

**ASSESSING THE HARVEST:
IMPLEMENTATION OF THE ENERGY EFFICIENCY PROVISIONS IN THE
*ENERGY POLICY ACT OF 2005***

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CONTENTS

Acknowledgments	iv
Referenced Legislation	iv
Executive Summary	v
Introduction	1
U.S. Energy Context, 2005–2010	1
Energy Efficiency Provisions Analysis by Section	2
Appliance Standards.....	2
Tax Incentives.....	3
Other Provisions	10
Estimating EPA’s Energy Savings	18
Discussion: Lessons Learned	19
Energy Policies Build on One Another	19
The Importance of Market Certainty	21
Funding	22
Tying Market Actor Education to Legislation	22
Get the Details Right.....	23
Next Steps	23
Conclusions.....	24
References.....	26
Appendix A. Methodology for Energy Savings Estimates Changes	30
Appendix B. Energy Savings Estimates, 2005 and 2011	34

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REFERENCED LEGISLATION

Name of Legislation	Abbreviation Used
Energy Policy and Conservation Act of 1975	EPCA
Public Utility Regulatory Policy Act of 1978	PURPA
National Appliance Energy Conservation Act of 1987	NAECA
Energy Policy Act of 1992	EPAct 1992
Energy Policy Act of 2005	EPAct 2005
Energy Independence and Security Act of 2007	EISA
Emergency Economic Stabilization Act of 2008	TARP
American Recovery and Reinvestment Act of 2009	ARRA
Middle Class Tax Relief Act of 2010	n/a
Implementation of National Consensus Appliance Agreements Act (proposed in 2010, not passed into law)	INCAAA
American Clean Energy and Security Act (passed the House in June 2009, not passed into law)	ACES
American Clean Energy Leadership Act (passed by Senate Energy and Natural Resources Committee, not passed into law)	ACELA

EXECUTIVE SUMMARY

On August 8, 2005, President George W. Bush signed the *Energy Policy Act of 2005* (known as EAct 2005) into law. The law included eighteen provisions dedicated to a wide range of energy topics, including considerable sections on energy efficiency and conservation, as well as titles addressing renewable energy, oil and gas, coal, nuclear power, vehicles and fuel, electricity, motor fuels, and ethanol. Notably, it included sections on appliance and equipment standards; tax incentives for advanced energy-saving technologies; and a variety of other provisions to improve federal energy efficiency, buildings efficiency, industrial efficiency, and utility efficiency policies.

EAct 2005 was the first major energy bill in thirteen years when it was passed. In subsequent years, Congress enacted a number of important pieces of legislation that addressed energy efficiency, including the *Energy Independence and Security Act of 2007* (EISA), the *Emergency Economic Stabilization Act of 2008* (TARP), and the *American Recovery and Reinvestment Act of 2009* (ARRA). In the 111th Congress, progress on energy or energy efficiency legislation failed despite passage of a comprehensive climate bill by the House of Representatives. Today, five years later, as the United States Congress begins its 112th session, energy and oil independence issues rank high on the priorities for the Administration and the newly Republican House. In this report, ACEEE examines the implementation and efficacy of the energy efficiency provisions in EAct 2005. We believe that policymakers can do a better job developing new legislation if we review the implementation status of past legislation.

Implementation by Provision

These findings are based on interviews with key stakeholders from government, business, and the nonprofit world, and research into the literature that documents savings from these provisions. In summary, we find that the *Energy Policy Act of 2005* was largely successful. For the most part, implementation has followed the legal mandate in the legislation, and many of these provisions became stepping-stones for further action in later legislation.

Among the successes are the following:

- Smooth implementation of most appliance and equipment standards, and the beginning of the Department of Energy's (DOE) strenuous efforts to get standards rulemakings back on schedule;
- The use of the lighting portion of the commercial buildings tax deduction;
- The market transformation toward energy-efficient new homes as a result of the new homes and appliance manufacturers tax incentives; and
- The hybrid vehicles tax incentive, which helped to expand domestic car manufacturers' participation in the hybrid market.

Two additional provisions, which had large effects on savings that ACEEE did not anticipate, were the appliance rebate program and the requirement that state utility commissions consider interconnection standards. Seventeen states that did not previously have interconnection standards adopted them after consideration in utility commissions. Streamlined interconnection standards address one of the major barriers to combined heat and power (CHP) implementation. In addition, the appliance rebate program, which was originally expected to have no funding, was funded as a part of ARRA. Interim program results indicate significant levels of consumer energy bill savings.

A number of EAct 2005 provisions were less successful. The less effective provisions include:

- Those provisions that were unfunded—like the campaign for HVAC maintenance consumer education, the energy-efficient public buildings grants, and the low income community energy efficiency pilot program;
- One specific appliance standard—ceiling fan light kits (because of a loophole);

- The tax incentives for two products that were not commercially available or ready for adoption—Residential Fuel Cell Cogeneration and heavy duty hybrids. These helped spur new products and demonstrations, but did not create appreciable market share for these products.

Energy Savings Impact

EPAct 2005 has achieved some significant energy efficiency gains, particularly in improving the efficiency of new homes; energy-intensive industrial plants; and new energy-consuming equipment such as lighting fixtures, residential clothes washers, dishwashers, and refrigerators, and a number of commercial products.

In 2005, ACEEE estimated that the energy efficiency provisions in the *Energy Policy Act of 2005* would save 0.7 quads in 2010 and 2.5 quads in 2020 (Nadel 2005). These estimates of energy savings were re-examined by ACEEE staff in the summer of 2006, after a year of implementation. They found that, due to delays in setting furnace fan standards and the lack of appropriations funding for a number of provisions, the savings estimates made in 2005 were likely high by 25% (Nadel, Prindle, and Brooks 2006). In the intervening four years, estimated savings have increased driven by savings from the appliance rebates program and appliance manufacturers tax incentive, and by lower than anticipated use of the dual fuel loophole.

Based on the energy savings estimates made by ACEEE in 2005 when the legislation was passed, and adjusted for actions and changes over the past five years, we estimate that EPAct 2005 reduced energy use in 2010 by approximately 0.66 quadrillion Btu, a savings of about 0.7% of the total energy use in 2010 (EIA 2010). These savings are likely to increase to 2.41 quadrillion Btu in 2020, or 2.3% of total projected energy use, as more of the energy efficiency technology and equipment fostered by EPAct take up an increasing share of stock.

Total Annual Savings in Quads		
	2010	2020
2005 Estimate	0.7	2.5
2010 Estimate	0.66	2.41
% difference between 2005 and 2010 estimates	-9%	-5%

The estimate of 2.4 quadrillion Btu energy savings in 2020 is 5% less than the original estimate made in 2005 as a result of a number of factors, including unintended loopholes or omissions in the EPAct language and lower sales as a result of the recession. In addition, some provisions had lower savings than anticipated due to implementation issues, like the ceiling fan light kit standards, the new homes tax credit, the appliance labeling provision, the public awareness campaign, and the daylight savings time provision. Some provisions had higher savings than anticipated, including the appliance rebates program, the appliance manufacturer tax incentive, and the real-time pricing provision.

Lessons Learned

The main lessons learned from the provisions in EPAct 2005 were the importance of education and stakeholder engagement, “getting the details right,” and carefully considering market conditions and barriers to product acceptance in order to choose the best policy or actions to address them. Many of the energy efficiency provisions served to accelerate market transformation for energy-efficient products and behaviors, or to set the stage for later action. In addition, those provisions that set up savings as a part of later legislation, like EISA, TARP, ARRA, and the Middle Class Tax Relief Act of 2010, were particularly successful.

Those provisions that were less successful were those where a key detail in the legislation allowed for a loophole or difficulty in enforcement, like the ceiling fan light kits standard or the service over-the-counter refrigeration standard. In addition, those provisions that did not include all of the necessary tools to

engage market actors, like education, continuity of incentives, and simple forms and processes, were less successful. Further, incentives for some products with essentially no market share in 2005, like fuel cells and hybrid trucks, were less successful because of the short incentive timeframe—with a longer lead time, they would do a better job of growing their market share. On the other hand, incentives for products with a low market share in 2005 were generally successful, including efficient new homes, appliances, and residential heating and cooling equipment.

Next Steps

Much of the energy efficiency savings from EAct 2005 result from later bills that leveraged its appliance standards, tax incentives, or other provisions to create greater energy savings. The period from 2005–2009 demonstrated the importance of continually assessing market conditions and using energy efficiency potential as a resource for policymakers attempting to work on problems like oil independence, recession, and unemployment.

A number of energy efficiency policies are being considered for the 112th Congress, and these proposals contain potential savings for consumers, businesses, and manufacturers that should not be left on the table. Many leverage the lessons learned in EAct 2005 and subsequent legislation. These include:

- An Energy Efficiency Resource Standard (a policy that was beginning to gain momentum when EAct 2005 passed), which would set national energy efficiency targets as a means of laying a foundation for sustained investment in energy efficiency. EAct 2005 required a study on the topic, and in the years since passage of this legislation in 2005, 20 states adopted a state energy efficiency resource standard.
- The *Implementation of National Consensus Appliance Agreements Act* (INCAAA), which almost passed the 111th Congress, and which would set standards for residential appliances, residential heating and cooling equipment, and other products. The successes of the appliance standards revisions in the *Energy Policy Act of 2005* relative to other types of provisions highlight the importance of these policies in saving energy for consumers and businesses.
- The new homes and appliances manufacturing incentives were among the most successful of the tax incentives in EAct 2005, transforming the market for clothes washers, dishwashers and refrigerators, and new homes. The incentives have been extended and the levels of efficiency improved twice, and these should be extended going forward.
- For residential tax credits, the prescriptive credits originally laid out in EAct 2005 should be modified to be more effective and extended past 2011, and performance-based credits should be added. Compared to manufacturer or builder standards, consumer incentives are typically more difficult to implement and take longer to ramp up. Now that momentum has begun on these incentives, it is important to refine and continue to reap their savings.
- The heavy duty hybrids credit in EAct 2005 was too early and at too low an incentive level to influence a significant market share, but it did succeed in getting some products to market. The market has moved in the intervening six years, and the time is ripe to reinstate this credit so that the fruits sown by the EAct 2005 credit can be harvested.
- The commercial buildings deduction in EAct 2005 was successful for lighting, but less so for whole building retrofits. Those differences can be attributed to a number of factors, including the lack of simple paths for building shells and HVAC measures, the fact that large savings needed to be achieved in a single systems (lighting, HVAC, or building shell) to achieve a credit, and the fact that DOE and IRS never implemented the regulations required in the legislation to make documentation of savings simple and reproducible. Going forward, the deduction should be modified to include an easy to use performance-based incentive for retrofits that achieve 20%+ savings, allowing building owners to mix lighting and other measures to reach savings targets.

INTRODUCTION

Energy efficiency legislation began with the *State Energy Resources Conservation and Development Act of 1974* in California. In response to the oil crisis of 1973–74, Congress passed the *Energy Policy and Conservation Act of 1975* (EPCA), which established the Energy Conservation Program for Consumer Products and mandated fuel economy standards, in addition to other provisions not related to energy efficiency. Appliance standards were set into law in the *National Appliance Energy Conservation Act of 1987* (NAECA), enacted by Congress and signed by President Reagan.

The *Energy Policy Act of 1992* (EPAAct 1992) was signed by President George H.W. Bush in October 1992, after two years of formal legislative debate and action. Like the previous bills, it was broad in scope, focusing on energy efficiency, but also on electricity, natural gas, nuclear power, and other energy issues. It authorized a variety of energy efficiency programs for industry, federal buildings, building codes, and research and development, and added products to be covered under minimum efficiency standards.

Between 1992 and 2005 no major energy bill passed the U.S. Congress. In 2001, Congress began work on energy issues, and a bill was almost enacted in 2003. This failed when the Senate refused to approve a conference report developed by a small number of Representatives and Senators. Work began anew in 2005. The House passed a bill in April 2005, and the Senate passed its own bill in June. After efforts by the bipartisan conference throughout the summer, on August 8, 2005, President George W. Bush signed the *Energy Policy Act of 2005* (known as EPAAct 2005) into law.

EPAAct 2005 was the first major energy bill in thirteen years when it was passed. In the years that followed, energy efficiency was a part of three major bills, one designed to address energy issues—the Energy Independence and Security Act of 2007 (EISA), and two written to address the financial crisis in 2008–2009: the *Emergency Economic Stabilization Act of 2008*, passed with the Trouble Asset Relief Program (TARP), and the *American Recovery and Reinvestment Act of 2009* (ARRA). Each of these pieces of major legislation contained elements that built upon provisions in the *Energy Policy Act of 2005*, and on earlier energy efficiency legislation.

ACEEE regularly scores, or assesses, the energy efficiency provisions in major pieces of legislation, like EPAAct 2005, and this report allows an examination of how those estimates held up 5 years later. In 1997, ACEEE and the Alliance to Save Energy (ASE) examined their original estimates about the Energy Policy Act of 1992 in a similar exercise (ACEEE and ASE 1997). We believe that policymakers can do a better job developing new legislation if we review how implementation of past legislation has gone. This report is based on interviews with key stakeholders from government, business, and the nonprofit world, and research into the literature that documents savings from these provisions.

U.S. ENERGY CONTEXT, 2005–2010

Several significant energy and economic trends in the U.S. affected both the energy savings achieved from the bill and the legislative climate for energy policy. Natural gas price volatility in the first half of the decade led to increased uncertainty about energy investments. On the other hand, this volatility was a key factor in the passage of EISA in 2007, which built heavily upon the provisions in the *Energy Policy Act of 2005*. In addition, high pump gasoline prices in 2007–08 did not reduce investment in efficiency.

In 2008 and 2009, the United States' housing market collapse led to an economy-wide financial collapse and high unemployment rates, which have only recently begun to recover. In response, Congress passed the *Emergency Economic Stabilization Act of 2008*, which, among other actions, extended a number of the energy efficiency tax provisions that had expired or were about to expire. In addition, Congress passed ARRA in February 2009, designed to save and create jobs through a variety of measures, including approximately \$30 billion devoted to energy efficiency investments. The auto industry bailout of General Motors and Chrysler may have also allowed greater progress on fuel economy than would have otherwise been achieved.

ENERGY EFFICIENCY PROVISIONS ANALYSIS BY SECTION

This section reviews the status of implementation of each of the energy efficiency provisions in the bill. We provide illustrative market data, case studies, and anecdotal evidence from stakeholders where available.

Appliance Standards

Sections 135-136; 141

The *Energy Policy Act of 2005* contained two important sets of provisions to save energy through federal minimum-efficiency appliance and equipments standards. The legislation included provisions setting new federal minimum-efficiency standards for 16 different products (Sections 135-136), and directed the Department of Energy to set standards on several other products. It also included provisions requiring DOE to catch up on missed standards deadlines (Section 141).

Implementation of the appliance and equipment standards included in Sections 135-136 of EPAAct 2005 appears to be on track, although Table 1 contains a few instances where energy savings might be higher or lower than originally anticipated.

Table 1. Standards set in EPAAct 2005 with Changes in Expected Market Conditions

Product Covered	Reason for Change in Savings Estimate
Torchiere lighting fixtures	These products have had a declining market share in the years since EPAAct 2005 was passed, and so savings from this provision are less than anticipated. However, these standards may contribute to a market shift away from torchiere lamps to alternative fixture types with lower energy use, so some of these savings may have been preserved despite the declining market share.
Commercial refrigerators and freezers	These are generally on track, but one niche product, service over-the-counter refrigeration, was set at a level too stringent for manufacturers to feasibly meet. This is particularly an issue, because many manufacturers won't be able to sell this product at all, since they cannot produce a compliant product. The consensus bill introduced by Senator Bingaman, <i>Implementation of National Consensus Appliance Agreements Act</i> (INCAAA), includes a fix to this issue (Amrane 2010). This would not affect the original estimate significantly because of the low sales level for this product.
Commercial pre-rinse spray valves	The penetration rate of compliant spray valves is lower than originally anticipated because some business owners in the food industry may use non-compliant products in lieu of the legal 1.6 gallons/minute valves. Nonetheless, anecdotal data suggests that this happens relatively rarely in commercial kitchens (Fisher 2010, 2011). In addition, most manufacturers still make spray products with higher flow rates, although most vendors claim these are for the export market or are just old inventory. The law covered the manufacture of the product, and not sales (Osann 2011). Unfortunately, there was not market data available that demonstrates the extent to which purchases of "offshore" products or existing stock of non-compliant units are an issue (Fisher 2011).

Congress instituted the first national appliance standards in 1987 with the passage of NAECA, and added more products with EPAAct 1992. During a Congressional moratorium on standards in the mid-1990s, the Department became concerned about whether it had sufficient resources to meet all the statutory deadlines, and instituted a prioritization approach in which the Department would first tackle those overdue rulemakings with the biggest savings. However, DOE's pace of work on new rulemakings slowed to a crawl during President George W. Bush's first term and by 2004, DOE was chronically behind in meeting Congressional deadlines for these standards, having missed legal deadlines for the review of 22

different standards. These delays were very costly: the U.S. Government Accountability Office estimates that delays for only four missed standards cost U.S. consumers and businesses \$28 billion in foregone energy savings (GAO 2007).

DOE was falling further and further behind, which led a coalition of states and efficiency advocates to file suit in New York, et. al. and Natural Resources Defense Council, et. al., v. Bodman. Nos 05 Civ. 7807 & 7808 (July 1, 2005 Southern District of New York). Section 141 of EAct 2005 included an important provision that required DOE to report on and provide explanations for its missed deadlines and to develop a plan for catching up. The law also requires DOE to provide status reports to Congress every six months. In November 2006, DOE signed a consent decree in the suit over the missed deadlines (Consolidated Civil Actions 2006).

DOE has been on time for rulemakings since the Consent Decree, which can be attributed to a combination of this legislation and the judicial action taken by the State of New York and NRDC. Under the new schedule, DOE committed to catch up on all missed legal deadlines by July 2011 and to meet new deadlines created by the 2005 law.

Projected savings from the rulemakings were consistent with ACEEE estimates with the exception of the following standards in Table 2.

Table 2. Standards Rulemakings in EAct 2005 with Changes in Expected Market Conditions

Product Covered	Reason for Change in Savings Estimate
Ceiling Fan Light Kits	Savings were less than expected because manufacturers chose to avoid the requirement for CFLs by using intermediate-base sockets. These were a little-used socket about ½-inch in diameter, and by using this socket, manufacturers avoid the standards that align with medium-base sockets.
Dehumidifiers	Higher energy savings will occur as a result of ENERGY STAR® and later legislation (EISA), which required a 1.5 liters/kWh floor for equipment of 35-45 pint capacity, an increase over the 1.3 liters/kWh mandated by EAct 2005.
Commercial Clothes Washers	DOE instituted a rulemaking in 2010, but savings were less than expected because top-loading and front-loading washers were made separate product classes for the first time. The rule was lenient for top-loading washers, which represent the majority of the market. The rule was also less stringent than it could have been on front-loading washers so as not to erode the market share of these products by driving up the cost differential between front-loading and top-loading washers (Osann 2010).

Appliance and equipment standards were one of the most successful portions of the *Energy Policy Act of 2005*, representing 40% of the projected savings in 2020 from energy efficiency in the bill. They achieved an estimated 0.82 quads of savings in 2010, a decrease of 21% from ACEEE’s original estimate of 1.03 quads, primarily due to the ceiling fan light kit loophole. More importantly, the requirements to get standards rulemakings and updates on track at the Department of Energy revitalized the appliance standards program, ensuring savings for the standards already in place. In addition, this bill reestablished a pattern of federal minimum efficiency standards legislation by Congress that has continued as a part of EISA and in proposed legislation in the 111th and 112th Congress.

Tax Incentives

EAct 2005 established energy efficiency tax incentives in the residential, commercial, and transportation sectors with the purpose of increasing the market share of advanced energy efficiency products and encouraging home/business-owners to undertake energy efficiency improvements. For the most part, these tax incentives were designed to cover the very highest levels of efficiency sold in 2005 (e.g.,

equipment and practices with less than a 5% market share), in order to keep costs to the Federal Treasury down and to minimize “free riders” (tax credit participants who would have purchased eligible products even if the tax credits weren’t available).

Congress instituted a federal tax credit for residential energy-efficient equipment from 1978 through 1983, worth 15% of “conservation expenditures” up to \$2,000 spent. This was claimed on an average of 4 million tax returns per year, and the total cost of the credits was \$2.3 billion (Hirst et. al. 1986). In general, the incentives were too low, and there were a lot of free riders. As a result, when the set of tax incentives included in EPAct 2005 was originally proposed, the focus was on increasing the market share of the most energy-efficient equipment.

Section 1331. Commercial Buildings

This provision provided a deduction per square foot for owners and tenants of new and existing commercial buildings that reduce energy use by 50% relative to ASHRAE standard 90.1-2001. This includes new buildings and retrofit projects. The 50% energy savings is for HVAC and interior lighting. While no specific data are available, in conversations with many people who work on energy efficiency in commercial buildings, the consensus is that few whole building deductions were taken in the period from 2005–2010. This is due in part to delays at DOE in releasing advice and at IRS in releasing guidance and software approval, but in larger part due to the fact that the guidance that was eventually released did not comply with the requirements of the legislation. We have heard complaints about the complexity of the process to claim the credits, which is a result of the fact that the generation of the reference building that meets ASHRAE 90.1 has to be done manually by the applicant rather than included automatically in the software as required by the law. The failure of DOE and IRS to do this caused problems for the USGBC’s LEED program as well. This is one reason why the Energy Foundation coordinated funding of a private sector initiative to develop a standard for software to use for Section 179, as well as LEED, ENERGY STAR target finder, and ASHRAE 90.1 and 189. This standard, which was written to comply with EPACT, can be found at COMNET.org. Participation in this credit was also low because of a requirement that building owners receive third-party certification, but DOE and IRS failed to establish, as the law required, standards for qualification of individuals and a national registry of eligible contractors, making it difficult to find an eligible certifier (Goldstein 2011).

In addition, partial deductions were available for building envelope, lighting, and heating, ventilation, and air conditioning (HVAC) systems. Deductions for commercial building envelope and HVAC improvements were relatively rare, again due to the fact that the guidance issued for envelope and HVAC failed to meet EPAct’s criteria; in the case of envelope the required savings to qualify in the initial guidance documented was higher than the entire energy use associated with the envelope! Commercial lighting deductions provided the vast majority of the incentives used because the regulations for demonstrating compliance were written into the law. Anecdotal evidence suggests that the lighting deductions were more common for a number of reasons: an interim lighting provision that allowed a prescriptive approach while energy audit software was being finalized, the ability to gain credit for lighting improvements on a sliding scale, and a significant educational campaign organized by the lighting industry. As a result, this credit was more successful in increasing the market share of advanced commercial lighting products, but less successful at increasing the number of whole building, HVAC, and building envelope improvements (Pitsor 2010).

This tax deduction was extended in the Emergency Economic Stabilization Act of 2008 (the same 2008 law that established the Troubled Assets Relief Program) until December 31, 2013. In general, these tax incentives should be implemented with a longer lead time. The original provision was effective immediately after enactment and provided the deduction until January 1, 2008. Because of the time necessary for DOE to issue advice and for IRS to create rules, and the time required to conduct an education campaign, only the last two years have had high levels of participation in the credit (Pitsor 2010).

We anticipate greater use of the deduction in the future if DOE and IRS adopt the COMNET guidelines, which they appear to be preparing to do (Goldstein 2011).

Section 1332. New Homes

This provision provides a credit of \$2,000 for builders of homes that use 50% less energy for space heating and cooling than homes built according to the 2004 supplement to the International Energy Conservation Code (IECC) for 2006–2008. It was extended in the *Emergency Economic Stabilization Act of 2008* until December 31, 2009. The credit lapsed in 2010, but was renewed to cover new homes built in 2010 and 2011 as a part of the *Middle Class Tax Relief Act of 2010*.

The tax credit has been successful in transforming the new homes market toward more energy-efficient homes. As shown in Table 3, the number of homes participating in the credit grew four-fold between 2006 and 2009. In addition, energy-efficient homes gained a greater market share, as the number of homes certified as complying with the tax credit rose to 10% of new homes sold in 2009, although due to the recession the number of new homes declined substantially (Baden 2010).

Table 3. Number of New Homes Certified as Complying with the Federal Tax Credit

Year	Number of Homes Certified as Complying with the Credit	Total US Homes	% of Market
2006	8,141	1,051,000	0.8%
2007	23,702	776,000	3.1%
2008	21,939	485,000	4.5%
2009	37,506	375,000	10%

Source: Baden 2010; RESNET 2010; Census 2010

The provision also includes a \$1,000 tax credit to the builder of a new manufactured home achieving 30% energy savings for heating and cooling over the 2004 IECC and supplements (at least 1/3 of the savings had to come from building envelope improvements), or a manufactured home meeting the ENERGY STAR requirements. Table 4 illustrates the number of new Manufactured Homes labeled as ENERGY STAR, which show a slightly increasing market share over time. Although this does not represent the actual number of tax incentives used by consumers, this industry is highly sensitive to costs, and consumers tend not to demand high performance homes. As a result, the growing market share is probably largely attributable to the manufactured homes tax incentive. In addition, this credit has helped utilities gain market share with ENERGY STAR-based rebate programs (Levy 2011).

Table 4. Number of New Manufactured Homes labeled as ENERGY STAR

Year	ENERGY STAR Homes	Homes Shipped	ENERGY STAR % of Total
2006	9,804	117,510	8.3%
2007	6,332	95,769	6.6%
2008	8,091	81,889	9.9%
2009	4,748	49,789	9.5%
2010	4,823*	50,000*	9.6%

*Estimated figures

Source: Systems Building Research Alliance 2011

Section 1333. Nonbusiness Energy Property Existing Home Improvements (Building Envelope and HVAC)

This section provides tax credits for energy-efficient new central air conditioners, heat pumps, and water heaters in existing homes. In addition, there are tax credits for upgrading building envelope components in existing homes, like windows, insulation, ENERGY STAR metal roofs, and others.

These provisions were originally for equipment put in place in 2006 and 2007. They were extended with some changes in eligibility levels as a part of the *Emergency Economic Stabilization Act of 2008*, covering improvements installed in 2009, but not 2008. ARRA extended these through December 2010, and increased the incentive to 30% of equipment cost (had been 10%) and increased the cap on incentives

from \$500 to \$1500 per household. They were extended to 2011, but with the original level of incentives and \$500 limit as a part of the *Middle Class Tax Relief Act of 2010*.

A preliminary GAO report on the “25C tax credits” found that most of the total reported spending by consumers in 2006 could be accounted for by three of the available types of improvements: windows, insulation, and exterior doors. Metal roofs, ‘energy-efficient building property,’ furnaces, hot water boilers, and circulating furnace fans each made up a small portion of consumers spending (GAO 2010a). In 2007, windows, insulation, and exterior doors dominated consumer spending, with a noticeable increase in energy-efficient exterior windows purchases in particular (GAO 2010b). A more robust GAO report is due out in July 2011, which will provide more information about the extent to which these credits were used in 2009 and 2010.

Table 5. Total Spending on Improvements on 25C Tax Credits in 2006 and 2007

Type of Improvements	Total Spending on Eligible Improvements (in millions)	
	2006	2007
Insulation	\$2,492	\$2,276
Exterior Windows	\$2,913	\$4,102
Exterior Doors	\$1,848	\$1,816
Metal Roof	\$324	\$508
Energy-Efficient Building Property	\$197	\$288

Source: GAO 2010 a, b

Although a full data set for the country is not available for all of the 25C-eligible products, a case study from CenterPoint Energy’s furnace and boiler rebate program in its Minnesota territory demonstrates the market transformational effect of these tax incentives. The data set in Table 6 shows a number of key trends, most prominently the shift in the make-up of furnace rebates from a majority in the 92% efficiency range to a majority in the 94% plus efficiency range (the tax credits were for 95%+ efficient units). The tax credits didn’t affect the total heating system rebates, but they did improve the efficiency levels receiving the credit (Kline 2011). CenterPoint Energy’s market research asked customers why they chose the high efficiency equipment, and 37% of respondents indicated that the tax credit affected their decision on the level of efficiency of the equipment (Kline 2011).

Table 6. Participation in CenterPoint Energy’s Furnace and Boiler Rebate Program, 2004–2010

Program Year	> 92% AFUE Furnace Participation	>94% AFUE Furnace Participation	>96% AFUE Furnace Participation	>85% AFUE Boiler Participation	>88% AFUE Boiler Participation	>88% CAE Integrated Appliance	Total Heating System Rebates
2004	9,738		-	61	-	19	9,818
2005	7,815	2,971	-	67	-	27	10,880
2006	6,648	3,949	-	71	-	18	10,686
2007	4,334	4,862	-	147	-	-	9,343
2008	3,714	5,533	-	635	-	-	9,882
2009	2,363	10,879	-	845		-	14,087
2010 (1)	2,424	8,752	749	-	238	-	12,163

Source: Kline 2011

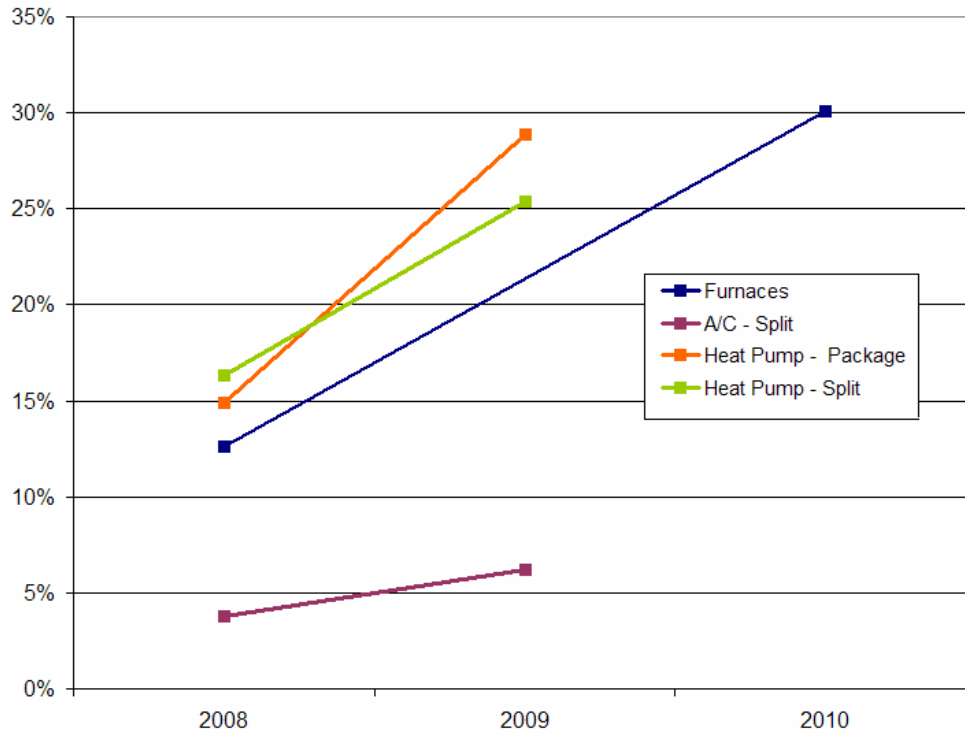
Note (1): 2010 participation was artificially capped by an expenditure limitation; staff indicate that there were at least 5,000 furnaces that were installed in 2010 that will be included in the 2011 program goals and most are in the 94–95% range of efficiency. They also stated that if we [CenterPoint] would have been more aggressively promoting the availability of rebates in the 4th quarter of 2010, that we [CenterPoint] likely would have exceeded 20,000 furnace rebates for the year.

In addition, there was a shift in the availability of these products from manufacturers during this time period—in 2008, there were only two manufacturers that had products that qualified for the tax incentives for the 95% efficient furnace, and by the end of 2009, all of the primary manufacturers of furnaces had a

unit that qualified for the tax credit for 95% efficient furnaces. In 2010, CenterPoint Energy added another tier of rebates for 96% efficient furnaces.

The market transformation effect of the HVAC 25C incentives is further established by market share data from some of the major HVAC equipment categories eligible for the tax incentive. Figure 1 below shows the percentage of manufacturer shipments eligible for the tax credit for 2008, 2009, and 2010. It demonstrates that the market share went up significantly between 2008, a year with no tax 25C tax incentives, and 2009/2010, when the tax incentive had been renewed by ARRA.

Figure 1. Market Share of Energy-Efficient Furnaces, Air Conditioners, and Heat Pumps



Source: AHRI 2011

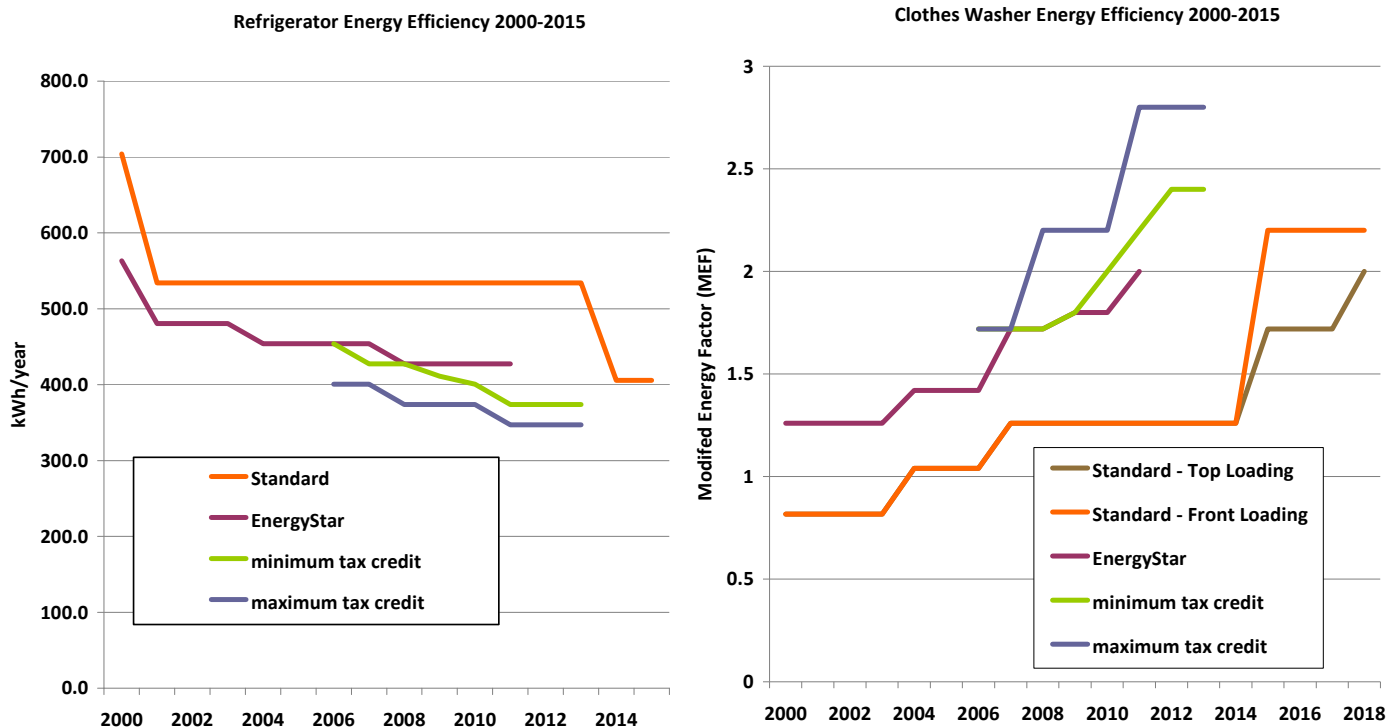
Section 1334. Appliances

This provision provided per-unit credits to manufacturers for the production of the most efficient refrigerators, clothes washers, and dishwasher. The incentives only applied to appliances produced in the United States during 2006 and 2007, and had a total cap of \$75 million per manufacturer.

These tax credits were extended to cover 2008–2010 and incentive levels were made more stringent as a part of the *Emergency Economic Stabilization Act of 2008*. They were extended again in 2011 as a part of the *Middle Class Tax Relief Act of 2010*, with incentive levels adjusted to focus on even more efficient products.

Figure 2 shows the market transformation of refrigerators and clothes washers that has occurred in recent years, spurred in part by the tax incentives. The tax incentives encouraged manufacturers to produce more of their highest efficiency products on the market and to offer related discounts and promotions on these units. As these products gained greater market share, the ENERGY STAR specifications were tightened, and the next phase of the tax incentives was adjusted to increase tax credit qualification levels.

Figure 2. Market Transformation of Refrigerators and Clothes Washers, 2000–2015



Of the ENERGY STAR clothes washers available in 2005 before the tax credit began, only 153 of 258 products (or 59%) had an efficiency level more than 1.72 MEF, the minimum tax incentive level (Karney 2011). By 2007, this was the minimum ENERGY STAR level, so 100% of the qualified ENERGY STAR products available were at 1.72 MEF. In 2005, ENERGY STAR products had a total market share of 36%, which increased to 42% in 2007 (ENERGY STAR 2009). As a result, we can estimate that the tax credit-eligible models’ overall market share went from about 21% of the total market to about 42% of the total market, doubling their market share.

Market data from the Association of Home Appliance Manufacturers in Table 7 reveals that the appliance manufacturing industry has responded to the tax credits by producing more eligible products over time. Between 2008 and 2009, when this tax incentive was extended again, the total potential units eligible for the tax credit went up by 120%.

Table 7. Units Eligible for Appliance Manufacturers Tax Credit, 2008–2009

	Total Potential Units Ineligible for Tax Credit		Unit Decrease (2008 to 2009)	Total Potential Units Eligible for Tax Credit		Unit Increase (2008 to 2009)	Energy Saved in 2009 (GWh/yr)
	2008	2009		2008	2009		
Dishwashers	4,645,291	1,684,282	(2,961,009)	1,349,709	3,718,718	2,369,009	131
Clothes Washers	7,091,331	4,920,450	(2,170,881)	1,200,669	2,944,550	1,743,881	978
Refrigerators	7,793,740	6,092,173	(1,701,567)	1,516,260	2,304,827	788,567	280
Total	19,530,362	12,696,905	(6,833,457)	4,066,638	8,968,095	4,901,457	1,390

Source: AHAM 2010

Section 1335. Residential Energy Efficiency Property—Fuel Cell Cogeneration

The residential fuel cell cogeneration tax credit, which provided individual tax credits of 30% for stationary fuel cell power plants up to \$1,000/kW, has been rarely used according to experts we consulted (Schafer 2010). The products available at the time of enactment were still at the demonstration stage, and

although some companies have created more commercial products in the years since 2005, few are inexpensive and scalable enough for the tax credit to be widely used. These were extended to 2016 as a part of the *Emergency Economic Stabilization Act of 2008*. Products are just starting to become commercially viable and available.

Section 1336. Commercial installation of Fuel Cells and Microturbine Power Plants

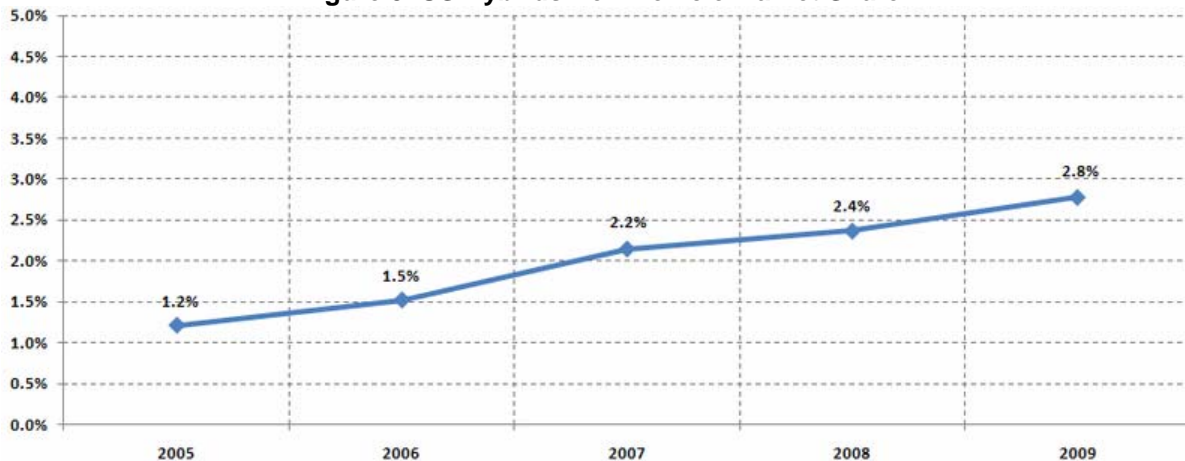
The commercial fuel cell credit has been utilized more widely, especially in applications like backup power for telecommunications, industrial vehicles (fork trucks), and large cells for power generation, and in large buildings for combined heat and power. Data from the U.S. Fuel Cell Council's 2007 Industry Survey indicated that sales increased 10% from 2005 to 2006, but no later data was available (USFCC 2007). The cap for commercial fuel cells was increased in the ARRA stimulus bill, but the cap was not increased for residential fuel cells in that bill. The *Emergency Economic Stabilization Act of 2008* extended these credits to 2016. According to one expert, the cap increase has been instrumental in moving markets towards high efficiency fuel cell installations (Schafer 2010).

Section 1341. Alternative Motor Vehicle Credit

Light duty hybrid and lean-burn (diesel) vehicles less than 8,500 lbs. were eligible for a tax credit from 2005 through 2010 based upon fuel economy improvement relative to average fuel economy for similar vehicles in 2002 and fuel savings relative to the 2002 fuel economy baseline. The credit ramps down for a given manufacturer after it has sold 60,000 vehicles, and as of October 2010, Toyota, Honda, and Ford are the only manufacturers that have reached that level of sales.

The market share of hybrid vehicles went from 1.2% to 2.8% as shown in Figure 3. While this represents a more than doubling of market share, it is still a small portion of total auto sales. In addition, the tax credit did not change the leader in the hybrid market—Toyota already had a clear vision of how to create a global market for hybrid vehicles before the credit, and reached the 60,000 vehicle sales threshold in the first year of the credit. Honda and Ford subsequently reached the threshold as well, and the availability of the credit likely greatly increased the participation of Ford and GM in the hybrid market. Ford, which had launched the Escape hybrid at the time EPA's passage, has gone on to produce additional successful hybrid models. GM has been less successful in hybrid sales but has nonetheless produced several models and gained significant experience with the technology, which will likely be essential to further fuel economy improvements.

Figure 3. US Hybrids New Vehicle Market Share



Source: Green Car Congress 2010

This provision also provided a tax incentive for advanced lean burn, or diesel vehicles that met certain fuel economy and emissions levels. No diesel vehicles were sold under the tax credit before 2008,

because there were none on the market that qualified for the credit. Model year 2009 was the first time that light duty diesel vehicles could qualify for tax credits. That is because emissions control technologies now allow diesels to meet the requirements for emissions of NOx and particulate matter.

The provision is structured to allow less efficient diesel vehicles to receive the tax credit. The credit is based on the number of gallons of fuel saved (the miles per gallon), and because of diesel's higher energy content per gallon, diesel vehicles that are about 11% less efficient than eligible gasoline vehicles will qualify for the credit. Although this provision did not affect many vehicles because of low sales, the same diesel fuel loophole has been incorporated into legislation twice since EAct 2005, in a provision providing large sums of money for retooling in both EISA (Section 136) and the *Emergency Economic Stabilization Act of 2008*.

Heavy Duty Hybrid Vehicles

EAct 2005 also contained a tax credit for heavy duty hybrid vehicles. Notwithstanding the large fuel savings potential from hybridization of trucks used in urban applications, such as pick-up and delivery and refuse hauling, heavy duty hybrid development lags light duty by several years. Consequently, there were few heavy duty hybrids available in the early years of the credits. Use of the credit was also low because the dollar amount of the credits was too low given the high incremental cost of the heavy duty hybrid technology. Nonetheless, by the time the credit expired at the end of 2009, ten manufacturers had placed over 50 eligible hybrid vehicles on the market, and interest in hybrids is very high in the heavy duty market today. The California [Hybrid Truck and Bus Voucher Incentive Project](#) is a program that began partially as a result of the availability of this tax credit, and there have been repeated efforts to renew this credit at the federal level now that the market has shifted. The most recent proposal was the *Bauchus Job Creation and Tax Cuts Act* in the 111th Congress.

Fuel Cell Vehicles

The bill also provides tax credits for fuel cell vehicles, but these vehicles are not yet commercially available, and so no tax credits have been applied to them.

Other Provisions

Section 102-105. Federal Facilities

Section 102 of the bill contains energy reduction goals for buildings owned by the federal government. The energy savings goals are 2% per year, or 20% by 2015, relative to the energy consumption per gross square foot (Btu/GSF) in 2003. The Office of Management and Budget's (OMB) Energy Scorecard found that 17 of 22 agencies reduced energy intensity by at least 12% in 2009 compared to 2003 (OMB 2010). In addition, President Bush signed Executive Order 13423 in January 2007, which increased the goal to 3% per year, or 30% by the end of 2015 (FEMP 2007b). This was later codified under Section 431 of EISA.

Section 103 of EAct 2005 directs that all federal buildings have advanced metering, directs DOE to create guidelines for implementation of advanced metering, and requires submission of implementation plans by federal agencies to DOE. The [Guidance for Electric Metering in Federal Buildings](#) was published on February 3, 2006. As of 2007, 11 agencies reported that their buildings were metered with standard meters, and EPA and the Department of Housing and Urban Development (HUD) had advanced metering in 100% of their buildings (FEMP 2007a). EISA enhances this provision by requiring agencies to identify and designate a facility energy manager for all facilities that make up at least 75% of the agency's facility energy use. These managers will have to complete regular energy and water evaluations, follow up on operations and maintenance (O&M) for implemented measures, and provide energy data for each building into a benchmarking system.

Section 104 requires that federal agencies procure ENERGY STAR-qualified or Federal Energy Management Program (FEMP)-designated products unless the equipment is not life-cycle cost-effective or does not meet the functional requirements of the agency. Section 104 also directs the General Services Administration (GSA) and the Defense Logistics Agency (DLA) to "clearly and prominently display" ENERGY STAR-qualified and FEMP-designated products in their supply catalogs and to supply only ENERGY STAR-qualified or FEMP-designated products in covered categories. The Alliance to Save Energy's 2008 research revealed low levels of awareness and compliance with the regulation. Results showed that agencies failed to integrate requirements into contract actions for the procurement of designed energy-consuming products, and agency personnel were largely unfamiliar with energy efficiency purchasing requirements and their role in complying with this regulation. The results also found that GSA and DLA purchasing Web sites listed mostly non-compliant products in designated products categories (ASE 2008). The Alliance is expected to release an update on agency progress in complying with energy efficiency procurement regulations in early 2011.

Information on DLA's progress in complying with this provision is unavailable because of newer security restrictions on their online supply Web site that make it difficult for non-military personnel to access product listings. At GSA, efforts have been made in recent years to help agencies more easily identify compliant products on its supply Web site—GSA Advantage! For instance, when federal customers select a product on the site that does not meet EAct 2005 requirements, an information box pops up to notify customers of the regulation and availability of compliant alternatives on the site. However, if federal customers chose to ignore this information, GSA will still supply non-compliant products, which is contrary to the provision. In addition, vendor self-certification of the environmental attributes of their products on GSA Advantage! has been problematic. There have been numerous examples of non-compliant products on the site being mislabeled as compliant. New mechanisms, established to prohibit non-compliant ENERGY STAR products from being labeled as compliant, have been moderately effective. Furthermore, no such quality control mechanisms exist for FEMP-designated products (Siciliano 2011; Payne 2011).

Section 105 extended energy savings performance contracts, or ESPCs, for 10 years from 2006 to 2016. This program was originally set up as a pilot in 1998 as a way to allow federal agencies to accomplish energy savings projects without upfront capital costs or special Congressional appropriations, but the authority for ESPCs lapsed in 2003. They were permanently authorized in Section 514 of EISA. Use of ESPCs has ramped up again since 2005, and was particularly active in 2009 because of a rush to complete projects under the existing contract as the government moved to a new ESPC contract, which has some new, more restrictive language (Schafer 2010).

Section 106. Voluntary Industrial Commitments

This provision created a program for companies in the industrial sector to enter into voluntary commitments with the Department of Energy to reduce energy intensity by 2.5% each year between 2007 through 2016. This provision was the basis for the *Save Energy Now* Leaders Program, in which DOE provides energy savings assessments to those companies that make these voluntary commitments. Between 2005 and the passage of ARRA in 2009, funds were provided to states to help implement these assessments (Genzer 2011). The LEADER efforts were launched in December 2009, and there are currently 105 companies that are *Save Energy Now* LEADERS (Wright 2011). According to the DOE's FY 2011 budget request, *Save Energy Now* conducted 2,421 energy assessments for manufacturers from 2006 through November 2009. These plants identified more than \$1.3 billion in potential cost savings per year, with \$231 million per year already implemented and \$437 million per year underway or scheduled (DOE 2010a). The provision requires reports to Congress in 2012 and 2017, at which point more information about the status of energy performance improvements will be available.

Sec 107. Advanced Building Efficiency Testbed Program

This provision created an Advanced Building Efficiency Testbed Program administered by a university to develop, test, and demonstrate advanced energy efficiency technologies for buildings. It authorized \$6 million a year for fiscal years 2006–2008. Carnegie Mellon University was selected for the program, and it used the funds to institute the Building as Power Plant (BAPP) project. This program provided valuable

knowledge and methods for system performance modeling and for incorporating a number of different types of energy-efficient chillers, fan coils, biodiesel engines, and solar driven chillers into building systems (Archer 2008).

Sec 109. High Performance Public Buildings

This provision required that federal agencies report whether their new buildings are 30% below the 2004 IECC or ASHRAE standard. This was updated in EISA, which created a Federal High-Performance Green Building Office and Advisory Committee in Section 436, and increased the time period for life-cycle cost calculations to 40 years from 25 years in Section 441. DOE issued a rule on this provision in December 2006. It is unclear whether this provision has had a significant impact because there has not been a lot of new federal building construction in this period. Additionally, the funding necessary to build to the enhanced standards has not been readily available and few agencies are willing to utilize energy savings performance contracting as a mechanism for new building construction (Schafer 2010).

Section 110. Daylight Savings Time

This provision increased the portion of the year subject to daylight savings time in order to save energy. It also required DOE to complete a study of the effects of the change. The study found total electricity savings of 1.3 TWh, or 0.03% of electricity consumption over the year, or 0.02 % (17 TBtu) in terms of national primary energy consumption. These savings tended to occur in the evening, with greater savings during the March extension of Daylight Savings Time than the November extension. Expected changes in national traffic volume and gasoline consumption were found to be statistically insignificant (DOE 2008a).

Section 123. State Energy Programs

This provision reauthorizes the State Energy Program (SEP) and requires that DOE meet with the Governor of each state to review their energy conservation plan at least once every three years. In order to be eligible for funding, the plans must include a 25% improvement in energy efficiency by 2012 against a 1990 baseline. \$100 million is authorized per year for FYs 2006 and 2007, and \$125 million is authorized for FY 2008 for this state-assistance fund (\$325 million total). The State Energy Program was funded at levels between \$36 million and \$58 million between 2006 and 2009, at which point an additional \$3.1 billion in funding was provided as a part of ARRA. A study conducted by Oak Ridge National Laboratory in 2005 found that each \$1 of SEP federal funds is typically leveraged by \$10.71 of state and private funds, making these appropriations go much further than typical federal energy programs. In addition, each \$1 of SEP funds is associated with annual savings of 1.03 million source BTUs and a cost savings of \$7.22 (ORNL 2005).

Section 124. Appliance Rebate Program

Section 124 established an appliance rebate program, and authorized funding at \$50 million a year from 2006–2010. Congress appropriated no funding, however, and DOE did not set up rules to implement the program. In 2009, Congress passed ARRA, and included \$300 million for this effort. DOE developed program rules, and allocated the dollars to states accordingly to a typical population weighting formula. Each state and territory selected its own set of ENERGY STAR® qualified appliances from a list including HVAC equipment, some kitchen appliances, water heaters and clothes washers. Figure 4 below documents the program results as of December 2010, demonstrating significant leveraging of consumer spending (DOE 2011). Of the 1.4 million consumer rebates paid to consumers, most were redeemed for major appliances, with lower levels of redemption for HVAC and water heater rebates.

Figure 4. State Energy-Efficient Appliance Program, Interim Results as of December 2010

	MAJOR APPLIANCES	HVAC	WATER HEATERS	ALL PRODUCTS
TOTAL REBATES (THOUSANDS) AND PERCENT OF TOTAL	1,262 (89%)	133 (9%)	28 (2%)	1,424 (100%)
REBATE PAYMENTS TO CUSTOMERS (MILLIONS)	\$144	\$57	\$6	\$207
CONSUMER SPENDING (MILLIONS) AND LEVERAGING RATIO	\$1,096 (7.6:1)	\$472 (8.2:1)	\$34 (6.1:1)	\$1,602 (7.8:1)
SALES TAX LEVERAGED (MILLIONS) AND LEVERAGING RATIO	\$60 (0.4:1)	\$27 (0.5:1)	\$2 (0.3:1)	\$89 (0.4:1)
ANNUAL COST SAVINGS (MILLIONS)	\$41	\$12	\$2	\$55
ANNUAL ENERGY SAVINGS (BILLIONS OF BTU)	631	618	132	1,381

Source: DOE 2011 (data as of December 2010)

Section 125. Energy Efficient Public Buildings

Section 125 provides grants to state agencies responsible for developing state energy conservation plans. If no plan exists, the grants are to go to agencies that assist local government in improving energy efficiency in new or existing public buildings and facilities to a level of energy use at least 30% below the most recent IECC code. No funding was appropriated for this provision. Nonetheless, there is ongoing activity related to improving the efficiency of public buildings in the states, through energy savings performance contracts (ESPCs) in the “mush” market of municipal/state buildings, universities, schools, and hospitals (Genzer 2011).

Section 126. Low Income Community Energy Efficiency Pilot Program

This section provides grants through DOE to local governments, non-profit community development organizations, and Indian tribe economic development entities that offer programs to improve energy efficiency in low-income communities. It is authorized at \$20 million per year for fiscal years 2006–2008 (\$60 million total). No funding was appropriated for this provision. However, this provision served as the statutory basis for response to damage from Hurricane Katrina by the Department of Natural Resource in Louisiana (Genzer 2011).

Section 127. State Technologies Advancement Collaborative

Section 127 directs the DOE to work with states to establish the State Technologies Advancement Collaborative, a cooperative program for research and development of energy efficiency, renewable energy or fossil energy technologies that can be used at the state or federal levels. Such funds as necessary are authorized to this collaborative for FY2006-FY2010. The State Technologies Advancement Collaborative (STAC) was created through \$19,2 million in Interior Department appropriations between 2003 and 2005, and projects continued using this provision’s authority through FY 2010. An additional 40% in state and private industry cost-share funds were leveraged for these projects. These multi-state projects included research, development, demonstration, and deployment (RDD&D) efforts. They were focused on supporting technologies with common Federal and State priorities in energy efficiency, fossil energy, and renewable energy (Terry 2011).

Section 128. State Building Codes Incentives

This provision adds to a prior law that established a technical assistance program to states on building code adoption by calling for increased funding and adding a code implementation component. This provision was dependent on appropriations, and these state building codes activities were funded, but at a level lower than the \$25 million authorized in the provision. This provision also may have led to Section

410 of ARRA, which stated that by accepting State Energy Program funding, each state committed to updating to the most recent codes and enforcing codes at 90% compliance levels on a timeline within eight years of enactment. (Ungar 2010; Genzer 2011).

Section 131. Energy Star Program

This provision officially established the ENERGY STAR[®] program at the Environmental Protection Agency and DOE. It requires DOE to create new energy efficiency qualifications for clothes washers and dishwashers by January, 1, 2006, effective January, 1, 2007. It also requires new energy efficiency qualifications for these products by January, 1, 2008, effective January, 1, 2010. DOE met the effective dates for both products and both deadlines.

Sec 132. HVAC Maintenance Consumer Education

This provision authorized a DOE and EPA program to educate homeowners and small business owners on proper heating, ventilation, and air conditioning systems. No funds were appropriated for this program. This section also mandated DOE/EPA work with the Small Business Association to provide educational material and establish a clearinghouse for small businesses to learn about how to implement efficiency in their day-to-day operations. DOE/EPA and the National Small Business Association met but SBA did not follow up with seed resources for the clearinghouse (Karney 2011).

Sec 133–134. Public Awareness Campaigns

Section 133 requires the Department of Energy to hold a conference to establish a national public energy education program. No further information on implementation of this provision was available.

Section 134 directs DOE to create a “comprehensive national program, including advertising and media awareness” to inform consumers about the benefits of reducing energy consumption, and practical, cost-effective measures to reduce energy use. The program is authorized at \$90 million a year for 2006–2010, but it is unclear how much of those funds were appropriated, likely very little. In 2005, the DOE kicked off the “Energy Star Change a Light, Change the World Campaign, a small program to encourage customers to change out old incandescent bulbs for new ENERGY STAR[®] compact fluorescent lamps (CFLs). Concurrently, the President’s budget in the next year zeroed out funding for this type of program. Nonetheless, by 2007, the Department began focusing on public education again. They produced a TV spot to promote energy efficiency with the Walt Disney Corporation, in 2008–2009, launched an energy efficiency campaign targeted to “tweens” (children 8-12) and a campaign targeted at military bases (DOE 2008b).

Section 137. Appliance Labeling

Section 137 required the Federal Trade Commission (FTC) to conduct a rulemaking to determine the effectiveness of the EnergyGuide label for consumer products. ACEEE and other energy advocates had conducted market research to create a series of recommendations for a new label, including a move from a continuous to a categorical label (for example, 1-5 stars), improved graphics, and clearer explanatory text (Amann and Egan 2002). The FTC’s rulemaking, completed in January 2007, made some of the recommended changes, but did not move to a categorical label (FTC 2007). As a result, the label changes didn’t achieve the full savings potential anticipated by ACEEE. The main factors in this decision included a lack of support from manufacturers, lack of support from EPA/DOE (mostly due to perceived potential conflicts with the ENERGY STAR[®] brand), and the limited financial and staff resources allocated to the FTC to administer the more staff-intensive categorical label.

Section 139. State and Regional Energy Efficiency Policies Study

This section required a study of the state and regional policies that promote cost-effective programs to reduce energy consumption. The report, produced by the National Association of Regulatory Utility Commissioners (NARUC) and National Association of State Energy Officials (NASEO), was completed in March 2007.

Sec 140 Energy Efficiency Pilot Projects

This section authorized \$5 million for three to seven state pilot programs in energy efficiency that provide reductions in electricity or natural gas consumption of 0.75%. No direct funding was appropriated to these projects. This provision, along with Section 126, the Low Income Community Energy Efficiency Pilot Program, served as the statutory basis for targeted efforts in some individual communities (Genzer 2011).

Section 151–154. Public Housing

Section 151 allowed longer terms for performance contracts to enable more comprehensive improvements to public housing through energy service companies. This provision was an attempt to make HUD (Department of Housing and Urban Development) projects, which were generally small and limited to short-term investments, more attractive to energy service companies (ESCOs). While the provision removed the issue of the length of investment allowed on HUD facilities, it did not address the small size of many projects, and as a result, did not impact small ESCO activity as much as it could have (Gilligan 2010). Nonetheless, there has been an increase in ESPCs in the years since the bills' passage, and to date, 213 Energy Performance Contracts have been completed in Public Housing. Over the lifetime of these contracts, the undiscounted total of all energy savings is nearly \$1.78 billion. A total of 235,721 units have received conservation improvement through the Energy Performance Contract initiative. Details are provided in Table 8 below.

Table 8. EPSCs Contracts Inventory

Running Count of Active and Completed EPCs—By Year and PHA Size							
PHA Size	2000	2002	2004	2006	2007	2008	2009
Very small (<250)	2	2	5	10	13	17	21
Small (250-499)	14	18	20	30	35	43	55
Medium (500-1,249)	6	13	27	35	42	47	58
Large (1,250-6,599)	7	25	37	50	56	68	72
Very large (>6,599)	4	5	7	7	8	8	7
TOTAL	43	63	96	132	154	183	213

Source: Williams 2010

Section 152 requires a housing agency to purchase FEMP-designated or ENERGY STAR products unless it is not cost-effective to the agency. This was implemented through a "general guidance notice" reflecting this requirement until February 2011, when it was reflected in official regulation through a proposed rule (HUD 2011). HUD chose not to issue a separate proposed rule to implement the statutory requirement for energy-efficient appliances in the interest of "streamlining." The agency combined this regulation with provisions related to contracting terms for energy performance contracts and the public housing operating fund. There were concerns expressed about these portions of the rule, and as a result, the energy-efficient products rulemaking was delayed until the other issues were resolved (GAO 2008).

Section 153 updates the building code references for HOPE VI assisted housing to the 2003 IECC energy code. In 2007, this section was superseded by Section 481 of EISA 2007, which imposed newer and higher energy standards for HUD new construction, to the 2006 IECC and 2004 ASHRAE standards.

Section 154 requires HUD to develop a strategy to reduce utility expenses through cost-effective energy efficiency measures, and to submit a report in 2006, and every two years after that. HUD successfully

submitted the reports in 2006 and 2008, and is currently working on the 2010 report. This was the first time that HUD had to consciously articulate their energy use reduction policy, and this served as a way to organize thinking around energy efficiency, driving action throughout the agency as a result (Williams 2010).

CAFE Dual Fuel Loophole (Section 722)

This bill marginally weakened the existing CAFÉ situation by extending through 2014 the "dual-fuel loophole" that gives manufacturers CAFÉ credit for making vehicles that can run on an alternative fuel, even though such vehicles rarely use alternative fuel. Full use of this loophole could erode actual fuel economy of the U.S. fleet by up to 5%, or a loss of 47,000 barrels/day in 2010 and 2020. In actuality, this loophole was exploited less than originally anticipated, and the fuel lost as a result of the loophole was between 5,500 and 10,500 barrels/day, depending on the year (NHSTA 2010).

Section 912. RD&D Authorizations

Section 912 authorized \$50 million for the Next Generation Lighting Initiative for 2007–2009 and 2010–2013. The FY 2007 budget included a request for solid-state lighting of \$19.8 million, an 80% increase over the FY 2006 request of \$11.0 million (DOE 2006; 2008c). FY 2008–2010 budget requests remained at about one-half the authorized level in EAct 2005, from \$19.8 million for FY 2008 to \$20.7 million for FY 2010. These budget requests were granted at the requested level for FY 2007 (DOE 2008c). As a result of this funding, the Solid State Lighting program continued successful projects to develop advanced illumination technologies like core LED and OLED science and product development.

Section 915. Secondary Electric Vehicle Battery Use Program

This provision authorized a research and development program to provide financial assistance to 5 proposals that would demonstrate the secondary use of batteries and supporting infrastructure in locations throughout the US. The provision authorized \$7,000,000 for each of fiscal years 2007–2009. No information on the results of this research or the extent to which it was funded could be obtained.

Section 916. Energy Efficiency Science Initiative

This provision authorized a grant program for peer review research related to energy efficiency. The general authorization of funds to DOE for energy efficiency, conservation, etc in Section 911 would apply to this provision. No information on the results of this research or the extent to which it was funded could be obtained.

Section 917. Advanced Energy Efficiency Technology Transfer Centers

This provision authorized grants from DOE to non-profit institutions, universities, and state and local governments to operate technology transfer centers. These centers would provide education and outreach to building and industrial professionals on deployment of advanced technologies. The general authorization of funds to DOE for energy efficiency, conservation, etc in Section 911 would apply to this provision, and in addition, "such sums as may be appropriated" could apply to this section. This was used as the basis for technology transfer centers, like the Midwest Buildings Technology Application Center (MBTAC) at the University of Illinois at Chicago and the Energy Center of Wisconsin, which provides education and technical assistance to Midwest states and commercial building partners on energy-efficient technologies and practices.

Sec 1817. Study on Distributed Generation

DOE completed this [study](#) on the potential benefits of cogeneration and small power production in September 2007.

Section 1252. Net Metering and Smart Metering

This provision directed state commissions and bodies with jurisdiction over municipal and cooperative electric utilities to consider and determine standards for smart metering, which enables real time pricing and demand response; and net metering, which is intended to encourage renewables and other distributed energy resources. These jurisdictional bodies were given one year to initiate the consideration of this standard (PURPA Standard 14), and complete them within two years. As of fall 2008, 38 states had initiated consideration of the standard and 32 had completed regulatory consideration of the standard. Of the states that completed consideration of the standard, 16 took regulatory action and 13 took legislative action on demand response, smart meters, or the smart grid. In many cases this action was related to but not a direct result of the EAct 2005 provision (DRCC 2008).

In addition, DOE's Office of Electricity has used this provision as the authority to undertake smart grid work. It was the first major federal authorization related to smart grid, and set the stage for later expansion of federal government involvement in smart grid in EISA 2007 and ARRA.

Sec 1253. Cogeneration and Small Power Production Purchase and Sale Requirements

This provision exempted competitive markets from compliance with the *Public Utility Regulatory Policy Act of 1978* (PURPA) Section 210's requirement that "qualifying facilities" (QF) like some renewables, cogeneration, and small hydropower be interconnected to the grid, that the electricity generated be purchased at the utilities' avoided cost, and that the facility be provided supplemental and backup power. This provision represented a negotiated consensus agreement between electric utilities, larger industrial CHP owners and CHP advocates that brought an end to a 25-year effort by the utilities to repeal the provision. When EAct passed in 2005, large industrials and CHP advocates expressed concern about the impact of this provision for CHP and distributed generation. These concerns were not borne out, as the trend toward competitive markets stalled in recent years. In fact, this provision has established a precedent that allows CHP to be bid as a resource into forward-capacity markets.

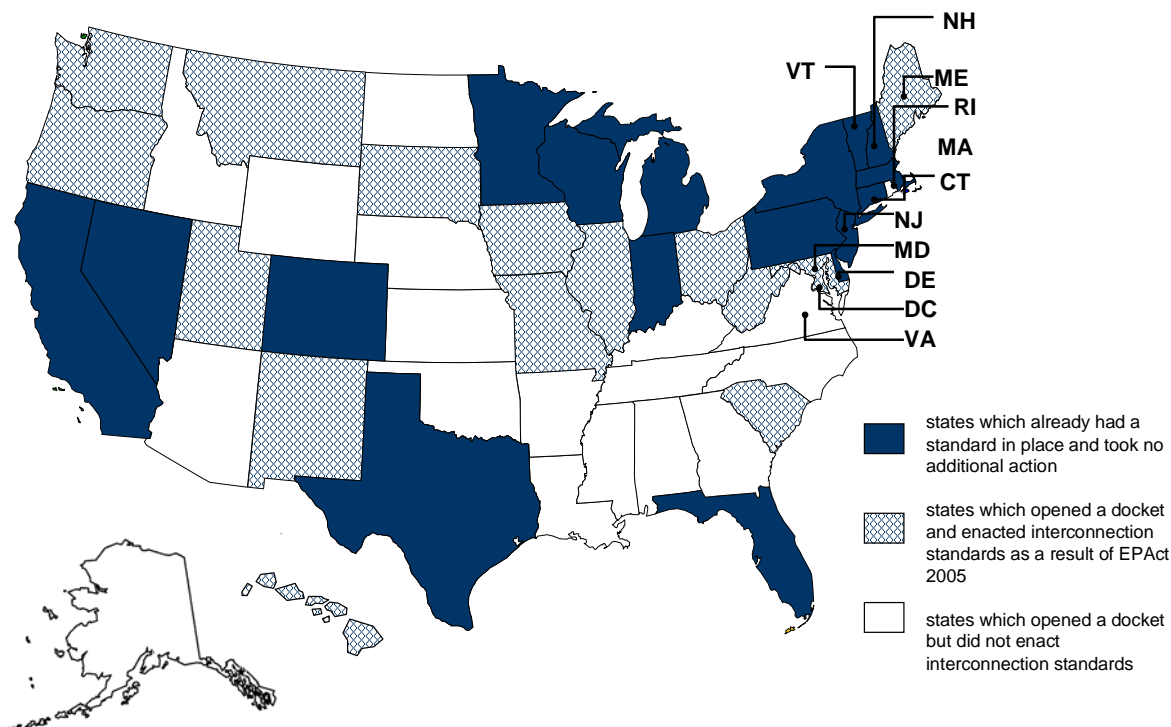
In vertically integrated markets that were not restructured, PURPA QFs remain a viable and frequently used mechanism for installation of CHP. The provisions from EAct 2005 appear to have had no adverse impact on this (Chittum and Kaufman 2011).

Sec 1254. Interconnection Standards

This provision calls for state commissions to consider the adoption of certain interconnection standards for distributed generation by electric utilities based on IEEE 1547, but does not require that they mandate adoption of the standard. This provision had a significant impact in getting states to consider new interconnection standards, in spite of its lack of mandated action. State commissions were required to open a docket and consider new interconnection standards, or provide an explanation for why they didn't need to consider new standards. The opening of dockets allowed CHP advocates and CHP developers an opportunity to provide arguments and evidence in support of adoption of new interconnection standards. Such an opportunity had not previously existed in many states. States that chose not to adopt new standards were required to explain their decision. Such a decision was difficult to explain in most cases, as most states had very poor interconnection standards in place prior to EAct 2005.

Before the enactment of EAct 2005, 17 states had an interconnection standard in place. Figure 5 demonstrates that as of 2010, 15 new states adopted new interconnection standards that provided for the interconnection of at least some forms of CHP as a result of rulemakings initiated by EAct 05 (Chittum 2010).

Figure 5. Interconnection Standards Before and After EPAct 2005

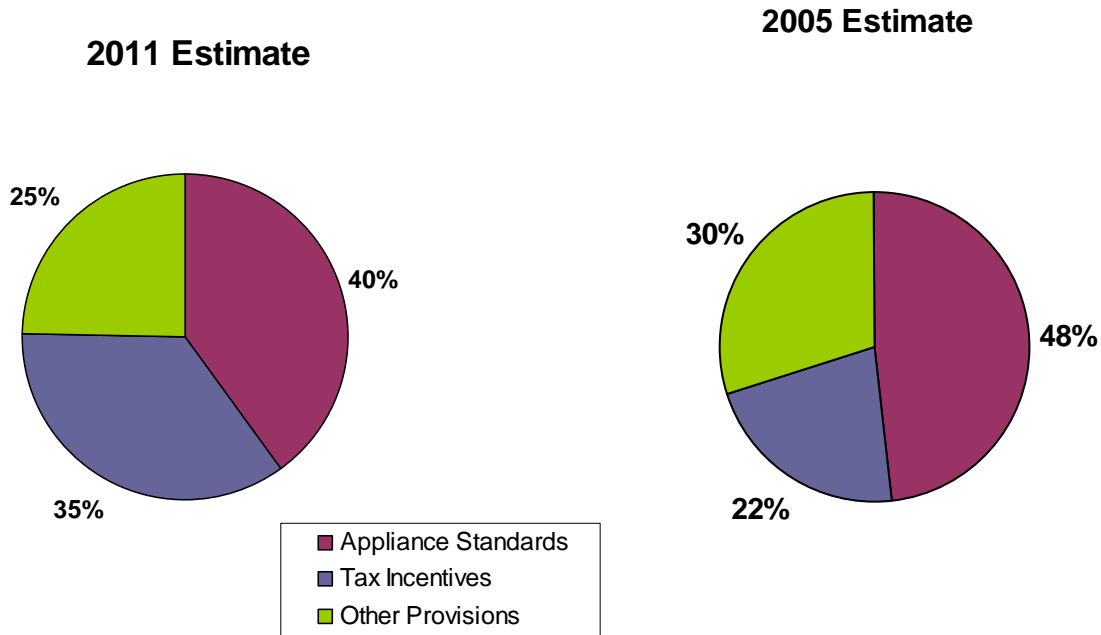


ESTIMATING EPACT'S ENERGY SAVINGS

In 2005, ACEEE estimated that the energy efficiency provisions in the *Energy Policy Act of 2005* would save 0.7 quads in 2010 and 2.5 quads in 2020 (Nadel 2005). These estimates of energy savings were re-examined by ACEEE staff in the Summer of 2006, after a year of implementation. They found that, due to delays in setting furnace fan standards and the lack of appropriations funding for a number of provisions, the savings estimates made in 2005 were likely high by 25% (Nadel, Prindle, and Brooks 2006).

We found that energy savings from EPAct 2005 are likely to be only 9% lower than originally estimated in 2010, and 5% lower than originally estimated in 2020. Lower savings estimates are attributable to implementation issues with a number of provisions. These include lower than expected savings from some appliance standards, like ceiling fan light kits, torchiere lighting fixtures, one class of commercial refrigerators and freezers, and commercial pre-rinse spray valves. There were also lower levels of energy savings for the new homes tax credit, the appliance labeling provision, the public awareness campaign, and the daylight savings time provision.

There were higher levels of savings from the building envelope tax credit, the appliance manufacturers' credit, and the furnace fan tax credit due to higher levels of sales for these energy-efficient products than originally anticipated. There was also less use of the dual fuel loophole than originally anticipated, so savings from CAFÉ did not erode as much as ACEEE originally anticipated. In addition, there were many provisions that were enhanced in later legislation or funded through later legislation. Our original analysis included estimates of the savings from market transformation effects, and in a few cases, we have included updated sales data as a result of tax credit extensions from later legislation. We did not calculate savings for most of the provisions which were enhanced in later legislation, but they are likely significant in scale.

Figure 6. Energy Savings from the *Energy Policy Act of 2005*, Updated

ACEEE's original estimates found that 48% of the savings would come from appliance standards, 22% from tax incentives, and 30% from the other provisions in the bill. In this updated analysis we find that 40% of the savings came from appliance standards, 35% from tax incentives, and 25% from the other provisions in the bill. These changes result from higher sales levels for some tax incentives, other provisions that were unfunded, and slightly lower savings from some appliance and equipment standards.

DISCUSSION: LESSONS LEARNED

In this section, we discuss the major lessons learned in this review of the *Energy Policy Act of 2005*. The legislation was generally successful, especially in setting the precedent for later, broader legislation, and in moving products and processes along the market transformation curve. The main lessons were the importance of education and stakeholder engagement, of “getting the details right”, and of carefully considering market conditions and barriers to product acceptance in order to choose the best policy or actions to address them.

Energy Policies Build on One Another

A number of the energy- and money-saving provisions in EAct 2005 were built on ideas and language that were originally a part of earlier legislation. For example, lessons learned from the conservation tax incentive of the 1970's and 1980's were applied to the tax incentives in this bill. As a result, the incentives had higher incentive amounts, and were focused on an earlier point in the market transformation curve—generally those products with a market share of less than 5%.

EAct 2005 was passed after years of federal inaction on energy policy, and ushered in a period of relatively high activity for federal energy efficiency policy. In the years that followed, energy efficiency was a part of three major bills, one designed to address energy issues (EISA), and two written to address the financial crisis in 2008–2009 (the *Emergency Economic Stabilization Act of 2008*, and ARRA). Each of these pieces of major legislation contained elements that built upon provisions in the *Energy Policy Act of 2005*, and on earlier energy efficiency legislation. Table 9 below details the major legislation built upon provisions from the *Energy Policy Act of 2005*.

Table 9. EPAct 2005 Provisions that Influenced Later Legislation

Provision in EPAct	Later Legislation	How it influenced
Appliance Standards	Energy Independence and Security Act (EISA 2007), <i>American Clean Energy and Security Act (ACES)</i> , <i>American Clean Energy Leadership Act (ACELA)</i> , <i>Implementation of National Consensus Appliance Agreements Act (INCAAAA)</i>	This provision built the market for efficient products, so that more efficient products could be brought to market and covered by standards in later legislation.
Commercial Buildings Tax Incentive	TARP	The incentive was extended to 2013.
New Homes Tax Incentive	TARP, Middle Class Tax Relief Act of 2010	The incentives were extended in TARP until December 31, 2009 and are renewed to cover new homes built in 2010 and 2011 in the Middle Class Tax Relief Act of 2010.
Building Envelope and HVAC Residential Tax incentive	TARP, Middle Class Tax Relief Act of 2010	The incentives were extended as a part of TARP, covering improvements installed in 2009, but not 2008. ARRA extended these to 2010, and increased the cap on incentives. Was extended to 2011, with lower incentives as a part of the Middle Class Tax Relief Act of 2010.
Appliances Tax Incentive	TARP, ARRA, Middle Class Tax Relief Act of 2010	The incentive was extended in TARP until December 31, 2010, then renewed to cover products manufactured in 2011 in the Middle Class Tax Relief Act of 2010. With each renewal, qualifying efficiency levels were made more stringent.
Residential and commercial fuel cells	TARP	The incentive was extended to 2016 as a part of TARP.
Advanced lean burn/diesel vehicles	EISA 2007, TARP	The same diesel fuel loophole has been incorporated into legislation twice since EPAct 2005, in a provision providing large sums of money for retooling in both EISA (Section 136) and TARP.
FEMP energy reduction goals	EISA	These goals were codified under Section 431 of the Energy Independence and Security Act of 2007.
Advanced metering in federal buildings	EISA	EISA requires agencies to identify and designate a facility energy manager for all facilities that make up at least 75% of the agency's facility energy use.
ESPCs for federal agencies	EISA	ESPCs for federal agencies were permanently authorized in Section 514 of EISA.
State Energy Programs	ARRA	An additional \$3.1 billion in funding was provided as a part of ARRA.
Appliance Rebate Program	ARRA	This program was funded at \$296 million for 2009 as a part of the stimulus.
State Building Codes Incentives	ARRA	Section 410 of ARRA required states to upgrade codes and provide a timeline for enforcement.
HUD Building Codes	EISA	EISA imposed newer and higher energy standards for HUD new construction.

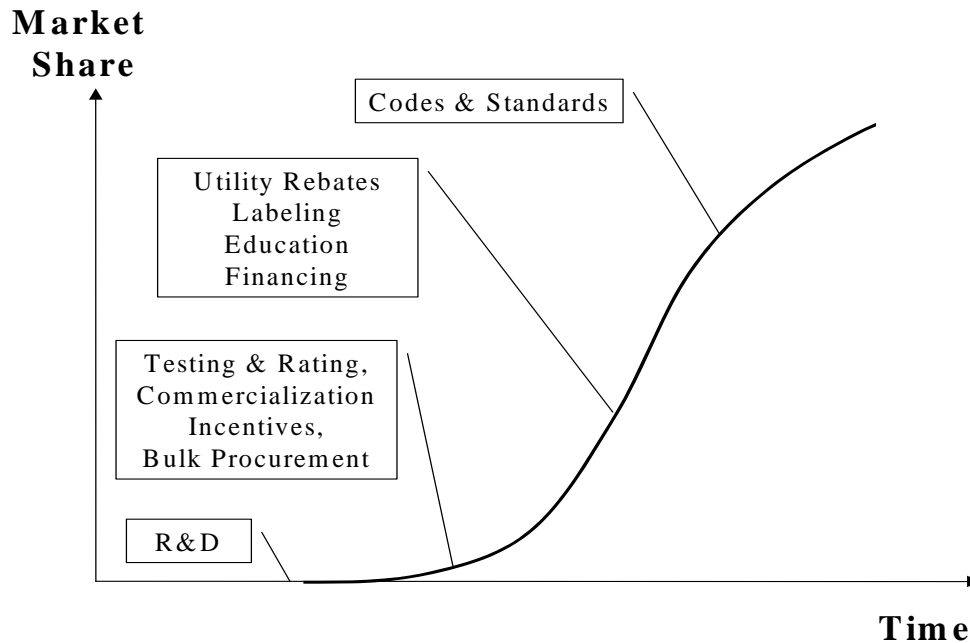
Italicized legislation is proposed legislation that did not pass into law.

In addition to the three large pieces of legislation passed between 2007 and February 2009, in the 111th Congress a variety of related provisions were included in the major House (ACES) and Senate (ACELA) bills.

The Importance of Market Certainty

Energy efficiency policies are often aimed at market transformation efforts—that is, strategically intervening in a market to create lasting change in market behavior by removing identified barriers or exploiting opportunities to accelerate the adoption of cost-effective energy efficiency. Most of the energy efficiency policies in EAct 2005 were aimed at removing barriers at different points of a market transformation curve (see Figure 5).

Figure 5. Policies on a Market Transformation Curve.



Source: Nadel and Latham 1998

Market transformation efforts work best when they are systematically re-evaluated and updated throughout the lifetime of the effort. EAct 2005 was the first in a series of energy legislation that has advanced market transformation for a number of key products. One of the best examples is the manufacturer incentives for appliances, specifically refrigerators. The *Energy Policy Act of 2005* set a minimum tax incentive level for \$75- \$175 per unit for 15–25% savings from the 2001 standard. These were revised to be more stringent in the TARP bill in 2008, with incentives of \$50-\$200 per unit for refrigerators savings 20–30% relative to the 2001 standard, and again in the *Middle Class Tax Relief Bill of 2010*, with incentives of \$150–200 per unit for models saving 30–35% relative to the 2001 standard. The standard in 2014 is anticipated to be 405 kWh/year, or 24% lower than the 2001 standard (DOE 2010b). In addition, ENERGY STAR® updated its qualifying efficiency levels over time, further pushing the process forward. The tax incentives pushed the market for energy-efficient appliances forward, ensuring that the next standard would achieve higher levels of energy savings cost-effectively.

The appliance tax incentives were particularly successful for three main reasons—they were mostly uninterrupted, there was robust stakeholder involvement and education, and the incentive was well timed. Although there was an interruption of 10 months between the end of 2007 and October 2008, the TARP bill enabled manufacturers to take credits for the entirety of 2008, so there was no significant market interruption. In contrast, there were interruptions for the residential HVAC and building envelope incentives. Stakeholders like manufacturers and energy efficiency advocates were actively involved in the

negotiations for the extensions of the appliance incentives and, as a result, were well-informed about how to use the incentives. That active engagement has helped move the incentives towards higher levels of efficiency in the intervening years. In contrast, some stakeholders were less involved in the negotiations about the commercial buildings tax deduction, and so there was unevenness in the treatment of HVAC and whole building improvements versus lighting in the bill. Also, only a few manufacturers were eligible for the appliance tax incentives, but for large amounts of money, and as a result, they have paid close attention to these tax incentives. Consumer incentives are typically more difficult to implement and take longer to ramp up.

In addition, the incentives were designed for appliances that had a small market share, ideally less than 5%, but which were out of the demonstration phase. Some of the tax incentives in EAct 2005, like residential fuel cells and fuel cell vehicles were for products that did not yet have appreciable availability to be able to take advantage of the credit. It is important that the right incentives are matched up with the right market barrier—for residential fuel cells, a different tool might have been more appropriate, like demonstration projects.

Funding

Issues around market certainty carry over into the authorization/appropriations process as well. Many of the R&D programs and some of the energy efficiency provisions other than tax incentives and standards are based on appropriations for funding. In addition, some of the regulatory provisions, with goals or requirements for energy savings for federal agencies or public housing, are reliant upon appropriations to fund implementation.

A number of energy efficiency provisions in EAct 2005 were funded by ‘authorized’ sums, subject to appropriations. With the exception of the RD&D provisions and the appliance rebates, most of these provisions remained unfunded, and as a result, there are no energy savings attributed to these sections. Among the energy efficiency provisions that were never funded are an HVAC consumer education program and a state building codes incentive. In addition, there are a number of provisions which were funded at a level less than the amount appropriated, or which were only funded later as a part of other legislation. For example, the Appliance Rebate program was not funded until the ARRA stimulus bill in February 2009. As a result, there were no energy bill savings from this provision until it was funded and implemented.

Although these provisions require funding in order to achieve the total potential amount of savings, there is an advantage in writing “authorizations” into law even when funding might not be forthcoming. In addition, funding is not necessarily expected for all of these provisions, and they are sometimes put into law with the hope, but not necessarily the guarantee, that they will be funded. As a result, most authorizations have not saved energy, but sometimes circumstances change and the value of the authorized program is recognized and, as a result, funded as in the case of the ARRA-funded provisions. The *Energy Policy Act of 2005* was the first in a series of four large pieces of legislation, and because there were unfunded authorizations on the books, policymakers scrambling to make jobs-creating programs in 2008 and 2009 had a place to begin.

Tying Market Actor Education to Legislation

Education of consumers and key actors in the supply chain is essential for both appliance standards and tax incentives. For example, commercial pre-rinse spray valves were mandated at a rate of 1.6 gallons per minute in the legislation, but there are a number of other valve options that will work for this application, like garden hose nozzles. As a result, there is some non-compliance among food service providers, although probably relatively rarely in commercial kitchens (Fisher 2011). An education campaign targeted at the food service industry could help encourage adoption of legal pre-rinse spray valves. There also appears to be a need for increased enforcement of this provision as some products supposedly produced for the export market may be improperly sold domestically.

The commercial buildings tax incentive also demonstrated the importance of education and informational programs designed in concert with legislation. The lighting industry, led by the National Electrical Manufacturer's Association (NEMA), designed <http://lightingtaxdeduction.org/>, a Web site with information about how to best take advantage of the tax credit. The HVAC and building envelope industries did not put together similar educational campaigns. Anecdotal evidence suggests that lighting accounted for a much greater proportion of these incentives than other products. Although education is one important factor that could have contributed to this difference, other factors likely played as much or more of a role, such as the lower savings threshold required for lighting measures relative to HVAC or building envelope improvements and the infrastructure for lighting retrofits resulting from years of utility, energy service provider, and contractors experience and promotions.

Get the Details Right

Although this 'lesson learned' seems obvious, it is clear that most of those provisions which were least successful were those where the new law contained some unanticipated loophole or problem. These issues can often be preempted through good information and active engagement of all stakeholders, like the implementers of the provision, manufacturers, vendors, and energy efficiency advocates.

One essential element in "getting the details right" is having the information to correctly improve problems that occur in future legislation. For example, a niche type of refrigerator was set at such a high standard that manufacturers could not cost-effectively meet the standard, and would not be able to sell the product at all, because there would be no other compliant product option. The Air-Conditioning, Heating, and Refrigeration Institute and its members should have caught the problem during negotiations on the standard. Nonetheless, subsequent legislative proposals, like the INCAAAA bill in 2010, have included a provision to solve this problem. Similarly, although manufacturers and energy efficiency advocates were engaged on the ceiling fan light kit negotiations, the loophole that just covered one subset of lighting sockets escaped notice. Since then, manufacturers have chosen to avoid the type of socket that would require a CFL, and instead have utilized the loophole, causing a loss in potential energy savings.

Conversely, if regulators, advocates, and manufacturers don't have accurate information about the use of incentives, it is difficult to track their efficacy. The new homes tax deduction has a form (IRS Form 8908) specifically designed to capture information about the number and type of homes taking the credit. Similarly, the residential existing home credits are divided by type of measure on IRS form 5695. As a result, there is good information about the impact of the provision on the marketplace. The commercial building tax deduction, on the other hand, requires no special forms for the deduction, and these incentives are combined with "other deductions" on the business tax forms. The IRS should develop a separate form, and collect the data about different types of qualifying measures installed (whole building, HVAC, building envelope, and lighting) for the commercial buildings tax deduction.

Next Steps

The most successful provisions in EPAAct 2005 were those that engaged relevant stakeholders to carefully assess details of the legislation and provided necessary education, funding, and good timing. Many of the energy efficiency provisions served to accelerate market transformation for energy-efficient products and behaviors, or to set the stage for later action.

Some of the potential savings created by EPAAct 2005's market transformation provisions have been achieved through EISA, TARP, ARRA, and the Middle Class Tax Relief Act of 2010. Nonetheless, significant opportunities for more energy savings abound. In this time of recession, Congress should do all it can to accelerate the adoption of energy saving technologies and behavior to help save consumers and businesses money.

Many of the policies needed to drive this change are low-cost to the federal government and highly cost-effective for consumers. Nonetheless, implementation of both the Energy Policy Act of 1992 and 2005 has demonstrated the importance of up-front funding for energy efficiency policies. An Energy Efficiency

Resources Standard, a policy that was beginning to gain momentum when EAct 2005 passed, would set national energy efficiency targets as a means of laying a foundation for sustained investment in energy efficiency.

A large proportion of the savings from EAct 2005 came from appliance, equipment, and lighting standards. In addition, the tax incentives in EAct 2005 moved the market for a number of energy-efficient products, which now have enough market share to be cost-effectively set in a standard. The *Implementation of National Consensus Appliance Agreements Act* (INCAAA) from the 111th Congress is currently being re-negotiated by manufacturers, efficiency advocates, and lawmakers. This bill would set standards for residential appliances, residential heating and cooling equipment, and other products, and could save 848 trillion BTUs in 2030. The successes of the appliance standards in the *Energy Policy Act of 2005* relative to other provisions highlight the importance of these policies in saving energy for consumers and businesses.

In addition, tax incentives were among the most successful provisions in EAct 2005. A number of proposals to improve and build upon those incentives are on the table for the 112th Congress. The new homes and appliances manufacturing incentives were among the most successful of the tax incentives, and these should be extended going forward. For residential tax credits, the prescriptive credits originally laid out in EAct 2005 should be modified to be more effective and extended past 2011, and performance-based credits should be added. Compared to manufacturer or builder standards, consumer incentives are typically more difficult to implement and take longer to ramp up. Now that momentum has begun on these incentives, it is important to refine and continue to reap their savings.

The heavy-duty hybrids credit in EAct 2005 was too early and at too low an incentive level to influence a significant market share, but it did succeed in getting some products to market. The market has moved in the intervening six years, and the time is ripe to reinstate this credit so that the fruits harvested by the EAct 2005 credit can be harvested. The commercial buildings deduction in EAct 2005 was successful for lighting, but less so for whole building retrofits. Going forward, it should be modified to include an easy to use performance-based incentive for retrofits that achieve 20%+ savings, allowing building owners to mix lighting and other measures to reach savings targets.

CONCLUSIONS

The *Energy Policy Act of 2005* was the first major federal energy policy in years, and ushered in an era of bustling activity in federal energy policy after years of federal inaction. It came at a time of energy price volatility. As a result, many of its provisions were timid, with small levels of energy savings. Nonetheless, this legislation created momentum that drove market transformation of energy-efficient products forward, and opened up the dialogue for greater energy savings down the road.

Implementation of EAct 2005's provisions has been tied directly to the larger macroeconomic, energy resource, and political climate of the times. Some of the provisions which had little promise in 2005, like the Appliance Rebate program or the CHP interconnection standards provision, opened up new avenues for energy savings when the larger climate was right.

In 1997, ACEEE and the Alliance to Save Energy completed an extensive study assessing the implementation of the Energy Policy Act of 1992. That study gave an overall grade of "C" for the Energy Policy Act of 1992 and found that it was a bill with too many weak provisions that diluted implementation efforts, either because of inadequate funding or their voluntary nature. That study found that adopting legislation does not guarantee results, and that without good program design, implementation and funding, the objectives are unlikely to be realized. The results of this study echo these conclusions—in general those provisions which were most successful were programs with good design, funding, and engaged stakeholders and implementers.

There are billions of dollars of energy efficiency savings still left on the table. For policymakers to maximize this resource in the 112th Congress and beyond, the focus should be on finding solutions to market barriers and creating the momentum for more action in the future.

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APPENDIX A. METHODOLOGY FOR ENERGY SAVINGS ESTIMATES CHANGES

Estimates of energy savings were made throughout 2005 as ACEEE tracked the energy efficiency provisions during the legislative process. These were made using the Energy Information Administration's Annual Energy Outlook 2005 as a baseline. In this analysis, ACEEE only updated estimates where new market data was available; if not, the original estimate was used.

Appliance Standards

Ceiling Fan Light Kits

Savings were less than expected because manufacturers chose to avoid the requirement for CFLs by using intermediate-base sockets. These were a little-used socket about ½-inch in diameter. The original estimate of savings was based on the change from the current baseline of incandescent to the standard, CFLs, and found savings of 18.9 TWh in 2020. We assume that 90% of these ceiling fan light kits still use incandescent bulbs, and are multiplying the savings numbers by 10%.

Commercial Clothes Washers

DOE instituted a rulemaking in 2010, but savings were less than expected because top-loading and front-loading washers were divided as a product class for the first time. The rule was lenient for top loading washers, which represent the majority of the market. The rule was also less stringent than it could have been on front-loading washers so as not to erode the market share of these products by driving up the cost differential between front-loading and top-loading washers (Osann 2010). Nonetheless, our original estimates only included savings from the 2008 standard, and did not include potential savings from the 2010 rule, so we have not adjusted our savings numbers.

Torchiere Lighting Fixtures

These products have had a declining market share in the years since EAct 2005 was passed, and so savings from this provision are less than anticipated. Market data on "tungsten halogen filament lamps greater than 100V, power less than 500 V" from the USA trade import database indicated a drop of 33% in sales (USA Trade Online 2011). Although sales were down by 33%, this provision may have driven the market toward lower wattage fixtures other than torchieres. We don't have market data on the extent to which this trend may be a factor in increased sales. As a result, we decreased the anticipated number of torchiere fixtures (12.2 million) by 33%. We don't have market data on this, so we assumed sales dropped by half of this, or 17.5%.

Commercial Refrigerators and Freezers

Generally on track, but one niche product, service over-the-counter refrigeration, was included at a level too stringent for manufacturers to feasibly meet. This is particularly an issue, because some manufacturers won't be able to sell this product at all, since they can't produce a compliant product. The consensus bill introduced by Senator Bingaman (INCAAA) includes a fix to this issue (Amrane 2010). This would not affect the original estimate significantly because of the low sales level for this product.

Commercial pre-rinse spray valves

The penetration rate is lower than originally anticipated because it is relatively easy for business owners in the food industry to use other products, like garden hose nozzles, in lieu of the legal 1.6 gallons/minute valves. There is not good market data about the extent of this enforcement problem, so we have assumed 20% of the original savings estimated are affected by this problem.

Tax Incentives

We are including effects from tax credit extensions and market transformation in 2008–2010 where data is available. Our original estimates included market transformation for tax incentives, and in most cases, we have maintained or slightly modified our original estimates.

New Homes Tax Credit

The original calculations assumed 335,000 homes/year between 2006 and 2010. This was replaced with actual data on new homes taking the credit from RESNET and manufactured homes eligible for the credit (RESNET 2010; Levy 2011). The actual data was about 15% of the original estimate, so the number of homes assumed to participate was multiplied by a factor of 0.15. Much of the original overestimate was as a result of the recession, and some was overly optimistic projections of market share.

Existing Homes Tax Credit

No data was available on this deduction, so we have used our original estimates.

Furnaces Credit

The furnace fan credit, originally estimated at 0.29 million in sales, was actually 234,435 units in 2006 (GAO 2010a). We assumed the same level of sales in 2007. This is about 20% less than originally anticipated, so for 2008 and on, we reduced the participation rate by 20%.

The furnace credit, originally estimated at 0.1 million in sales, was actually 1.08 million units in 2006. (GAO 2010a). For 2007 and on, we assumed that participation rates would be two times higher than originally anticipated.

Central AC/HP

Shipments were likely lower than originally anticipated due to the recession, but ACEEE's original estimates of eligible units sold was accurate, so the market share of efficient equipment increased more than we originally anticipated. Nonetheless, the estimate of savings was based on units of energy-efficient equipment sold, so our savings estimates have not changed.

Gas water heaters, and HP water heaters

The information from GAO did not break down into these categories, so sales data was not available, and we have continued to use our original estimate.

Appliances

There was no available data for 2006 and 2007, the original years of the tax incentive. This tax incentive was extended for 2008 and 2009, and there were 4,066,638 total potential units eligible for the credit in 2008 and 8,968,095 potential units in 2009. We used those figures for 2008 and 2009 sales, and assumed that sales in 2007 were equivalent to 2008, and that 2006 sales were one-half of 2007. For years following 2010, we assumed that the eligible units remained at 2009 levels.

Commercial Buildings

No data was available from GAO on the 179D commercial buildings deduction, so we have used our original estimates.

Fuel Cell vehicles

These vehicles are not yet commercially available, and so the tax credits have not been used in at appreciable level. We assumed there were no savings from this provision.

Hybrid vehicles (light duty)

The original estimate assumed 167,000 hybrid cars would be sold in each year in 2006–2008 and 250,000 cars would be sold in 2009 and 2010, and savings of 31.5 MBtu/year for each hybrid sold. This amounts to 16,000 barrels per day of savings in 2010 and 63,000 barrels a day of savings for 2020.

Green Car Congress sales data indicates that between 205,000 and 347,000 hybrids were sold each year from 2006–2008, and 290,000 hybrids were sold in 2009. However, a majority of the market is represented by Toyota and Honda hybrids, and these companies were bringing hybrids to market before the introduction of the tax credit. As a result, the tax credit only had an appreciable impact on Ford and GM, a much smaller percentage of the market. We assumed that savings will be similar to the original estimates and have made no changes.

Hybrid vehicles (heavy duty)

The original estimate assumed 800 hybrid trucks would be sold in each year in 2006–2007, 2,200 trucks would be sold in 2008, 6,000 trucks in 2009, and 9,000 trucks in 2010, and savings of 84.9 MBtu/year for each hybrid sold. This amounts to 800 barrels per day of savings in 2010 and 50,000 barrels a day of savings for 2020. We have not adjusted our original estimate.

Voluntary industrial commitments

ACEEE originally estimated that 5% of eligible facilities would participate, averaging 0.5% savings per year for 10 years. This generated about \$100 million in savings in 2010 and \$400 million in savings in 2020. DOE's FY 2011 budget notes the \$231 million in savings per year have already been implemented, and \$437 per year are underway or scheduled. As a result, we assumed that savings will be similar to the original estimates and have made no changes.

Daylight Savings Time

The original estimate was based on an estimate of savings of 1% for 2/12 of the year, which was based on a government study in the 1980s. DOE conducted a study as a requirement of EAct, which found total electricity savings of 17 TBtu in the four extra weeks of 2007. This is 0.02% of the total energy consumption in the U.S. in 2007, so we assumed that the savings would be 0.02% of energy consumption in each following year (from EIA 2010) as well.

Appliance Labeling

The original calculations utilized the following rough estimate: A rough “order of magnitude” estimate of potential annual energy savings provides an indication of the importance of appliance labels. According to the Residential Energy Consumption Survey (EIA 2000), products covered by the FTC labeling program consumed approximately 13 quads of primary energy in 1997. If we estimate that a revised label affects purchase decisions by 20% of consumers, and that each affected consumer saves 10%, then nationwide energy savings would amount to roughly 0.25 quads per year, once the existing appliance stock has turned over.

In the revised estimate, we estimated that the label would affect purchase decisions by 10% instead of 20% of customers, because the categorical labels were not chosen in the FTC rulemaking. In addition, we estimated that each affected customer would save 5% instead of 10%, because the categorical labels which were not chosen were better at helping customers at the outer bounds of the label in decision-making and differentiation between products (Amann and Egan 2002).

Appliance Rebates

ACEEE did not originally estimate savings for this provision. DOE's estimates of savings from the program through December of 2010 found savings of 1.38 TBtu from \$207 in funding. We assumed that savings will grow proportionally for the remaining \$89 million in funds, and therefore assumed savings of 1.97 TBtu in 2010. Because the measure lives for most of the products eligible for the rebates are longer than 10 years, we assumed savings in 2020 would be the same as in 2010, or 1.97 TBtu.

Building Codes

This provision was dependent on appropriations, and about ¼ of the 25 million authorized was appropriated each year. As a result, we divided the original estimates by 3, assuming limited funds were targeted to the most effective actions.

A/C Maintenance Education

There were no energy savings from this program because no funds were appropriated for this provision.

Public Awareness Campaign.

There were only small public awareness campaigns until 2008–2009, so savings have been halved from the original estimate. The original estimate of 110 TBtu of savings in 2010 and 60 TBtu in 2020 was based on low levels of funding, but assumed a faster ramp-up of the program.

Public Housing

The original estimate was based upon an assumption of \$200 million in energy savings, then divided in half because energy-efficient mortgages were not included in the legislation. HUD's 2009 report to Congress projected annual savings in 2007 of \$102.8 million. As a result, we assumed that savings will be similar to the original estimates and have made no changes.

Interconnection Standards

The original estimate assumed that states representing 20% of potential act would act in response to this provision. 15 states adopted interconnection standards as a result of this provision. This represents 30% of states, but natural gas prices were high for much of this period, impeding CHP development, so we used our original estimates.

Real Time Pricing

The original estimate assumed that 5% of states would change their policies to encourage smart and net metering, and that 3% savings from eligible capacity would result in the states that changed their policies. We found that 26% of states changed their policies. We assumed that of those, perhaps half, or 13% were influenced by EAct 2005, so we adjusted the estimate to be based on 13% of states.

RD&D authorizations

We have no new information on these authorizations, which would require research beyond the scope of this paper.

Energy Efficiency Resource standard

Our original estimate assumed savings of 6.75% of electricity and natural gas sales nationwide, then assumed that only 2% of those savings would be achieved through the pilot programs and report. We have no new information, so we have not adjusted this estimate.

Dual Fuel Loophole

The original estimate assumed full use of the loophole, which would erode actual fuel economy of the U.S. fleet by up to 5%, or a loss of 47,000 barrels/day in 2010 and 2020. In actuality, this loophole was exploited less than originally anticipated, and the fuel lost as a result of the loophole was between 5,500 and 10,500 barrels/day, depending on the year (NHTSA 2010).

APPENDIX B. ENERGY SAVINGS ESTIMATES, 2005 AND 2011

Conference Report 2005

Policy Initiative	ACEEE staff analysis February 2011								ACEEE staff analysis August 2005							
	2010 Savings				2020 Savings				2010 Savings				2020 Savings			
	TWH	Total Gas BCF	Oil MBD	Quads	TWH	Total Gas BCF	Oil MBD	Quads	TWH	Total Gas BCF	Oil MBD	Quads	TWH	Total Gas BCF	Oil MBD	Quads
1. Appliance Efficiency Standards	16	130	0.00	0.21	71	450	0.00	0.82	21	170.1	0.00	0.3	90.0	562.6	0.00	1.0
2. Tax incentives																
a. New Homes	0.07	0.89	0.00	0.001	0.40	5.00	0.00	0.01	0.7	8.7	0.00	0.01	2.9	36.1	0.00	0.05
b. Central AC/HP	1	4	0.00	0.01	8	42	0.00	0.08	0.7	3.8	0.00	0.01	8.0	41.6	0.00	0.08
c. Gas water heaters	0	2	0.00	0.00	0	22	0.00	0.02	0	2.3	0.00	0.00	0	22.4	0.00	0.02
d. HP water heaters	0	1	0.00	0.00	1	3	0.00	0.01	0.1	0.7	0.00	0.00	0.6	3.3	0.00	0.01
e. Furnaces	0.6	11.2	0.0	0.01	4	63	0.00	0.09	0.7	5.3	0.00	0.01	4.6	35.8	0.00	0.06
f. Appliances	2	70	0.00	0.08	10	292	0.00	0.34	0.5	13.3	0.00	0.02	3.0	87.6	0.00	0.10
g. Comm. Bldgs.	1	6	0.00	0.01	3	27	0.00	0.04	0.7	5.8	0.00	0.01	3.2	27.1	0.00	0.04
h. Fuel cell cogen.	0	0	0.00	0.00	0	0	0.00	0.00	0	0.0	0.00	0.00	0	0.1	0.00	0.00
i. Fuel cell vehicles	0	0	0.00	0.00	0	0	0.00	0.00	0	0.0	0.00	0.00	0	0.0	0.00	0.00
j. Hybrid vehicles (light duty)	0	0	0.01	0.02	0	0	0.03	0.06	0	0.0	0.01	0.02	0	0.0	0.03	0.06
k. Hybrid vehicles (heavy duty)	0	0	0.00	0.00	0	0	0.01	0.03	0	0.0	0.00	0.00	0	0.0	0.01	0.03
l. Existing homes	0	3	0.00	0.00	0	8	0.00	0.01	0.1	2.7	0.00	0.00	0.3	8.0	0.00	0.01
3. CHP and Recycled Energy	11	35	-0	0.04	30	107	-0	0.11	11	35.1	-0	0.04	29.9	106.7	-0	0.11
4. RD&D authorizations	2	20	0.01	0.05	12	120	0.06	0.30	2	20.0	0.01	0.05	11.6	120.0	0.06	0.30
5. Misc. efficiency provisions																
a. Voluntary industrial commitments	2	21	0.01	0.03	5	62	0.02	0.13	2	21.0	0.01	0.03	4.6	62.1	0.02	0.13
b. Labeling of appliances	2	13	0.00	0.02	6	37	0.00	0.07	8	48.7	0.00	0.09	22.5	141.4	0.00	0.26
c. Federal facilities	1	4	0.00	0.02	4	25	0.00	0.05	1	4.2	0.00	0.02	3.6	25.0	0.00	0.05
d. High performance public buildings	0	2	0.00	0.00	1	7	0.00	0.01	0	2.4	0.00	0.00	1.0	6.9	0.00	0.01
e. A/C maintenance education	0	0	0.00	0.00	0	0	0.00	0.00	0	1.8	0.00	0.00	1.0	5.2	0.00	0.01
f. Public housing	0	2	0.00	0.00	1	7	0.00	0.01	0	2.5	0.00	0.00	0.8	7.3	0.00	0.01
g. Real-time pricing	4	23	0.00	0.05	13	67	0.00	0.13	2	8.9	0.00	0.02	5.0	25.7	0.00	0.05
h. Energy efficiency resource stand	2	19	0.00	0.03	3	29	0.00	0.05	2	19.1	0.00	0.03	3.4	29.3	0.00	0.05
i. Daylight savings time	1	3	0.00	0.01	1	3	0.00	0.01	3	18.2	0.00	0.04	4.0	20.7	0.00	0.04
j. Appliance rebates	0.02	0.8	0.00	0.001	0.03	0.00	0.00	0.001	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
6. Building Energy Codes	0.12	1.8	0.00	0.00	0.8	0	0.00	0.02	0.4	5.3	0.00	0.01	2.5	34.0	0.00	0.05
7. Public Awareness Campaign	3.05	26.05	0.01	0.06	1.80	14.58	0.00	0.03	6	52.1	0.01	0.11	3.6	29.2	0.01	0.06
8. Transportation																
a. Extend dual fuel loophole	0	0	-0.01	-0.02	0	0	-0.01	-0.02	0	0.0	-0.05	-0.09	0.0	0.0	-0.05	-0.09
TOTAL	49	399	0.03	0.66	175	1,391	0.13	2.41	63	452	0.00	0.72	206.2	1,438	0.10	2.55