010 and 3.9% in 2020. These savings would be roughly triple those of H.R. 6. Savings would be higher than in H.R. 6 due to additional appliance standards, additional measures to promote combined heat and power (CHP) and efficient dispatch, and inclusion of a provision to save 1.75 million barrels of oil (MBD) per day by 2015. Gas savings would be substantially higher (7.9% in 2020) than total energy savings due to the fact that half of electricity on the margin will come from gas plants, according to our estimate. The biggest savings would be due to three provisions—the 1 MDB of oil savings provision (1.5 quads in 2020), appliance standards and labeling (1.1 quads), and tax incentives (1.0 quads) (see Figure 4). On a cumulative basis, the bill would reduce natural gas use by about 3.3% over the 2006–2010 period, which would apply significant downward pressure on prices. However, the bill would fall short of the 4–5% reduction needed to achieve 20% or greater reduction in natural gas prices. On the other hand, by reducing energy use, the bill would provide direct reductions in energy costs of about $39 billion over the 2006–2010 period and $297 billion over the 2006–2020 period. Downward pressure on natural gas prices would add to these amounts.

Enhanced Bill

Taking the best features of H.R. 6 and the Alexander bill (S. 726) and adding some additional features would increase energy savings substantially. Such a bill would combine the miscellaneous efficiency provisions in H.R. 6, the tax incentives in both bills, the expanded appliance standards and CHP provisions in S. 726, and a few additional

improvements, such as the Energy Efficiency Resource Standard (EERS), additional enforceability and authorization provisions added to Senator Alexander's oil savings target, a provision to assist states with updating their building codes, and full funding for the energy efficiency public information campaign.

Overall, we estimate that this package would reduce U.S. energy use by about 4.8% in 2010 and 8.3% in 2020. These savings would be more than double those of the Alexander bill (S. 726) and about five to six times as much as those for H.R. 6. Gas savings would be substantially higher (16.0% in 2020) than total energy savings. The biggest savings would be due to the 1 million barrels of oil provision (3.1 quads in 2020), the Energy Efficiency Resource Standard (2.4 quads), tax incentives (1.4 quads), appliance standards and labeling (1.1 quads), and the CHP and efficient dispatch provisions (0.9 quads) (see Figure 5). On a cumulative basis, the bill would reduce natural gas use by about 6.6% over the 2006–2010 period, achieving the 4–5% reduction needed to achieve 20% or greater reduction in natural gas prices. On a cumulative basis, this package would result in direct energy cost savings of $97 billion over the 2006–2010 period and $750 billion over the 2006–2020 period. If we add a 20% reduction in natural gas prices in 2006–2010 and a 10% reduction in natural gas prices over 2011–2015, the cumulative savings would total about $290 billion from 2006–2010 (a three-fold increase!) and $1,120 billion from 2006–2020 (nearly a 50% increase).

Conclusions

All three bills examined would save energy and help the economy; however, S. 726 saves more than twice as much energy as H.R. 6, and an enhanced bill would save more than five times the energy of H.R. 6. H.R. 6 would save about 18 quads and $144 billion on a cumulative basis over the 2006–2020 period. S. 726 offers cumulative savings totaling 46 quads and $297 billion. In addition, the Alexander bill would save more natural gas over the critical 2006–2010 period, which would provide downward pressure on gas prices not reflected in the numbers above. However, each of these two bills contains provisions not in the other. By combining the best features of both bills, plus adding a few key policies, savings can be increased approximately five- to six-fold relative to H.R. 6. We estimate that cumulative savings for this enhanced package would be about 105 quads and $1,120 billion over the 2006–2020 period (this latter value includes about $370 billion of savings due to lower natural gas prices).

Based on these findings, at a minimum we recommend combining the best features in H.R. 6 and the Alexander bill (S. 726). These include the appliance and equipment efficiency standards and tax incentives in both bills; the miscellaneous efficiency provisions in H.R. 6; and the CHP, efficient dispatch, and oil savings target provisions in the Alexander bill. In addition, key additional provisions would substantially increase the energy and economic benefits: these include (1) a national Energy Efficiency Resource Standard; (2) specific provisions to ensure the oil savings target would actually be reached; and (3) funding a substantial public information campaign aimed at households, businesses, and the nation at large.

ACKNOWLEDGMENTS

The authors express their appreciation to the Energy Foundation and the American Chemistry Council for their support that made this report possible. In addition, Bill Prindle of ACEEE provided invaluable insights into various provisions analyzed in this report. Also, Michael Parr of DuPont, Peter Molinaro of the Dow Chemical Company, and Lynn Schlosser of Eastman Chemicals provided advice on measures to include in this analysis plus general encouragement. The authors would also like to thank Jean Connelly, David Goldstein, and Joe Loper for providing comments on the report draft, and Renee Nida for her help in editing and producing the final version of this report.

INTRODUCTION

> …Two roads diverged in a wood, and I—I took the one less traveled by, and that has made all the difference
>
> —Robert Frost

The United States faces a fork in the road in terms of energy policy. For the past five years, the U.S. Congress and the present Administration have been working on comprehensive energy legislation. As President Bush noted on March 9, 2005:

> …To meet America's energy needs in the 21st century, we need a comprehensive national energy policy. It's time for Congress to act… A sound energy bill must meet four objectives: it must promote conservation and efficiency, increase domestic production, diversify our energy supply, and modernize our energy infrastructure. And as we pursue all these goals, we will also uphold our responsibility to be good stewards of the environment. (White House 2005)

Legislation passed both Houses of Congress in both 2002 and 2003, but could never be finalized due to a variety of contentious issues. In 2003, House-Senate conferees concluded an agreement, but the agreement could not summon the 60 votes needed for passage in the Senate. In 2005, Congress will be trying again.

In seeking to develop successful legislation, members of Congress face several choices:

- Do they continue to work on legislation that puts "band-aids" on our nation's energy problems, or are they ready to make the difficult choices that are needed to provide adequate energy, a clean environment, and a healthy economy for many decades?
- Are they prepared to make compromises needed to enact broadly supported legislation, or will they instead seek to draft narrow legislation that they hope can garner bare-majority support?
- In grappling with these questions, are they prepared to embrace policies that will capture the large cost-effective energy efficiency savings available in the country, or will they continue to leave most of the available savings "on the table"?

The House-Senate conference report developed in 2003 (U.S. Congress 2003), by most accounts, would have had only a modest impact on U.S. energy demand and supplies. According to the U.S. Energy Information Administration (a branch of the U.S. Department of Energy—DOE), approximately 15 provisions in the bill have "significant potential to affect energy consumption and supply at the national level" (EIA 2004a). However, in a follow-up analysis (EIA 2004b), EIA estimated small impacts from most of those provisions. As is discussed later in this report, much more can and should be done.

The 2003 conference report is full of many little provisions that were of concern to various narrow interests. Senator John McCain called it the "no lobbyist left behind" act. The bill contained only a few broad provisions with widespread support. To broaden the support

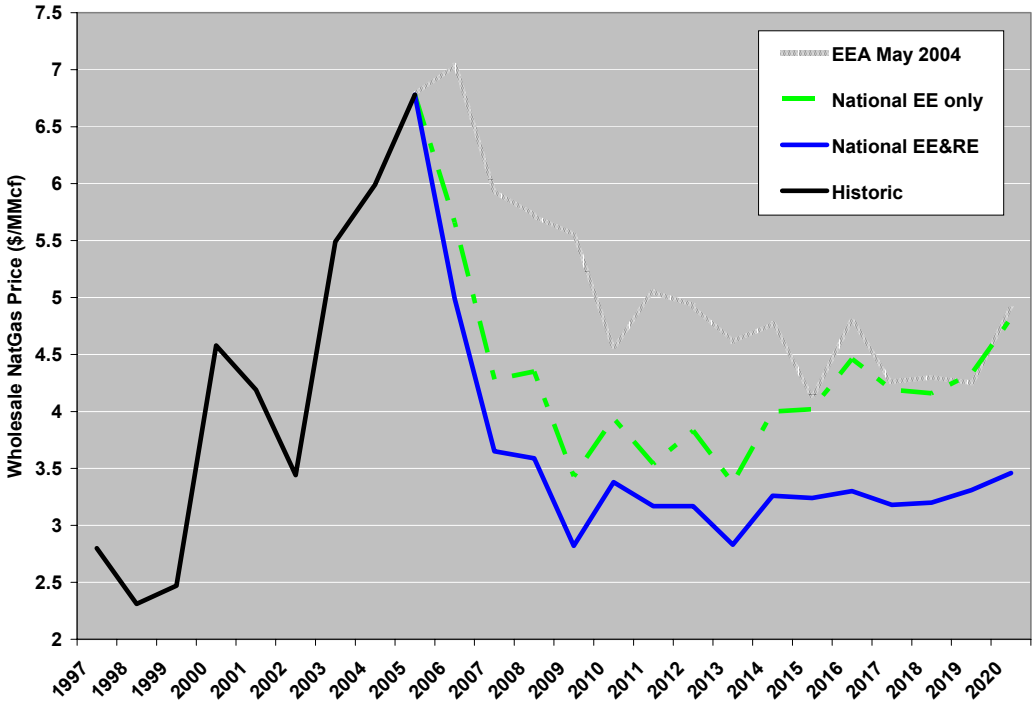
for the bill will require some tough choices and compromises. Senator Peter Domenici, Senator Lamar Alexander, Senator Richard Lugar, and others have been talking lately about the need to take a fresh look at issues and to try to make the bill more comprehensive and truly bipartisan. We can only hope that this attitude prevails in Congress, or else we'll be left with a narrow bill that may or may not garner a majority plus one.

In trying to craft a more effective and broadly supported bill, one of the key issues Representatives and Senators must face is the role of energy efficiency resources. Previous ACEEE studies have found that the adoption of a comprehensive set of policies could reduce U.S. energy demand in 2020 by 26% relative to the EIA reference case forecast. Such savings were projected to save consumers about $600 billion through 2020 and reduce oil imports in 2020 by about 40% relative to the EIA reference case (Nadel and Geller 2001).

However, the 2003 conference report barely makes a down-payment toward achieving these savings. As discussed later in this report, with a little political will, we can increase the energy savings achieved under the bill by about a factor of four. These energy efficiency savings alone will not solve our energy problems, but they will certainly make a large dent.

For example, as can be seen in Figure 1, in a recent analysis ACEEE found that if the United States could reduce natural gas and electricity use by 4–5% over the next five years, natural gas prices would decline by about 25% for about a ten-year period (Elliott and Shipley 2005).

Figure 1. Effects of Energy Efficiency and Renewable Energy on the Henry Hub Wholesale Price of Natural Gas



Source: Elliott and Shipley 2005

Likewise, as discussed later in this report, cost-effective energy efficiency investments can substantially reduce peak electric demand, thereby contributing to electric system reliability, can reduce oil use, thereby reducing our reliance on imported oil, and can reduce emissions of carbon dioxide, the leading gas that causes global warming. While we freely acknowledge that energy efficiency resources alone will not be sufficient to meet future U.S. energy needs, efficiency resources do represent the quickest and cheapest resources available. Failure to pursue energy efficiency resources will make it much, much harder to address our energy problems.

Thus, like Robert Frost, we face a fork in the road. Will we continue to take the well-worn path and try to "muddle-through," leaving energy problems to fester and requiring action again in just a few years time? Or instead, will we take a different path, a path that can make all the difference?

Purpose of this Report

This report does not address all elements of a comprehensive energy bill. Instead, we concentrate on what we believe should be the foundation of any energy plan or energy bill—using energy as efficiently and cost-effectively as possible. In the next section of the report, we discuss different energy efficiency resources provisions that could be enacted. We look in particular at three major categories of policy options:

- Those in the 2003 House-Senate Conference Report (commonly referred to by its bill number—H.R. 6) (U.S. Congress 2003);
- Those in a bill just introduced by Senator Lamar Alexander (R-TN) entitled the *Natural Gas Price Reduction Act of 2005* (S. 726, 2005); and
- Some additional high priority ideas incorporated in several other legislative proposals.

These are not the only bills that could or should be analyzed but this is all we could do within our time and budget constraints. For example, Senators Snowe and Feinstein have introduced a comprehensive energy efficiency bill called *Efficient Energy through Certified Technologies and Electricity Reliability (EFFECTER) Act of 2005* (S. 680, 2005).

Following this review of policy options, we estimate the energy savings from each of these options, in 2010, in 2020, and on a cumulative basis over the 2006–2010 and 2006–2020 periods. As part of this analysis, we look at overall U.S. energy savings, as well as electricity savings (both electricity use and peak demand savings), natural gas savings, oil savings, and reductions in carbon dioxide emissions. In a final section we put these analysis results in a broader context and draw some conclusions. The intent of this effort is to provide objective information to policy makers, as they shape what ultimately goes into legislation, and also to provide information to a broader public about the benefits and costs of investing in energy efficiency resources so they can judge how well the policy makers have done.

CURRENT AND PROPOSED ENERGY EFFICIENCY PROVISIONS

Many policy ideas have been advanced to further cost-effective energy efficiency investments in the United States. These policies have been generally designed to address the many barriers that hinder use of energy efficiency best practices.[1] In this section, we summarize the key energy efficiency policy areas that are or should be considered as part of pending energy legislation.

Appliance and Equipment Efficiency Standards

Minimum efficiency standards for appliances and other equipment have been adopted by Congress in legislation passed in 1987, 1988, and 1992. Efficiency standards require products to meet at least a minimal level of efficiency, removing inefficient equipment from the market while leaving more efficient products with a wide-range of product features. In the past few years, efficiency supporters and manufacturers have negotiated a series of agreements to establish new federal standards on a variety of products. These standards will preempt standards on these products that have been adopted by several states. Essentially, under these agreements, savings expand to states without standards, while manufacturers can return to a uniform national market, without a patchwork of state standards.

New efficiency standards fall into three categories: (1) those in the 2003 House-Senate conference agreement (U.S. Congress 2003); (2) consensus agreements reached since 2003 and likely to be incorporated in any 2005 federal legislation that emerges; and (3) a few additional possibilities that are still under discussion and could perhaps be added to a final bill. In addition, the 2003 House-Senate conference agreement called for the U.S. Department of Energy to set standards for vending machines, ceiling fans, battery chargers, and external power supplies via a rulemaking. Products in each category are listed in Table 1.

Table 1. Products for New Federal Appliance and Equipment Efficiency Standards

Specific Standards in H.R. 6	Additional Consensus Agreements Reached	Additional Possibilities
Exit signs	Commercial refrigerators and freezers	Pedestrian signals
Traffic signals	Commercial packaged air conditioners	Digital television adaptors
Torchiere lighting fixtures	Residential dehumidifiers	Mercury vapor ballasts
Distribution transformers	Pre-rinse spray valves	Commercial ice-makers
Compact fluorescent lamps		Commercial clothes washers
Commercial unit heaters		Residential furnaces and boilers
		Commercial furnaces and boilers
		Residential ceiling fans

The analysis of energy savings from these standards is discussed later in this report. Based on this analysis, the five most important products for energy savings are (in order) residential furnaces (including combustion and fan efficiency), ceiling fans, torchiere lighting fixtures, pre-rinse spray valves, and commercial packaged air conditioners.[2]

[1] For a discussion of these barriers, see Golove and Eto (1996).

[2] These ranks are based on projected natural gas savings in 2020 from standards on each product.

Tax Incentives

Tax incentives can be used to spur sales and adoption of advanced energy-saving technologies and practices, allowing them to increase in market share. The 2003 House-Senate conference report included a variety of tax incentives, typically for a three-year period. Among the products and practices covered are:

- High-efficiency new homes (e.g., those using 30–50% less energy than required under national model building codes);
- High-efficiency new commercial buildings (similar savings to new homes);
- Combined heat and power systems (also referred to as cogeneration);
- Fuel cell and microturbine cogeneration systems;
- High-efficiency refrigerators and clothes washers;
- Weatherization of existing homes;
- Advanced meters for managing energy use; and
- Hybrid and other advanced technology vehicles, both light and heavy duty.

To this list we recommend that residential air conditioners, furnaces, and water heaters be added. The latter two were included in Senate legislation, but not in the final conference agreement. The air conditioner incentives were dropped by the Senate due to lack of a consensus; since then, manufacturers and efficiency supporters have agreed on a package they all can support. We also recommend that the new and existing homes provisions be clarified to make clear that duct sealing and measures to reduce infiltration of outdoor air are covered.[3]

Energy Efficiency Resource Standard

An Energy Efficiency Resource Standard is a simple, market-based mechanism to encourage more efficient generation, transmission, and use of electricity and natural gas. An EERS consists of electric and gas end-use savings targets for retail utilities, with flexibility to achieve them through a market-based trading system. With trading, a utility that saves more than its target can sell savings credits to utilities that fall short of their savings targets. Trading would also permit the market to find the lowest-cost savings nationwide. However, unlike other resources such as renewable energy and coal, energy efficiency resources are distributed throughout the 50 states—studies on many states have found cost-effective opportunities to reduce electric end-use energy use by 20% or more.

We recommend that the EERS targets for electricity and natural gas start at modest levels (e.g., 0.25% of sales annually) and ramp-up over several years to savings levels currently achieved by the most successful states (e.g., 0.75% of sales annually). Peak electricity demand savings should also be included. To ensure that costs will be moderate, in addition to

[3] Field studies have shown that the average energy use of a typical U.S. home could be reduced by 20% or more by sealing distribution air ducts to prevent leakage of heated and cooled air to basements, attics, and other unheated spaces, and by sealing hidden leaks between the living spaces and unheated spaces (Neme, Proctor, and Nadel 1999). Hidden leaks are typically identified with the aid of special tools such as a *duct blaster* and *blower door*, and then sealed with long-lived foams and mastics.

permitting trading, we recommend that electric and gas utilities be permitted to buy credits for 3 cents per kWh of electricity or 30 cents per therm of gas, which is less than half of the current retail cost of these energy sources.

EERS-like laws are now in operation in several states and countries. Texas's electricity restructuring law created a requirement for electric utilities to offset 10% of their demand growth through end-use energy efficiency. Utilities in Texas have had no difficultly meeting their targets and are currently exceeding them (PUCT 2003). Pennsylvania's new Alternative Energy Portfolio Standard includes end-use efficiency among other clean energy resources. The Pennsylvania program has been enacted into law but has yet to begin (PA 2004). The Governor of Illinois has just proposed an EERS, based on the Texas program but with higher savings targets. EERS-like programs have also been established in the United Kingdom and Italy and are being considered by other countries (Pagliano, Alari and Ruggieri 2003).

Because EERS annual requirements are cumulative, over a decade annual savings would steadily mount. Under our proposal, after ten years, annual electricity and natural gas use would be reduced by 6.75% below current forecasts. EERS savings would amount to roughly half of the currently projected *growth* in electric sales over the decade 2006–2016 and over one-half of projected growth in natural gas sales over this same period.

Combined Heat and Power and Recycled Energy

Combined heat and power or cogeneration systems produce two or more usable energy products (e.g., electricity and steam) from a single fuel source. By combining the production of these products, system losses can be significantly reduced, producing efficiencies significantly greater that separate systems (see Elliott and Spurr 1999). In addition, there are various places in energy systems (e.g., high temperature exhaust from industrial process or pressure reducing valves in steam systems) where energy is wasted that could be recaptured to produce usable energy. This recapture is called "recycled energy," because no additional energy input is required to produce this usable energy stream. Because these systems have a very high efficiency, analysis has shown that they can significantly reduce U.S. natural gas consumption (EEA 2003).

Utility Tariff and Interconnection Practices

CHP and recycled energy systems face significant hurdles in many markets where electric utility interconnection and tariff practices do not treat these systems as they do other utility customers (see Elliott and Spurr 1999). In addition, these systems are often not credited for the electricity generation that they displace or for the benefits that they can provide to electric system stability and reliability. Furthermore, CHP systems rarely have access to the same preferred natural gas transmission tariffs that utilities have. While many of these issues will need to be addressed at the state level by regulatory bodies (e.g., public utility commissions), the federal government can provide leadership on these issues. We suggest several policy proposals:

1. Rate equity for behind-the-meter generation. This proposed provision would clarify a matter currently in controversy before the Federal Energy Regulatory Commission (FERC) and elsewhere by stating as a matter of policy that rates and charges for utility services provided upstream of the customer's meter will not be varied as a function of the fact that a customer has its own generation behind the meter, except to the extent that onsite cogeneration or small power production has an actual cost impact on the utility, which may be positive or negative. At present, some system operators or utilities have sought to charge onsite power generators a share of total transmission system costs that includes generation that never leaves their sites, effectively charging small generators transmission rates for their own generation that is never transmitted elsewhere. This has the effect of discouraging self-generation by depriving the cogenerators of some of the economic value of their power production.

2. Election of federal or state interconnection procedures. Although FERC is now finalizing its small generator interconnection rules, which should be more expedited, reasonable in cost, and standardized than most states offer, there are some states whose rules are procedurally and substantively preferable to small generators. This provision allows small generators intending to engage in FERC-jurisdictional transactions nonetheless to elect to use the state interconnection rules at their option for interconnecting a small generator to the grid.

3. Equity for cogenerators' natural gas transmission rates. This provision would adopt within FERC jurisdiction a concept that New York State has adopted, assuring that cogenerators are entitled to the same beneficial rates charged by gas utilities to electric utilities and others who generate electricity with natural gas, but at significantly lower efficiency.

Revolving Loan Fund for CHP Projects

While many of the promising candidate facilities are in the private sector and could take advantage of the CHP tax credit discussed above, a significant fraction of the candidates are in the public sector (e.g., universities, hospitals, and government facilities). To address these, we propose establishing a revolving loan fund to modestly subsidize these projects. This federal fund would be leveraged through the private financing sector to provide competitive financing for public sector CHP systems, so that they too can benefit from the efficiency and cost savings that result.

While these provisions by themselves would not address many of the barriers that currently face CHP and recycled energy projects, they would send a clear message to state and local regulators regarding the benefits of CHP and provide national leadership that would be important to advancing equitable treatment of these systems. When combined with support for new project development, such as is currently being provided by the DOE and U.S. Environmental Protection Agency (EPA) CHP initiative, plus the CHP tax credits provided above, these provisions would be important to creating a positive environment for expanded implementation of CHP and recycled energy projects.

Output-Based Emissions Standards

Current state environmental regulations continue to pose a hurdle to siting of CHP systems. The challenge comes from environmental regulations that did not envision an emissions source that produces both thermal and electric energy and that fails to recognize the higher efficiencies and environmental benefits of such combined systems (Elliott and Spurr 1999). As a result, many regulations are based on fuel inputs that do not recognize the emissions reductions from the energy efficiency inherent in CHP systems. A better alternative is to regulate emissions per unit of energy output, which recognizes the higher efficiency of combined systems. EPA has been working on guidance to states for treatment of CHP systems, but has yet to issue the document because of competing priorities. Congress should direct EPA to issue the guidance to states in a timely manner.

Efficient Dispatch

In spite of public perception, all natural gas generation is not necessarily efficient. While modern combined-cycle natural gas turbine electric-only generation facilities (CCGT) can achieve heat rates[4] of less than 7,000 Btu/kWh, the average natural generation plant in the United States had a heat rate of almost 12,000 Btu/kWh in 2004 (EIA 2005a). In efficient dispatch, the system operator chooses which generation plants to operate by using the plants' efficiency as the criterion. Choosing to dispatch a more efficient plant can result in significant savings. For example, a 10,000 Btu/kWh natural gas plant would consume about 32.5 billion cubic feet (Bcf) per year, while a 7,000 Btu/kWh natural gas plant would consume about 22.75 Bcf per year—a 9.75 Bcf difference.[5]

Many regions of the country, particularly those that have moved to competitive wholesale markets, already operate under efficient dispatch. However, almost half of the country does not, which results in higher cost power and less efficient use of fuels, of which natural gas is increasingly important (see Elliott and Shipley 2005). Under the proposal, FERC would establish standards to guide public utilities in the implementation of efficient system dispatch. Such standards would be designed to ensure that all generation resources have the opportunity (under terms that are just, reasonable, and not unduly discriminatory or preferential) to specify their availability to provide, and their price for, power and energy for inclusion in efficient system dispatch.

Research and Development

Research and development (R&D) helps develop new technologies that can be promoted in the future. The 2003 House-Senate conference report authorized a significant expansion of the DOE energy efficiency R&D program. Among the technologies targeted were solid-state lighting (e.g., light emitting diodes—LEDs), whole building performance, vehicle energy storage, and electric motor controls. Useful updates to the 2003 House-Senate language are provided in H.R. 610 in the current Congress, a bill introduced by Representatives Biggert

[4] Heat rate is defined as the fuel (measured in Btus) required to generate one kWh of electricity net of any use of electricity in the generation process.

[5] Assumes the plant operates at full capacity for 6,500 hours per year.

and Bohlert. Actual R&D expenditures will depend on future appropriation processes and thus authorizing language is just the beginning of the process.

Building Energy Codes

About two million new buildings are constructed in the United States every year. The design decisions and construction practices applied to these buildings will affect national energy use for 50 years or more. Intelligent design can substantially reduce energy demand in new buildings, often with little or no impact on construction costs. It is thus imperative to require energy efficiency in new buildings through energy codes. The Energy Policy Act of 1992 currently requires states to use the ASHRAE 90.1 standard as the basis for commercial building energy codes and to consider using the International Energy Conservation Code for residential buildings.

We recommend that Congress make the International Energy Conservation Code mandatory for states, for both residential and commercial buildings. Also, whether or not a mandatory requirement ultimately proves possible, we recommend that Congress authorize increased grant support for state energy code adoption and implementation. Experience has shown that education and technical assistance are essential in helping state officials, local code officials, home builders, contractors, and others understand, accept, and comply with energy code requirements. We thus recommend an authorization for up to $15 million for state grants to support these activities. We recommend that $10 million of this be reserved for implementation. This encourages states to adopt codes and directs the bulk of funds to implementation, where field experience shows it is most needed.

Public Awareness Campaign

In 2001 California had a major electricity crisis, with rolling blackouts early in the year and projections for more regular blackouts during the summer when demand for power peaks. To address this problem, California instituted a major energy efficiency program including expansions of existing energy efficiency incentive programs and a major public awareness campaign. The latter included television advertisements, appeals from the Governor and other state officials, and utility mailers and print ads that recommended specific steps that consumers could take to reduce energy use. As a result of this effort, electricity use in California in 2001 was reduced about 6%, and peak demand about 11% (Global Energy Partners 2003). While not all of these savings were due to the public awareness campaign, based on our review of the evaluation reports on California's 2001 efforts, we estimate that roughly a third of the savings were due to the campaign. We recommend that Congress direct DOE to lead a substantial national public awareness effort, in concert with other agencies that offer energy efficiency programs and information. We recommend that $100 million annually be authorized for such an effort.

Transportation

Over two-thirds of oil consumed in the United States goes to the transportation sector, yet recent energy bills have all but ignored transportation. Raising fuel economy (CAFE)

standards has proved controversial and politically difficult, but there are alternative approaches to improving the efficiency of vehicles that may gain more traction. One option is a revenue-neutral *feebate* system that grants a rebate or charges a fee on vehicle purchases depending on the vehicle's fuel consumption relative to the average (Greene et al. 2005). Another is simply to require new vehicles to meet current fuel economy standards over a realistic drive cycle, rather than under the test cycle currently used, which understates fuel economy by over 15% (EIA 2005b). There are good opportunities to save oil by boosting heavy truck efficiency as well, which would help the freight industry save on fuel costs (Langer 2004). We recommend, at a minimum, establishment of fuel economy test procedures for these vehicles today, which would allow for the establishment of efficiency-based standards or incentives at a later date.

While transportation consumes the bulk of oil, there are opportunities for oil savings in all sectors of the U.S. economy. The Alexander bill (S. 726) contains a provision requiring a reduction of 1.75 MBD, relative to EIA projections, by 2015—a worthy and achievable goal. An amendment sponsored in 2003 by Senator Landrieu (D-LA) set a target of 1 MBD. However, provisions of this type should be strengthened to include an enforceability mechanism (e.g., specific savings measures that would take effect if progress toward the goal were inadequate, according to annual assessments) and to also specifically establish authority for the U.S. Department of Transportation to establish feebates and heavy truck fuel economy testing and standards. With those additions, these goals would be a good start towards the much deeper cuts needed over the next 15–20 years. 1.75 MBD represents a little more oil than we now import from Saudi Arabia each day. Both buildings and industry could make substantial contributions to this goal through measures such as updating building codes and efficiency standards for residential heaters, and enhancing the efficiency of industrial boilers.

Miscellaneous Provisions

A variety of miscellaneous provisions were included in the 2003 House-Senate conference report. These include:

- Direction to the Federal Trade Commission to revise the Energy Guide label for residential appliances;
- Establishment by DOE of a program to seek voluntary energy efficiency improvements by industry;[6]
- An update of the guideline for programs that seek to reduce energy use in federal facilities;
- Improvements to existing housing laws, allowing public housing authorities and other agencies to achieve significant savings in public housing;

[6] However, this provision lacks savings targets, monitoring, and funding for technical assistance. Targets and monitoring were included in bills passed by the House and Senate and should be restored. We also recommend authorizing funding of $10–20 million per year for technical assistance to industry to help them establish and implement their voluntary commitments.

- Direction to DOE to set up a program to encourage and assist high-performance public buildings;
- Establishment at DOE of a program to publicize the benefits of proper air-conditioner maintenance; and
- Encouragement to state utility commissions to consider instituting real-time pricing programs (real-time pricing means that prices charged to consumers vary depending on hour-by-hour prices determined by electricity markets).

ESTIMATED ENERGY SAVINGS

Methodology

For each of the policies discussed above, we estimated energy savings in 2010, 2020, and cumulatively. Estimates were developed for electricity (use and peak demand), natural gas, oil, and all energy sources together. Our natural gas savings estimates include gas burned in power plants, assuming half the generation on the margin is gas fired.[7] We also estimated reductions in customers' energy bills and carbon dioxide emissions. In general, we used EIA's *Annual Energy Outlook 2005* (EIA 2005a) as our reference case and also took key assumptions from this document including projected energy prices, power plant heat rates, and carbon dioxide emissions per unit of fuel saved (for carbon dioxide from power plants, we assumed a mix of 50% gas on the margin and 50% coal on the margin).[8] To estimate peak demand savings, we used the ratio of peak demand savings per unit reduction in electricity sales from an EIA report on DSM efforts (EIA 2000).

Several of the sections in the different bills *authorize* establishment of a specific program or funding level. However, the way Congress works, these authorizations need to be followed by an explicit *appropriation* of funds. Appropriations are handled by the House and Senate Appropriations Committees and are not included in any of the energy bills. The federal government is now running a large deficit, and thus it will be difficult to fund newly authorized programs. Due to this constraint, our estimates of energy savings generally assumed only limited appropriations and not full funding. Where relevant, in the sections below we describe the assumptions we made regarding appropriations. In the following sections we summarize how energy savings were calculated for each of the policies.

Appliance and Equipment Efficiency Standards

Energy savings from appliance standards was estimated using a complex spreadsheet developed by ACEEE for the Appliance Standards Awareness Project (ASAP). The methodology and assumptions are documented in an ACEEE/ASAP joint report, *Leading the*

[7] In the *Annual Energy Outlook 2005,* EIA estimated that natural gas will account for about 26% of total electricity generation in 2020. On the other hand, it projected that 76% of power plants built between 2005 and 2020 will be gas fired. Our assumption of 50% of power on the margin coming from natural gas is about midway between these two figures.

[8] See note above. EIA estimated that coal will account for about 47% of total electricity generation in 2020 and 19% of power plants built between 2005 and 2020. If we assume that 50% of generation on the margin is gas, then the rest needs to come from coal, as the other major generation sources (hydro and nuclear) will be used to their full capabilities since they have very low operating costs and will not be on the margin.

Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards (Nadel et al. 2005). We used most of the assumptions from that report, but changed effective dates to follow those in the pending federal legislation.

Tax Incentives

Tax incentive energy savings were also developed using a complex ACEEE spreadsheet, originally developed for a 2001 ACEEE report, *Tax Incentives for Innovative Energy-Efficient Technologies* (Quinlan, Geller, and Nadel 2001). The general methodology is described in that report. For the current study, we updated most of the assumptions using EIA's *Annual Energy Outlook 2005* and the latest market data on the different technologies. We also added existing homes and heavy-duty hybrid trucks, important elements of the tax credits in the House-Senate Conference Report that were not included in the earlier analysis. However, ultimately, the key assumptions were estimates of participation under the different tax credit provisions, and sales of similar products/services after the tax credits expire. These estimates were made by ACEEE staff after looking at recent market trends, projections of future trends, and participation rates in previous incentive programs.

Energy Efficiency Resource Standard

An energy efficiency resource standard mandates that gas and electric utilities achieve specific levels of energy savings each year. We modeled an EERS calling for 0.25% savings in 2006, an additional 0.50% in 2007, and an additional 0.75% annually until 2015. We assumed savings would be maintained from 2016–2020, but did not include any new savings, assuming that an extension of the EERS would be up to a future Congress. These percentage savings were applied to EIA projections of gas and electricity sales for each year in the analysis. However, we adjusted the EIA projections downward to account for the impacts of the EERS in prior years. For electricity, we included only larger utilities (those with sales of at least 500 million kWh per year—about 90% of total sales), following the coverage of the Renewable Portfolio Standard proposed by Senator Jeffords. For natural gas, we included all residential and commercial gas sales, and half of industrial sales, estimating that the other half of industrial sales will not be under firm contracts with natural gas distribution utilities.

Combined Heat and Power and Recycled Energy Provisions

Utility tariff and interconnection practices and EPA CHP emissions guidance. ACEEE assumed that the interconnection and tariff provisions, and direction of EPA to issue CHP emissions guidance to states would produce a net 10% increase in the projected CHP installations. We used our own internal forecast for projected CHP capacity as a reference (see Table 2).

Table 2. Projected Installations of CHP Capacity in the ACEEE Reference Case and with Federal Interconnection and Tariff Policies

Capacity (GW)	2010	2015	2020
ACEEE reference projection	100	165	230
With interconnect & tariff	110	182	253
Net	10	16.5	23

Revolving loan fund for CHP projects. To estimate the impact of this provision, we assumed that half of the commercial and institutional implementable potential that is not eligible for the CHP tax credit could take advantage of the preferred financing under this provision. We assumed that the funding is repaid on a five-year cycle, providing an equivalent level of incentive to the tax credit.

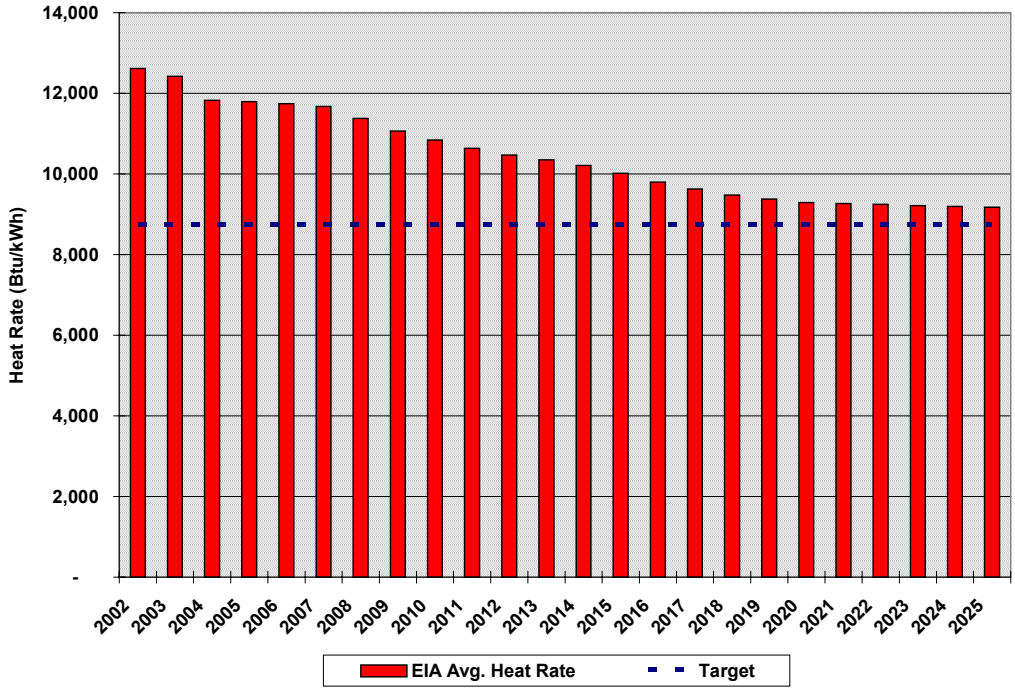
Efficient Dispatch

To assess the impact of efficient dispatch on natural gas markets, we took EIA (2005a) projections of electricity utility generation from natural gas and gas consumed for utility electricity generation, and calculated the implied heat rate (see Figure 2). We then chose a target heat rate of 8,750 Btus per kWh, reflecting a reasonable target for an efficient mix of gas-fired generation. The resulting difference represents the opportunity. Since about half the electricity currently generated is in competitive wholesale markets and we assumed that these markets are already operating under efficient dispatch, we assumed that the potential efficiency improvements apply only to half of the national generation. Further, we assumed a two-year rulemaking period and a three-year implementation ramp-up. As a result, 2010 is the first year for which we project full realization of the potential. The savings decline in the out years as the overall electric power sector efficiency improves (see Figure 2).

Research and Development

In 1997, the President's Committee of Advisors on Science and Technology (PCAST) recommended that federal funding of $880 annually be provided for energy efficiency R&D and estimated that energy bills would be reduced by $75–95 billion in 2020 (PCAST 1997). Based on these estimates, ACEEE's *Smart Energy Policies* report (Nadel and Geller 2001) projected that a robust investment in R&D could reduce U.S. energy use by 1 quadrillion Btus (a "quad" is 10^{15} Btus) in 2010 and 3 quads in 2020. For the current study, we reduced these numbers further, estimating 0.25 quad savings in 2010 and 1.5 quads in 2020, if the authorizations are largely funded. However, if appropriators largely ignore the authorizations and leave funding at present levels, we estimate savings relative to the EIA reference case of only 0.05 quad in 2010 and 0.30 quad in 2020. We allocated these savings to the different energy sources and fuels based on EIA projections for 2010 and 2020. All of these estimates apply to the broad category of R&D without attempting to get into which specific provisions will be funded and which will not. The appropriations process is very complicated and we do not attempt to predict the program-specific outcomes of this process.

Figure 2. Average Projected Natural Gas Electric Generation Heat Rate with Efficient Dispatch Target



Source: EIA (2005a) with ACEEE developed target

Building Energy Codes

ACEEE's *Smart Energy Policies* report (Nadel and Geller 2001) also included estimates of savings from aggressive efforts to update building codes. However, most of this activity takes place at the state level. What the federal government can do is provide technical assistance and funding to the states. We examined a legislative provision that authorized increased grant support to states for energy code adoption and implementation. We estimated that this provision will only achieve part of the potential savings available from updating building codes. *Smart Energy Policies* estimated savings of 0.31 quads in 2010 and 1.5 quads in 2020 from building codes. For this report, we took one-quarter of the 2010 number (since 2010 is only five years away) and one-third of the 2020 number. We allocated these savings to the different energy sources and fuels based on EIA projections for 2010 and 2020.

Public Awareness Campaign

As noted above, California's public awareness campaign in 2001 reduced electricity use by about 3%. We recognize that a national campaign is not likely to be as intensive, nor does the nation face as immediate a threat as California faced in 2001. Therefore, we estimated that a large national campaign (e.g., budgeted for about $100 million over several years) could reduce U.S. electricity and natural gas, and passenger vehicle gasoline use by about 1.5% by 2010, with half of these savings persisting through 2020.

Transportation

Estimates of oil savings from light-duty vehicle policies were made by translating these policies into the fuel economy improvements they would yield, then using ACEEE's vehicle stock turnover model to project the effect on oil consumption (DeCicco 1995). According to Greene et al. (2005), a feebate implemented at a rate of $1,000 per 0.01 gallons per mile would produce a 29% increase in fuel economy, assuming manufacturers have sufficient lead time to gear up production of more efficient vehicles. We phase in this increase linearly over the period 2007–2015, roughly two product cycles. For the truth-in-testing measure of reconciling vehicles' actual fuel economies with their CAFE values, we estimated that the effect would be a 20% improvement in average fuel economy; we phased this in over the period 2007–2010 in our analysis.

We also included two versions of the 1 MBD savings provision. As indicated above, this would be a multi-sector measure producing the required savings by 2015. For purposes of representing the possible consequences of the measure in the analysis years 2010 and 2020, we phased in an increase in light duty fuel economy sufficient to achieve 72% of the 2015 savings (we assumed the other 28% of the target would be met by renewable fuel requirements).[9] As a reminder that the 1 MBD savings will not be achieved absent a means of enforcement, we have also included a scenario in which the savings reach only 0.5 MBD in 2015, with 0.2 MBD achieved from renewable fuels as discussed above and the remaining 0.3 MBD from efficiency improvements. Without enforcement, it will be difficult to distinguish savings between the 1 MBD target we analyze here and the 1.75 MBD target in the Alexander bill.

Finally, our analysis includes a new CAFE standard at 40 miles per gallon beginning in 2015. This policy is a useful benchmark for comparing the impact of other transportation efficiency and oil-saving policies.

Miscellaneous Provisions

For each of the miscellaneous provisions, ACEEE had previously developed estimates of energy savings over the 2001–2003 period. We updated these estimates for this study. Key assumptions were as follows:

- A voluntary industrial commitment program can reach 15% of factories and save an average of about 0.5% of energy use in these factories for a ten-year period. However, if funding is not provided, participation will be half of these levels, and without specific savings targets in the legislation, savings will be a further one-third lower.
- Improved appliance labels can reduce U.S. energy use by about 0.25 quads per year once the appliance stock turns over (Thorne and Egan 2002).
- The federal facilities provision can reduce energy use in these facilities by an average of 5% by 2020.

[9] This is an analytical device and should not be interpreted as a recommendation of how to implement the 1 MBD requirement. The estimate of the renewable fuels portion of these savings comes from NRDC (2005).

- The high-performance public buildings provision can lead to 20% energy savings in 10% of local government buildings.
- The air-conditioner education provision can lead to a 10% reduction in air-conditioner energy use in 10% of homes.
- The public housing provision can save $200 million per year according to proponents (Morgan 2002). To be conservative, we take one-half of this number and extrapolate to the different energy sources based on EIA energy price and energy use estimates.
- The real-time pricing provision can result in actions by states accounting for 5% of the U.S. population, resulting in 3% energy savings in these states and peak demand savings based on the ratio of air conditioner peak demand to air conditioner annual energy use.

Results

For each of the provisions covered in this report, we estimated energy savings in 2010, 2020, and on a cumulative basis through 2010 and 2020. The results of the 2020 analysis, on a provision-by-provision basis, are provided in Table 3. Similar results for 2010 and on a cumulative basis are provided in the appendix. As can be seen in Table 3, if all of the efficiency provisions are adopted, energy savings in 2020 would total 15.4 quads. This is a 12% reduction in projected U.S. energy use, a sizable achievement. Reductions in natural gas use are somewhat higher (about 17% of projected 2020 gas use) due to the large electricity savings and our estimate that half of the electricity displaced will come from gas-fired power plants. The largest savings in 2020 are from transportation measures and miscellaneous oil-saving measures (7.0 quads), an energy efficiency resource standard (2.4 quads), R&D (1.5 quads assuming full funding), tax incentives (1.4 quads), and appliance and equipment efficiency standards and labeling (1.1 quads).

However, Table 3 includes some controversial measures. For example, we include updated CAFE standards for passenger vehicles in the table in order to illustrate the savings available, but Congress has rejected such changes in recent years. Likewise, given the budget deficits facing the federal government, it is unlikely that R&D and tax incentives will be fully funded and therefore the full savings listed are unlikely to be achieved. In order to estimate the savings from a less politically charged set of policies, we examined three policy packages as follows:

1. The House-Senate 2003 Conference Report (H.R. 6)
2. S. 726, just introduced by Senator Lamar Alexander
3. An enhanced bill, including most of the provisions in H.R. 6 and S. 726, and a few additional items.

Table 4 shows which specific provisions are included in each of these packages. The following sections discuss the results of this analysis.

Table 3. Estimated Savings in 2020 from Specific Energy Efficiency Legislative Provisions

Policy Initiative	TWH	MW	Direct Gas BCF	Total Gas BCF	Oil MBD	Quads	$ million	Carbon (MMT)
1. Appliance Efficiency Standards								
a. In HR6	37	8,852	34	228	0	0.42	$3,376	8.0
b. Additional consensus agreements	10	8,296	34	87	0	0.14	$1,143	2.5
c. Feasible additions	23	6,917	31	152	0	0.27	$2,186	5.1
Subtotal	71	24,066	99	467	0	0.83	$6,704	15.6
2. Tax incentives								
a. New Homes	12	3,147	84	144	0.00	0.20	$1,573	3.6
b. Central AC/HP	9	2,340	0	45	0.00	0.09	$925	1.7
c. Gas water heaters	0	0	21	21	0.00	0.02	$155	0.3
d. HP water heaters	1	182	0	3	0.00	0.01	$55	0.1
e. Gas furnaces	11	2,850	56	111	0.00	0.17	$1,278	2.9
f. Appliances	5	1,218	107	131	0.00	0.15	$1,162	2.5
g. Comm. Bldgs.	14	3,883	49	123	0.00	0.20	$1,535	3.6
h. Fuel cell cogen.	0	0	0	0	0.00	0.00	$2	0.0
i. Fuel cell vehicles	0	0	0	0	0.00	0.00	$22	0.0
j. Hybrid vehicles (light duty)	0	0	0	0	0.03	0.06	$797	1.1
k. Hybrid vehicles (heavy duty)	0	0	0	0	0.03	0.05	$686	0.9
l. CHP	0	0	347	347	0.00	0.35	$2,563	5.1
m. Existing homes	3	880	74	91	0.00	0.11	$812	1.7
Subtotal	54	14,499	738	1,016	0.06	1.41	$11,564	23.6
3. Energy efficiency resource standard	172	46,380	576	1,465	0.02	2.35	$19,214	43.5
4. CHP and Recycled Energy								
a. Revolving loan fund	12	1,912		44	~0	0.05	$656	2.5
b. Utility tariffs & connection stds.	150	23,000		534	~0	0.55	$7,890	29.8
Subtotal	162	23,000		578	0.00	0.60	$8,546	32.3
5. Efficient Dispatch			271	271		0.28	$1,420	4.0
6. RD&D supplemental approp.								
a. If authorizations funded	58	15,652	300	600	0.31	1.50	$13,389	26.6
b. Without extra funding	12	3,130	60	120	0.06	0.30	$2,678	5.3
Subtotal	58	15,652	300	600	0.31	1.50	$13,389	26.6
7. Misc. efficiency provisions								
a. Voluntary industrial commitments								
Without targets	3.1	830	26	41	0.014	0.08	$483	1.5
Additional with targets	1.5	414.8	12.8	20.7	0.01	0.04	$242	0.7
Additional with funding	4.6	1244.4	38.3	62.1	0.02	0.13	$725	2.2
b. Labeling of appliances	22.5	6,075	25	141	0.000	0.26	$2,068	4.9
c. Federal facilities	1.0	269	2	7	0.001	0.01	$99	0.3
d. High performance public buildings	1.0	271	2	7	0.001	0.01	$100	0.3
e. A/C maintenance education	1.0	1,174	0	5	0.000	0.01	$83	0.2
f. Public housing	0.8	212	3	7	0.002	0.01	$93	0.3
g. Real-time pricing	5.0	5,782	0	26	0.000	0.05	$334	1.0
Subtotal	40	16,273	108	318	0.05	0.62	$4,226	11.2
8. Building Energy Codes	25	6,783	210	340	0.02	0.50	$3,931	8.6
9. Public Awareness Campaign								
a. Significant campaign	36	9,742	105	292	0.09	0.65	$5,942	11.7
b. Limited campaign (no signif. $)	4	974	10	29	0.01	0.06	$594	1.2
Subtotal	36	9,742	105	292	0.09	0.65	$5,942	11.7
10. Transportation & misc. oil								
a. 1 million barrels/day oil savings by 2015					1.25	2.37	$29,702	43.1
b. Alexander Bill, no enforcement					0.53	1.18	$14,851	21.5
c. Feebate					1.69	3.20	$40,157	58.3
d. Truth in testing					1.43	2.71	$33,979	49.3
e. CAFÉ: 40 mpg by 2015					3.06	5.80	$72,710	105.5
Subtotal					3.53	6.69	$83,848	121.6
TOTAL	**618**	**156,394**	**2,136**	**5,075**	**4.07**	**15.14**	**$157,366**	**294.8**

Table 4. Specific Policies Included in the Three Policy Packages

Policy Initiative	Provisions Analyzed for Each Package		
	H.R. 6	S. 726	Enhanced
1. Appliance efficiency standards			
a. In HR6	X	X	X
b. Additional consensus agreements		X	X
c. Feasible additions		Mostly	X
2. Tax incentives			
a. New Homes	X	X	X
b. Central AC/HP			X
c. Gas water heaters			X
d. HP water heaters			X
e. Gas furnaces			X
f. Appliances	X	X	Updated
g. Commercial buildings	X	X	Higher amount
h. Fuel cell cogeneration	X	X	X
i. Fuel cell vehicles	X	X	X
j. Hybrid vehicles (light duty)	X	X	X
k. Hybrid vehicles (heavy duty)	X	X	X
l. CHP	X	X	X
m. Existing homes	X	X	Cost reduced
3. Energy efficiency resource standard			
4. CHP and recycled energy			
a. Revolving loan fund		X	X
b. Utility tariffs & connection standards		X	X
5. Efficient dispatch		**X**	**X**
6. RD&D supplemental appropriations			
a. If authorizations funded			
b. Without extra funding		X	X
7. Misc. efficiency provisions			
a. Voluntary industrial commitments			
Without targets	X		
Additional with targets			X
Additional with funding			
b. Labeling of appliances	X	X	X
c. Federal facilities	X		X
d. High performance public buildings	X		X
e. A/C maintenance education	X		X
f. Public housing	X		X
g. Real-time pricing	X		X
8. Building energy codes			**X**
9. Public awareness campaign			
a. Significant campaign			X
b. Limited campaign (no significant $)		X	
10. Transportation & misc. oil			
a. 1 MBD oil savings by 2015			X
b. Alexander Bill, no enforcement		X	
c. Feebate			Authorize
d. Truth in testing			
e. CAFE: 40 mpg by 2015			

House-Senate 2003 Conference Report (H.R. 6)

Savings from the House-Senate conference report are summarized in Table 5. Overall, we estimate this bill will reduce U.S. energy use by about 0.7% in 2010 and 1.7% in 2020. Gas savings are somewhat higher (4.5% in 2020) due to the reductions in gas used to generate electricity while oil savings are much lower (0.5% in 2020) since the bill has few provisions to address oil use. The biggest savings are due to tax incentives (1.0 quads in 2020) and appliance standards and labeling[10] (0.7 quads in 2020) (see Figure 3). On a cumulative basis, the bill will reduce natural gas use about 1.6% over the 2006–2010 period, which will apply some downward pressure on prices. However, the bill would fall short of the 4-5% reductions needed to achieve 20% or greater reductions in natural gas prices. On the other hand, by reducing energy use, the bill would provide direct reductions in energy costs of about $19 billion over the 2006–2010 period and $144 billion over the 2006–2020 period.

Table 5. Savings from Efficiency Sections in H.R. 6 Conference Report

	Annual		Cumulative	
	2010	**2020**	**2006–2010**	**2006–2020**
Electricity				
GWh	30	110	78	818
Percentage	0.7%	2.2%	0.4%	1.2%
Peak MW	9,460	33,783		
Percentage	1.0%	3.2%		
Natural gas (BCF)	**593**	**1,357**	**1,949**	**11,127**
Percentage	2.3%	4.5%	1.6%	2.8%
Oil (MBD)	**0.03**	**0.14**		
Oil (billion barrels)			**0.02**	**0.31**
Percentage	0.1%	0.5%	0.0%	0.1%
Total energy (quads)	**0.79**	**2.20**	**2.44**	**17.59**
Percentage	0.7%	1.7%	0.5%	1.0%
Energy bills (million $)	**$6,003**	**$17,697**	**$19,298**	**$143,646**
Carbon (MMT)	**13.5**	**38.3**	**41.3**	**307.8**
Percentage	0.7%	1.9%	0.5%	1.1%

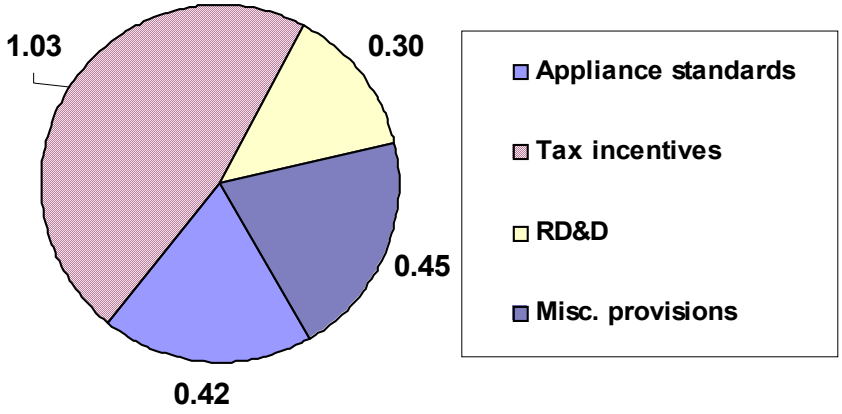
Alexander Bill (S. 726)

Savings from S. 726 are summarized in Table 6. Overall, we estimate this bill will reduce U.S. energy use by about 1.8% in 2010 and 3.6% in 2020. These savings are more than triple those of H.R. 6. Savings are higher than in H.R. 6 due to additional appliance standards, additional measures to promote CHP and efficient dispatch, and inclusion of a provision to save 1.75 MBD of oil by 2015. Gas savings are substantially higher (7.9% in 2020) than total energy savings due to the fact that we estimate that half of electricity on the margin will

[10] Labeling is included in "misc. provisions" in the figures.

come from gas plants. The biggest savings are due to three provisions—the 1.75 MBD of oil savings provision (1.2 quads in 2020 without an enforcement mechanism), appliance standards and labeling (1.1 quads), and tax incentives (1.0 quads) (see Figure 4). On a cumulative basis, the bill would reduce natural gas use about 3.3% over the 2006–2010 period, which would apply significant downward pressure on prices. However, the bill would fall short of the 4–5% reductions needed to achieve 20% or greater reductions in natural gas prices. On the other hand, by reducing energy use, the bill would provide direct reductions in energy costs of about $36 billion over the 2006–2010 period and $283 billion over the 2006–2020 period. Downward pressure on natural gas prices would add to these amounts. With regard to oil use, it should be noted that the estimated reduction due to a savings target alone is a fraction of what could be achieved by incorporating an enforcement mechanism.

Figure 3. Distribution of Energy Savings in H.R. 6 with Energy Savings by Policy in Quads



Also, it should be noted that Senator Alexander did not include the Energy Efficiency Resource Standard in his bill, though staff for Senate Energy Committee Chairman Pete Domenici has expressed interest in exploring a variant (Domenici 2005). Addition of this provision would further add to savings.

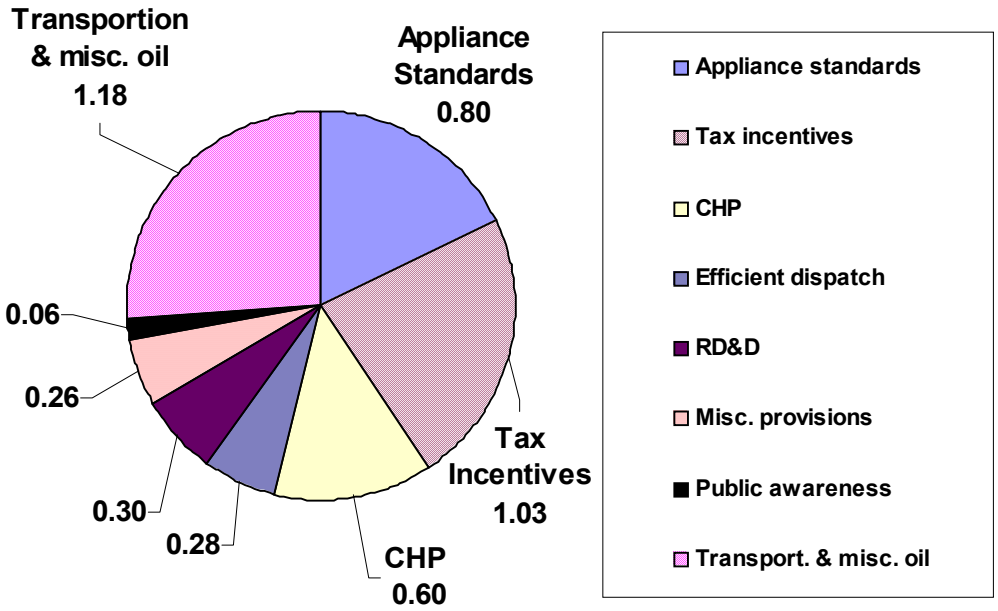
Enhanced Bill

Taking the best features of H.R. 6 and the Alexander bill and adding some additional features would increase energy savings substantially. Such a bill would combine the miscellaneous efficiency provisions in H.R. 6, the tax incentives in both bills, the expanded appliance standards and CHP provisions in S. 726, and a few additional improvements such as the Energy Efficiency Resource Standard, additional enforceability and authorization provisions added to Senator Alexander's oil savings target, a provision to assist states to update their building codes, and full funding for the energy efficiency public information campaign. Savings from such a package are summarized in Table 7.

Table 6. Savings from Efficiency Sections in S. 726

	Annual		Cumulative	
	2010	**2020**	**2006–2010**	**2006–2020**
Electricity				
GWh	101	297	256	2,008
Percentage	2.4%	5.9%	1.2%	3.0%
Peak MW	22,157	64,432		
Percentage	2.3%	6.1%		
Natural gas (BCF)	**1,553**	**2,381**	**3,926**	**22,192**
Percentage	6.1%	7.9%	3.3%	5.5%
Oil (MBD)	**0.11**	**0.66**		
Oil (billion barrels)			**0.04**	**1.56**
Percentage	0.5%	2.5%	0.0%	0.4%
Total energy (quads)	**2.03**	**4.54**	**4.72**	**42.94**
Percentage	1.8%	3.6%	0.9%	2.5%
Energy bills (million $)	**$15,766**	**$45,245**	**$36,407**	**$283,151**
Carbon (MMT)	**42.3**	**101.5**	**100.1**	**759.3**
Percentage	2.3%	4.9%	1.1%	2.7%

Figure 4. Distribution of S. 726 Energy Savings in 2020 by Policy (Quads)



Overall, we estimate this package would reduce U.S. energy use by about 4.4% in 2010 and 7.8% in 2020. These savings are more than double those of the Alexander bill and about five to six times as much as those for H.R. 6. Gas savings are substantially higher (16.0% in 2020) than total energy savings. The biggest savings are due to the 1 million barrels of oil provision (2.4 quads in 2020), the Energy Efficiency Resource Standard (2.4 quads), tax incentives (1.4 quads), appliance standards and labeling (1.1 quads), and the CHP

and efficient dispatch provisions (0.9 quads) (see Figure 5). On a cumulative basis, the bill would reduce natural gas use about 6.6% over the 2006–2010 period, achieving the 4–5% reductions needed to achieve 20% or greater reductions in natural gas prices. On a cumulative basis, this package would result in direct energy cost savings of $96 billion over the 2006–2010 period and $737 billion over the 2006–2020 period. If we add a 20% reduction in natural gas prices in 2006–2010 and a 10% reduction in natural gas prices over 2011–2015, the cumulative savings would total about $290 billion from 2006–2010 (a three-fold increase!) and $1,110 billion from 2006–2020 (nearly a 50% increase).

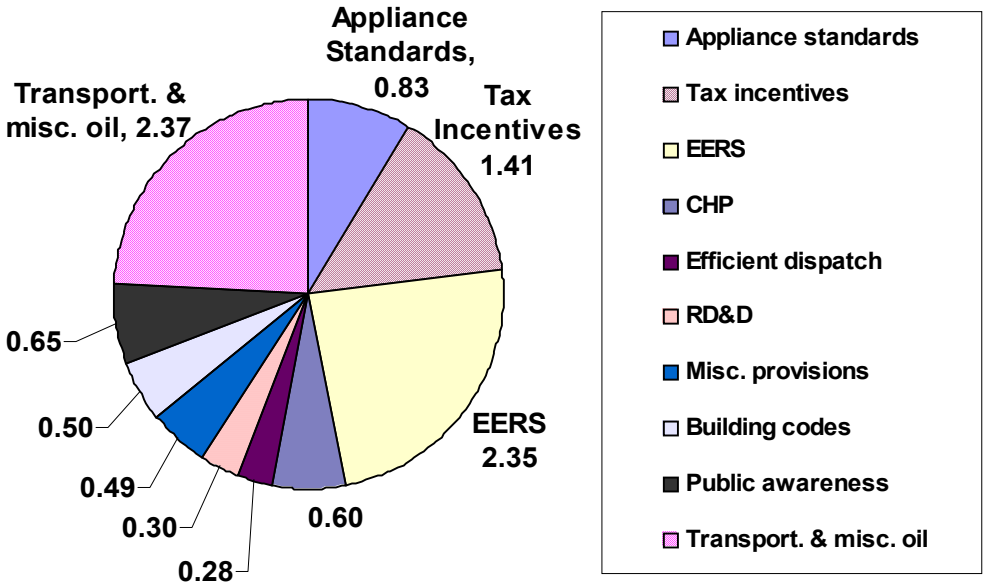
Table 7. Savings from Efficiency Sections in the Enhanced Bill

	Annual		Cumulative	
	2010	**2020**	**2006–2010**	**2006–2020**
Electricity				
GWh	276	567	700	5,342
Percentage	6.4%	11.3%	3.4%	7.9%
Peak MW	71,221	142,628		
Percentage	7.5%	13.6%		
Natural gas (BCF)	**3,059**	**4,804**	**7,871**	**50,681**
Percentage	12.0%	16.0%	6.6%	12.6%
Oil (MBD)	**0.36**	**1.52**		
Oil (billion barrels)			**0.31**	**4.08**
Percentage	1.6%	5.8%	0.3%	1.1%
Total energy (quads)	**4.90**	**9.78**	**12.37**	**102.14**
Percentage	4.4%	7.8%	2.3%	5.9%
Energy bills (million $)	**$38,958**	**$93,203**	**$94,081**	**$737,219**
Carbon (MMT)	**96.1**	**196.8**	**242.5**	**1839.3**
Percentage	5.3%	9.6%	2.8%	6.5%

CONCLUSIONS

All three policy packages examined in this analysis would save energy and help the economy. However, they vary more than five-fold in the levels of energy savings and economic benefits they offer. For example, H.R. 6 would save about 18 quads and $144 billion on a cumulative basis over the 2006–2020 period. However, the Alexander would do substantially much more, with cumulative savings totaling 46 quads and $297 billion. In addition, the Alexander bill would save more natural gas over the critical 2006–2010 period, which would provide downward pressure on gas prices not reflected in the numbers above. However, each of these two bills contains provisions not in the other. By combining the best features of both bills, plus adding a few key policies, savings could be increased approximately five- to six-fold relative to H.R. 6. We estimate cumulative savings for this enhanced package to be about 105 quads and $1,120 billion over the 2006–2020 period (this latter value includes about $370 billion of savings due to lower natural gas prices).

Figure 5. Distribution of Enhanced Bill Energy Savings in 2020 by Policy (Quads)



Interestingly, the savings calculated here are similar to savings calculated by Goldstein (2005) for the Snowe-Feinstein bill. Goldstein estimated savings of 380 TWh of electricity and 1.3 Quads of direct natural gas savings from Snowe-Feinstein in 2015. Our enhanced package would save about 420 TWh and 1.9 Quads of natural gas in 2015. The enhanced package would have higher savings due primarily to the EERS and additional appliance efficiency standards.

Based on these findings, at a minimum we recommend combining the best features in H.R. 6 and the Alexander bill. These include the appliance and equipment efficiency standards and tax incentives in both bills, the miscellaneous efficiency provisions in H.R. 6, and the CHP, efficient dispatch, and oil savings target provisions in the Alexander bill. In addition, key additional provisions would substantially increase the energy and financial savings: (1) a national Energy Efficiency Resource Standard; (2) provisions that ensure the oil savings target is truly reached; and (3) funding a substantial public information campaign on opportunities to reduce energy use and the value of these savings to households, businesses, and the nation at large.

REFERENCES

[S. 680] Olympia Snowe. 2005. *Efficient Energy through Certified Technologies and Electricity Reliability (EFFECTER) Act of 2005*. Senate bill S. 680. Washington, D.C.: U.S. Senate

[S. 726] Lamar Alexander. 2005. *Natural Gas Price Reduction Act of 2005*. Senate bill S. 726. Washington, D.C.: U.S. Senate.

DeCicco, John. 1995. "Projected Fuel Savings and Emissions Reductions from Light-Duty Fuel Economy Standards." *Transportation Research 29A (3), 205–228*. London, Great Britain: Elsevier Science Ltd.

Domenici, Senator Pete. 2005. "Domenici Affirms Strong Interest in Clean, Renewable Portfolio Standard in Energy Bill." Press release. March 8. Washington, D.C.: Senate Energy Committee.

[EEA] Energy and Environmental Analysis, Inc. 2003. *Natural Gas Impacts of Increased CHP*. http://uschpa.admgt.com/CHP_GasOct03.pdf. Washington, D.C.: U.S. CHP Association.

[EIA] Energy Information Administration. 2000. *Electric Utility Demand Side Management 1999: Executive Summary.* http://www.eia.doe.gov/cneaf/electricity/dsm99/dsm_sum99.html. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

———. 2004a. *Annual Energy Outlook 2004*. DOE/EIA-0383(2004). http://www.eia.doe.gov/oiaf/aeo/index.html. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

———. 2004b. *Analyses of Selected Provisions of Proposed Energy Legislation: 2003*. SR/OIAF/2003-04. http://www.eia.doe.gov/oiaf/servicerpt/eleg/pdf/sroiaf(2003)04.pdf. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

———. 2005a. *Annual Energy Outlook 2005 with Projections to 2025.* http://www.eia.doe.gov/oiaf/aeo/index.html. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

———. 2005b. *Assumptions to the Annual Energy Outlook 2005*. http://www.eia.doe.gov/oiaf/aeo/assumption/pdf/0554(2005).pdf. Washington, D.C.: U.S. Department of Energy, Energy Information Administration.

Elliott, R.N. and A.M. Shipley. 2005. *Impacts of Energy Efficiency and Renewable Energy on Natural Gas Markets: Updated and Expanded Analysis.* Forthcoming. Washington, D.C.: American Council for an Energy-Efficient Economy.

Elliott, R.N. and M. Spurr. 1999. *Combined Heat and Power: Capturing Wasted Heat*. http://aceee.org/pubs/IE983.htm. Washington, D.C.: American Council for an Energy-Efficient Economy.

Global Energy Partners, LLC. 2003. *California Summary Study of 2001 Energy Efficiency Programs, Final Report.* (January 13 draft). Lafayette, Calif.: Global Energy Partners, LLC.

Goldstein, David. 2005. "S. 680 (Snowe-Feinstein), Cunningham/Markey Bill (House), 109th Congress." San Francisco, Calif.: Natural Resources Defense Council.

Golove, W.H. and J.H. Eto. 1996. *Market Barriers to Energy Efficiency: A Critical Reappraisal of the Rationale for Public Policies to Promote Energy Efficiency.* LB-38059. Berkeley, Calif.: Lawrence Berkeley National Laboratory.

Greene, D., 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), 757–775. April.

Langer, T. 2004. "Energy Saving Through Increased Fuel Economy for Heavy-Duty Trucks." In *Ending the Energy Stalemates: A Bipartisan Strategy to Meet America's Energy Challenges*. Washington, D.C.: National Commission on Energy Policy.

Morgan, Stephen (Citizens Conservation Services). 2002. Personal communication with S. Nadel.

Nadel, Steven and Howard Geller. 2001. *Smart Energy Policies: Saving Money and Reducing Pollutant Emissions through Greater Energy Efficiency.* http://aceee.org/pubs/e012full.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

Nadel, Steven, Andrew deLaski, Jim Kliesch, and Toru Kubo. 2005. *Leading the Way: Continued Opportunities for New State Appliance and Equipment Efficiency Standards.* http://aceee.org/pubs/a051.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

[NRDC] Natural Resources Defense Council. 2005. "Securing America: Solving our Oil Dependence Through Innovation." http://www.nrdc.org/air/transportation/oilsecurity/plan.pdf. New York, N.Y.: Natural Resources Defense Council and Institute for the Analysis of Global Security.

Neme, Chris, John Proctor, and Steven Nadel. 1992. *Energy Savings Potential from Addressing Residential Air Conditioner and Heat Pump Installation Problems.* Washington, D.C.: American Council for an Energy-Efficient Economy.

Pagliano, Lorenzo, Pierluigi Alari, and Gianluca Ruggieri. 2003. "The Italian Energy Savings Obligation to Gas and Electric Distribution Companies." In the *Proceedings of eceee 2003 Summary Study*, 3, 1059–1078. Stockholm, Sweden: : European Council for an Energy Efficient Economy.

[PA] General Assembly of Pennsylvania. 2004. "The Alternative Energy Portfolio Standards Act." *Senate Bill 1030.* Harrisburg, Penn.: General Assembly of Pennsylvania.

[PCAST] President's Committee of Advisors on Science and Technology. 1997. *Federal Energy Research and Development for the Challenges of the Twenty-First Century.* Report of the Energy Research and Development Panel. Washington, D.C.: President's Committee of Advisors on Science and Technology.

[PUCT] Public Utilities Commission of Texas. 2003. *Mid-Year Report on Energy Efficiency Program Activities.* Report prepared by Frontier Associates. Austin, Tex.: Public Utilities Commission of Texas.

Quinlan, Patrick, Howard Geller, and Steven Nadel. 2001. *Tax Incentives for Innovative Energy-Efficient Technologies (Updated).* http://aceee.org/pubs/e013full.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

Thorne, Jennifer and Christine Egan. 2002. *An Evaluation of the Federal Trade Commission's Energy Guide Appliance Label: Final Report and Recommendations*. http://aceee.org/pubs/a021full.pdf. Washington, D.C.: American Council for an Energy-Efficient Economy.

U.S. Congress. 2003. *Energy Policy Act of 2003*. Proposed legislation. http://energy.senate.gov/legislation/energybill2003/energybill2003.cfm. Washington, D.C.: U.S. Congress.

White House, The. 2005. "President Discusses Energy Policy." http://www.whitehouse.gov/news/releases/2005/20050309-5.html. Washington, D.C.: The White House.

APPENDIX: OTHER ANALYSIS RESULTS

Table A-1. Analysis of Savings by Policy in 2010

Policy Initiative	TWH	MW	Direct Gas BCF	Total Gas BCF	Oil MBD	Quads	$ million	Carbon (MMT)
1. Appliance Efficiency Standards								
a. In HR6	9	2,188	4	54	0	0.10	$756	2.0
b. Additional consensus agreements	1	510	4	8	0	0.01	$84	0.2
c. Feasible additions	9	2,687	3	51	0	0.10	$728	2.0
Subtotal	19	5,385	12	113	0	0.22	1,569	4.2
2. Tax incentives								
a. New Homes	3	751	20	35	0.00	0.05	$363	0.9
b. Central AC/HP	1	255	0	5	0.00	0.01	$95	0.2
c. Gas water heaters	0	0	3	3	0.00	0.00	$20	0.0
d. HP water heaters	0	26	0	1	0.00	0.00	$7	0.0
e. Gas furnaces	2	444	9	18	0.00	0.03	$191	0.5
f. Appliances	1	184	16	20	0.00	0.02	$175	0.4
g. Comm. Bldgs.	3	812	10	26	0.00	0.04	$305	0.8
h. Fuel cell cogen.	0	0	0	0	0.00	0.00	$0	0.0
i. Fuel cell vehicles	0	0	0	0	0.00	0.00	$1	0.0
j. Hybrid vehicles (light duty)	0	0	0	0	0.01	0.02	$201	0.3
k. Hybrid vehicles (heavy duty)	0	0	0	0	0.00	0.00	$21	0.0
l. CHP	0	0	312	312	0.00	0.31	$2,373	4.6
m. Existing homes	2	558	47	58	0.00	0.07	$512	1.1
Subtotal	11	3,029	417	477	0.01	0.56	$4,266	8.8
3. Energy efficiency resource standard	107	29,025	377	955	0.02	1.53	$11,409	28.9
4. CHP and Recycled Energy								
a. Revolving loan fund	4	637		13	~0	0.01	$202	0.9
b. Utility tariffs & connection stds.	55	10,000		175	~0	0.18	$2,696	11.7
Subtotal	59	10,637		189	0.00	0.19	$2,898	12.6
5. Efficient Dispatch			644	644		0.66	$3,076	9.5
6. RD&D supplemental approp.								
a. If authorizations funded	9	2,511	50	100	0.05	0.25	$2,057	4.5
b. Without extra funding	2	502	10	20	0.01	0.05	$411	0.9
Subtotal	9	2,511	50	100	0.05	0.25	$2,057	4.5
7. Misc. efficiency provisions								
a. Voluntary industrial commitments								
Without targets	1.0	277	9	14	0.005	0.02	$148	0.5
Additional with targets	0.5	277	4	7	0.002	0.01	$74	0.3
Additional with funding	1.5	277	13	21	0.007	0.04	$222	0.8
b. Labeling of appliances	7.5	2,025	8	49	0.000	0.09	$652	1.7
c. Federal facilities	0.3	90	1	2	0.000	0.00	$31	0.1
d. High performance public buildings	0.3	90	1	2	0.000	0.00	$31	0.1
e. A/C maintenance education	0.3	391	0	2	0.000	0.00	$26	0.1
f. Public housing	0.3	71	1	2	0.001	0.00	$42	0.1
g. Real-time pricing	1.7	1,927	0	9	0.000	0.02	$105	0.4
Subtotal	13	5,424	36	109	0.02	0.20	$1,332	3.9
8. Building Energy Codes	4	1,012	33	53	0.00	0.08	$553	1.4
9. Public Awareness Campaign								
a. Significant campaign	61	16,484	193	521	0.15	1.13	$9,704	20.8
b. Limited campaign (no signif. $)	6	1,648	19	52	0.01	0.11	$970	2.1
Subtotal	61	16,484	193	521	0.15	1.13	$9,704	20.8
10. Transportation & misc. oil								
a. 1 million barrels/day oil savings by 2015					0.17	0.32	$3,961	5.8
b. Alexander Bill, no enforcement					0.07	0.16	$1,981	2.9
c. Feebate					0.22	0.42	$5,126	7.6
d. Truth in testing					0.33	0.63	$7,690	11.3
e. CAFÉ: 40 mpg by 2015					0.45	0.85	$10,486	15.5
Subtotal					0.51	0.97	$11,971	17.7
TOTAL	**285**	**73,506**	**1,117**	**2,516**	**0.75**	**5.13**	**$45,760**	**102.8**

Table A-2. Analysis of Cumulative Savings by Policy over the 2006–2010 Period

Policy Initiative	TWH	Direct Gas BCF	Total Gas BCF	Oil Billion Bbls	Quads	$ million	Carbon (MMT)
1. Appliance Efficiency Standards							
a. In HR6	23	11	135	0	0.26	1,891	5.1
b. Additional consensus agreements	2	11	19	0	0.03	211	0.5
c. Feasible additions	23	7	129	0	0.25	1,820	4.9
Subtotal	47	29	283	0	0.54	$3,922	10.5
2. Tax incentives							
a. New Homes	8	60	105	0	0.15	$1,115	2.7
b. Central AC/HP	2	0	13	0	0.03	$253	0.5
c. Gas water heaters	0	7	7	0	0.01	$59	0.1
d. HP water heaters	0	0	2	0	0.00	$22	0.1
e. Gas furnaces	5	25	50	0	0.07	$550	1.3
f. Appliances	2	47	58	0	0.07	$527	1.1
g. Comm. Bldgs.	9	30	77	0	0.12	$908	2.3
h. Fuel cell cogen.	0	0	0	0	0.00	$1	0.0
i. Fuel cell vehicles	0	0	0	0.00	0.00	$2	0.0
j. Hybrid vehicles (light duty)	0	0	0	0.01	0.02	$565	0.8
k. Hybrid vehicles (heavy duty)	0	0	0	0.00	0.00	$40	0.1
l. CHP	0	1,162	1,162	0	1.16	$9,269	17.1
m. Existing homes	7	160	198	0	0.24	$1,818	3.9
Subtotal	34	1,492	1,672	0.01	1.87	$15,128	29.9
3. Energy efficiency resource standard	274	961	2,433	0.01	3.90	$29,060	73.7
4. CHP and Recycled Energy							
a. Revolving loan fund	10		33		0.03	$505	2.2
b. Utility tariffs & connection stds.	138		439		0.45	$6,741	29.3
Subtotal	148	0	472	0.00	0.49	$7,246	31.5
5. Efficient Dispatch		1,308	1,308		1.35	$6,250	19.2
6. RD&D supplemental approp.							
a. If authorizations funded	23	125	250	0.05	0.63	$5,143	11.2
b. Without extra funding	5	25	50	0.01	0.13	$1,029	2.2
Subtotal	23	125	250	0.05	0.63	$5,143	11.2
7. Misc. efficiency provisions							
a. Voluntary industrial commitments							
Without targets	3	21	35	0.00	0.05	$370	1.3
Additional with targets	1	11	18	0.00	0.04	185	0.6
Additional with funding	4	32	53	0.01	0.11	555	1.9
b. Labeling of appliances	19	21	122	0.00	0.22	1,630	4.3
c. Federal facilities	1	1	6	0.00	0.01	78	0.2
d. High performance public buildings	1	1	6	0.00	0.01	79	0.2
e. A/C maintenance education	1	0	5	0.00	0.01	66	0.2
f. Public housing	1	3	6	0.00	0.01	105	0.2
g. Real-time pricing	4	0	22	0.00	0.04	262	0.9
Subtotal	34	90	271	0.01	0.50	$3,329	9.8
8. Building Energy Codes	9	81	132	0.00	0.19	$1,384	3.4
9. Public Awareness Campaign							
a. Significant campaign	153	482	1,302	0.13	2.83	$24,261	52.0
b. Limited campaign (no signif. $)	15	48	130	0.01	0.28	$2,426	5.2
Subtotal	153	482	1,302	0.13	2.83	$24,261	52.0
10. Transportation & misc. oil							
a. 1 million barrels/day oil savings by 2015				0.13	0.68	$3,029	12.2
b. Alexander Bill, no enforcement				0.00	0.03	$116	0.5
c. Feebate				0.20	1.04	$4,660	18.8
d. Truth in testing				0.20	1.04	$4,660	18.8
e. CAFÉ: 40 mpg by 2015				0.30	1.56	$6,990	28.3
Subtotal				0.35	1.81	$8,126	32.8
TOTAL	**722**	**3,261**	**6,816**	**0.57**	**12.76**	**$97,598**	**254.8**

Table A-3. Analysis of Cumulative Savings by Policy over the 2006–2020 Period

Policy Initiative	TWH	Direct Gas BCF	Total Gas BCF	Oil Billion Bbls	Quads	$ million	Carbon (MMT)
1. Appliance Efficiency Standards							
a. In HR6	281	259	1,711	0	3.07	$25,316	59.7
b. Additional consensus agreements	77	253	652	0	0.86	$8,576	19.1
c. Feasible additions	175	233	1,137	0	2.19	$16,391	38.2
Subtotal	532	745	3,500	0	6.12	$50,284	117.0
2. Tax incentives							
a. New Homes	82	592	592	0	1.44	$11,005	25.1
b. Central AC/HP	48	0	0	0	0.50	$5,026	9.6
c. Gas water heaters	0	120	120	0	0.12	$910	1.8
d. HP water heaters	4	0	0	0	0.04	$314	0.8
e. Gas furnaces	60	318	318	0	0.94	$7,178	16.6
f. Appliances	27	635	635	0	0.91	$6,929	14.6
g. Comm. Bldgs.	97	329	329	0	1.34	$10,227	24.2
h. Fuel cell cogen.	0	1	1	0	0.00	$10	0.0
i. Fuel cell vehicles	0	0	0	0.00	0.00	$99	0.1
j. Hybrid vehicles (light duty)	0	0	0	0.09	0.17	$5,953	8.2
k. Hybrid vehicles (heavy duty)	0	0	0	0.04	0.09	$3,018	4.2
l. CHP	0	4,563	4,563	0	4.56	$34,835	67.1
m. Existing homes	35	799	799	0	1.16	$8,859	18.8
Subtotal	353	7,359	7,359	0.13	11.27	$94,363	191.1
3. Energy efficiency resource standard	2,261	7,701	19,399	0.12	31.10	$253,973	574.9
4. CHP and Recycled Energy							
a. Revolving loan fund	72		255		0.75	$3,825	14.4
b. Utility tariffs & connection stds.	886		3,107		9.17	$46,738	176.5
Subtotal	958	0	3,362	0.00	9.92	$50,563	191.0
5. Efficient Dispatch		6,049	6,049		6.23	$31,654	88.9
6. RD&D supplemental approp.							
a. If authorizations funded	435	2,250	4,500	0.85	11.25	$100,421	199.5
b. Without extra funding	87	450	900	0.17	2.25	$20,084	39.9
Subtotal	435	2,250	4,500	0.85	11.25	$100,421	199.5
7. Misc. efficiency provisions							
a. Voluntary industrial commitments							
Without targets	23	191	311	0.04	0.64	$3,623	11.1
Additional with targets	12	96	155	0.02	0.32	$1,812	5.5
Additional with funding	35	287	466	0.06	0.96	$5,435	16.6
b. Labeling of appliances	169	188	1,061	0.00	1.93	$15,508	36.4
c. Federal facilities	7	12	51	0.00	0.10	$848	1.9
d. High performance public buildings	8	13	51	0.00	0.10	$852	1.9
e. A/C maintenance education	8	0	39	0.00	0.08	$620	1.5
f. Public housing	6	24	55	0.00	0.11	$938	2.0
g. Real-time pricing	37	0	193	0.00	0.39	$3,053	7.4
Subtotal	304	811	2,382	0.13	4.62	$32,689	84.3
8. Building Energy Codes	188	1,575	2,550	0.04	3.75	$31,719	64.7
9. Public Awareness Campaign							
a. Significant campaign	694	2,056	5,647	0.60	12.52	$107,229	225.6
b. Limited campaign (no signif. $)	69	206	565	0.06	1.25	$10,723	22.6
Subtotal	694	2,056	5,647	0.60	12.52	$107,229	225.6
10. Transportation & misc. oil							
a. 1 million barrels/day oil savings by 2015				2.95	15.32	$70,096	278.6
b. Alexander Bill, no enforcement				1.20	6.23	$28,514	113.3
c. Feebate				3.80	19.74	$90,294	358.9
d. Truth in testing				3.80	19.74	$90,294	358.9
e. CAFÉ: 40 mpg by 2015				7.10	36.88	$168,707	670.5
Subtotal				8.21	42.62	$194,993	775.0
TOTAL	**5,725**	**22,497**	**48,698**	**10.08**	**133.17**	**$916,233**	**2,423.1**