

**OPPORTUNITY KNOCKS: CAPTURING POLLUTION
REDUCTIONS AND CONSUMER SAVINGS FROM
UPDATED APPLIANCE EFFICIENCY STANDARDS**

Appliance Standards Awareness Project

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ABOUT ASAP

The Appliance Standards Awareness Project is dedicated to increasing awareness of and support for appliance and equipment efficiency standards. Founded by the American Council for an Energy-Efficient Economy, the Alliance to Save Energy, and the Natural Resources Defense Council, ASAP is led by a steering committee that includes representatives from the environmental community, consumer groups, utilities, and state government. For more information, visit www.standardsASAP.org.

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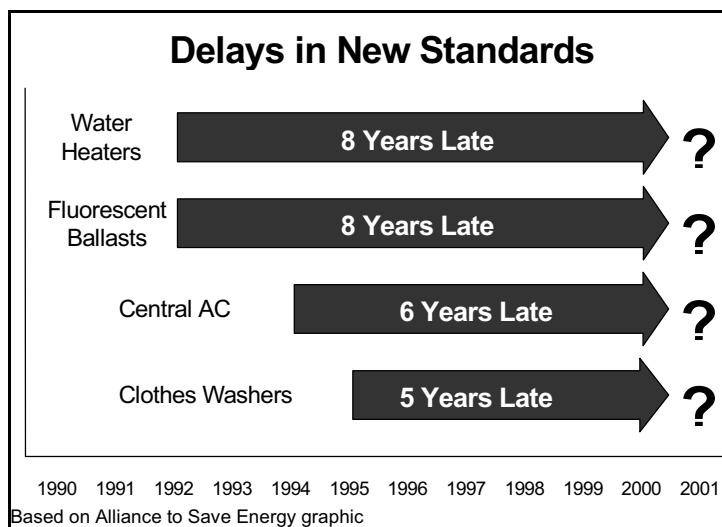
EXECUTIVE SUMMARY

Appliance and equipment efficiency standards have proven to be one of the most successful strategies for improving energy efficiency in the United States. Standards already in effect will save 1.2 quadrillion British thermal units (Btus or “quads”) in 2000 — equivalent to the annual energy use of about 6.5 million American households. These standards will also cut U.S. carbon emissions by 29 million metric tons (MMT) in 2000 — equivalent to removing more than 23 million cars from our roads. By cutting energy consumption and the related emissions of nitrogen oxides, sulfur dioxide, and particulate matter, standards help to alleviate widespread public health problems including asthma and other respiratory diseases, and environmental degradation from smog, acid rain, and haze.

Congress created the first national minimum efficiency standards with passage of the National Appliance Energy Conservation Act of 1987 (NAECA). Minimum efficiency standards remove inefficient products from the market, allowing all consumers to benefit from advances in product performance and design. NAECA called on the U.S. Department of Energy (DOE) to review established standards periodically and upgrade the standards where “technically feasible and economically justified.”

Despite this requirement, the standards setting process has fallen terribly behind schedule (see chart). New standards on water heaters and fluorescent ballasts are 8 years late, central air conditioners and heat pumps are 6 years late, and clothes washers are 5 years late. Standards on transformers are equally behind schedule.

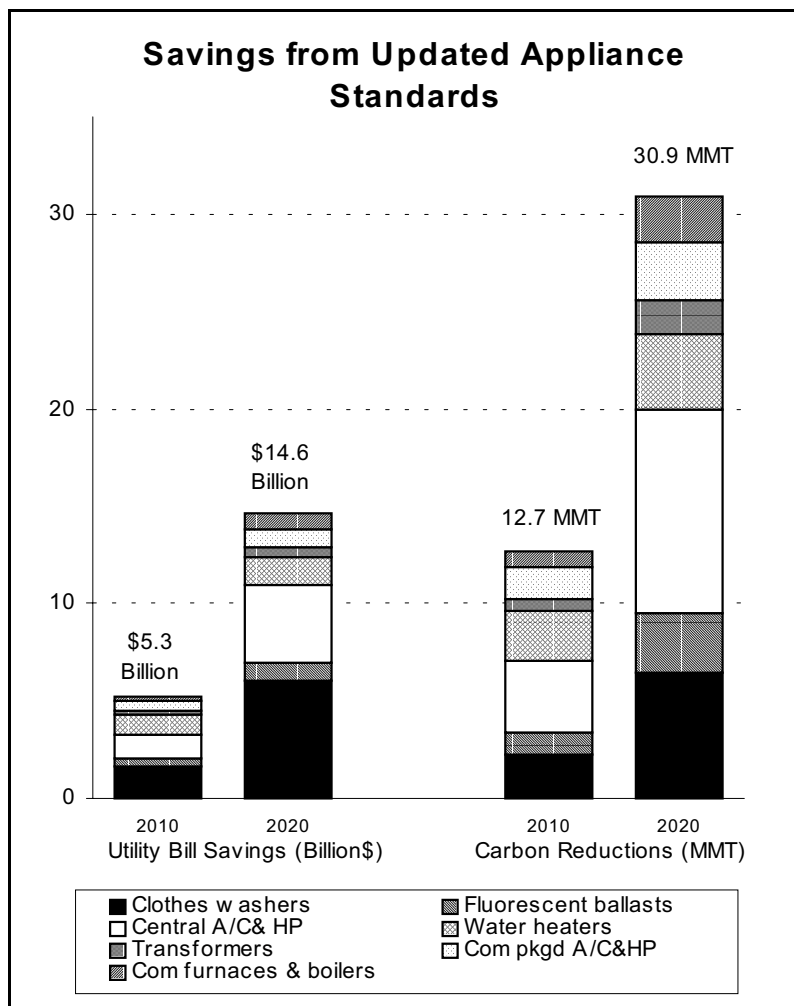
The benefits from upgrading standards to keep pace with energy-saving innovations are substantial. As a result of revisions to refrigerator standards, a new refrigerator purchased in 2001 will use less than one-fourth of the energy of a model purchased in the early 1970s. Developments in appliance technology have led to a new generation of water heaters, clothes washers, heating and cooling equipment, and other products for which updated standards are appropriate.



This report demonstrates how much more can be achieved with updated efficiency standards. We provide estimates of the energy and water savings, utility bill savings, peak electricity reductions, and pollutant emissions reductions possible with adoption of new standards. Estimates are given for 2010 and 2020 at the national level and on a state-by-state basis.

Findings

- Updated efficiency standards would produce primary energy savings of 0.7 quads in 2010 and 1.8 quads in 2020, approximately 5.3 percent of current residential and commercial energy consumption.
- Energy savings are greatest in the hottest states (see map on page vi). This is largely due to the products included in our analysis. States in warmer climates use the most air conditioning, the largest source of savings.
- Improved standards would eliminate the need for almost 32,000 megawatts (MW) of summer peak generating capacity in 2010 — the equivalent of the power produced by 64 large (i.e., 500 MW) power plants. In 2020, peak capacity reductions grow to more than 91,000 MW — the equivalent of 180 large power plants. Cutting peak demand reduces the risk of power outages on hot summer days, like those experienced last summer in the Midwest and New York City.
- New clothes washer standards would eliminate close to 10 percent of household indoor water use. Reduced

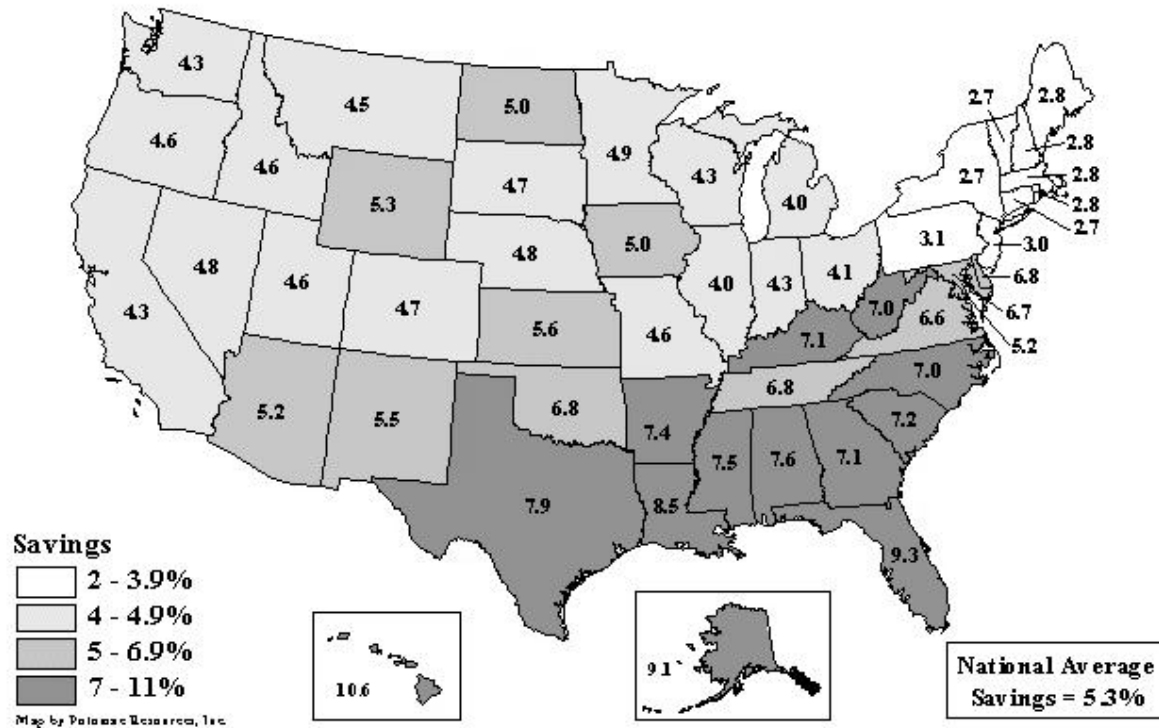


water demand is particularly important in regions facing water shortages. However, everyone will benefit as water savings help avoid or delay construction of costly drinking water and wastewater treatment facilities.

- Consumer utility bills — including energy, water, and sewer costs — would be cut by \$5.3 billion in 2010 and \$14.6 billion in 2020 (see chart on previous page).
- Cumulative net savings from updated standards will approach \$19 billion by 2010 and grow to more than \$41 billion by 2020. For every dollar of increased appliance purchase price, consumers will save more than two dollars on their utility bills.
- The most populous states will realize the largest net savings (see map on page vii). By 2020, cumulative net savings — utility bill savings less the increased appliance purchase price — range from \$56 million in Wyoming to \$4.3 billion in California.
- Upgraded standards would reduce carbon emissions by nearly 13 MMT in 2010. In 2020, carbon reductions would approach 31 MMT (see chart on previous page). Carbon dioxide is the leading contributor to global warming. By cutting carbon emissions, appliance standards can help the United States meet the carbon emissions reduction targets set out in the Kyoto Protocol, an international agreement reached in December 1997.
- Improved standards would reduce smog-forming nitrogen oxide emissions by 40,000 metric tons (MT) in 2010 and almost 89,000 MT in 2020. Sulfur dioxide emissions (the main component of acid rain) would be cut by 154,000 MT in 2010 and 348,000 MT in 2020. Particulate (soot) emissions would decrease by more than 2,000 MT in 2010 and more than 5,000 MT in 2020. By reducing these pollutants, appliance standards help to alleviate public health problems and environmental degradation.

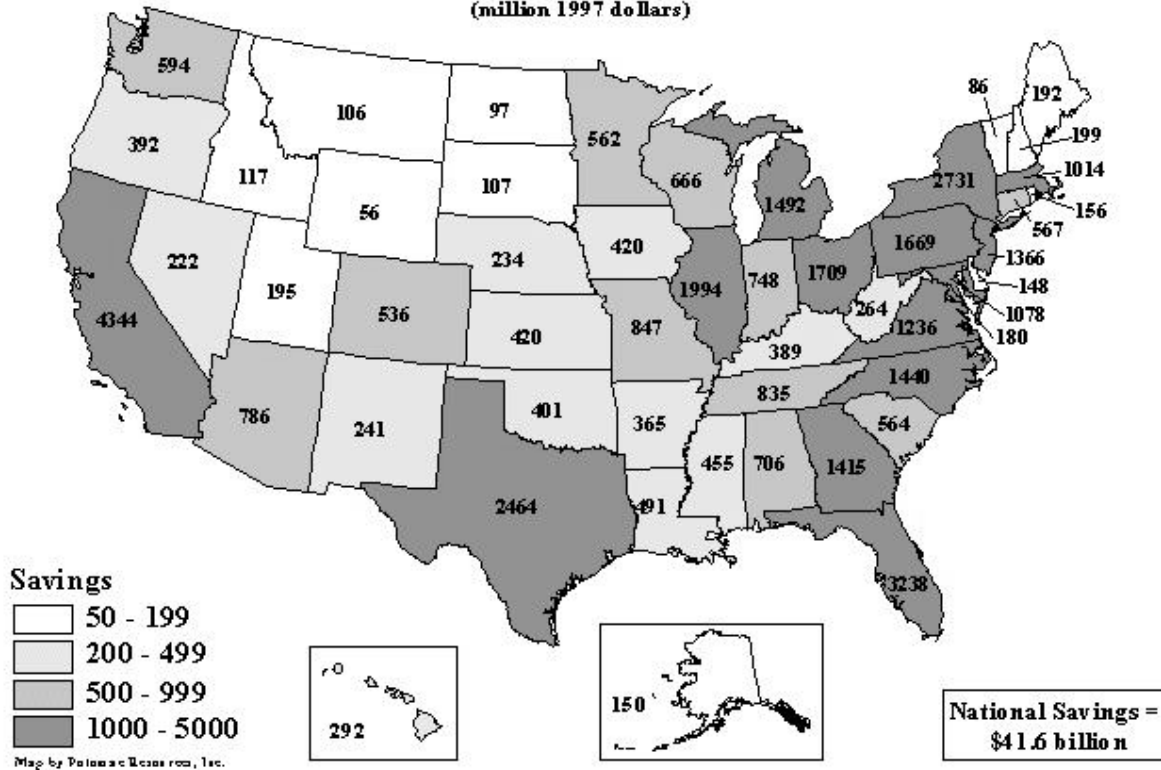
Energy Savings In 2020

(as percentage of 1997 residential & commercial energy use)



Net Savings to Consumers Through 2020

(million 1997 dollars)



INTRODUCTION

Appliance and equipment efficiency standards have proven to be one of the most successful strategies for improving energy efficiency in the United States. Federal standards already in effect will save 1.2 quadrillion British thermal units (Btus or “quads”) in 2000 — equivalent to the annual energy use of about 6.5 million American households (Nadel and Pye 1996). By 2015, annual savings from already existing standards will grow to 3.1 quads, the annual consumption of more than 16 million households (Geller and Goldstein 1998). These savings benefit consumers by lowering utility bills, improving air quality, and reducing emissions of carbon dioxide, the leading contributor to global warming. Power plants that burn fossil fuels such as coal, natural gas, and oil to generate electricity are a major producer of carbon dioxide and other air pollutants. Current efficiency standards will cut U.S. carbon emissions by 29 million metric tons (MMT) in 2000 — equivalent to removing more than 23 million cars from our roads (EPA 1993; Geller and Goldstein 1998). Standards are also helping to reduce the levels of sulfur dioxide, nitrogen oxides, and particulate matter in the air that we breathe. By cutting the levels of these pollutants, standards help to alleviate widespread public health problems, including asthma and other respiratory diseases, and environmental degradation from smog, acid rain, and haze.

Congress created the first national minimum efficiency standards with passage of the National Appliance Energy Conservation Act of 1987 (NAECA). The original statute established standards for refrigerators, water heaters, clothes washers and dryers, dishwashers, heating and cooling equipment, and other products. Standards for additional products were adopted in 1988 and 1992. Table 1 provides a full list of products subject to efficiency standards. By setting a minimum efficiency level, standards remove inefficient products from the market and ensure that efficiency improvements are incorporated into all new products. For example, due to standards, all new refrigerators use high-efficiency motors and compressors, better insulation, and improved heat exchangers. As a result, higher-efficiency products become more widely available and all consumers enjoy the benefits from advances in product performance and design.

NAECA instructed the U.S. Department of Energy (DOE) to periodically review the existing standards and to upgrade standards where “technically feasible and economically justified.” Under pressure from some manufacturers in 1995, Congress passed a one-year moratorium on setting new standards. DOE then reformed the standards setting process, thereby avoiding an extension of the moratorium. Nevertheless, the program has fallen terribly behind schedule. DOE has failed to fulfill its legal obligations by continually missing the NAECA deadlines as well as the revised dates it has set for the publication of new standards. DOE’s delays and the manufacturers’ stalling tactics have effectively stymied progress — since 1992 only two new

Table 1: Products Subject to Appliance Efficiency Standards

Products Included in the National Appliance Energy Conservation Act	
Refrigerator/freezers	Clothes washers
Freezers	Clothes dryers
Room air conditioners	Dishwashers
Central air conditioners and heat pumps	Ranges and ovens
Furnaces and boilers	Pool heaters
Water heaters	Fluorescent lamp ballasts
Direct-fired space heaters	Televisions*
Products Added in the Energy Policy Act of 1992	
Fluorescent lamps	Showerheads
Incandescent reflector lamps	Faucets and aerators
Electric motors (1-200 horsepower)	Toilets
Packaged air conditioners and heat pumps	Distribution transformers*
Furnaces and boilers	Small electric motors (<1 horsepower)*
Water heaters	High-intensity discharge lamps*

*Specific standards were not set in the legislation, but instead DOE was instructed to investigate whether standards are technically feasible and economically justified and to set standards where these criteria are met.

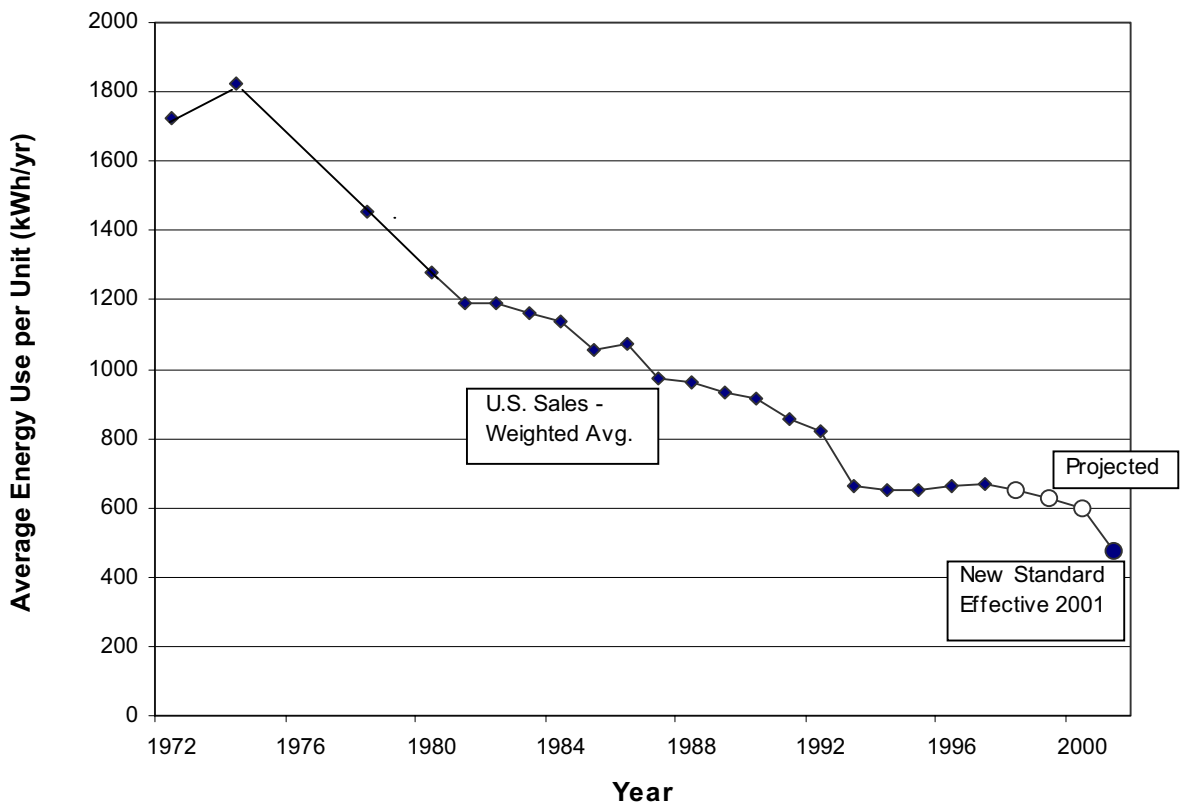
Source: Nadel and Pye 1996

standards rulemakings have been completed: refrigerators and freezers, to take effect in July 2001; and room air conditioners, to take effect in October 2000.¹

The benefits from upgrading standards to keep pace with energy-saving innovations are substantial. For example, since 1976, state and federal standards on refrigerators have been revised five times. As a result, a refrigerator purchased in 2001 will use about one-fourth of the energy of a model purchased in the early 1970s (Geller and Goldstein 1998). Figure 1 demon-

¹ In October 1998, DOE completed a rule for electric ovens and ranges, leaving the previous standard unchanged.

**Figure 1: Improvements in Refrigerator Efficiency
1972 - 2001**



Source: Association of Home Appliance Manufacturers and ACEEE estimates

strates the dramatic improvement in refrigerator efficiency since 1972. Developments in appliance technology have led to a new generation of products for which updated standards are appropriate. Examples include water heaters with beefed-up insulation to reduce heat loss and high-efficiency front-loading clothes washers designed to meet the needs of U.S. consumers. New standards based on these advances can build on the success of current standards. Further delays in modernizing standards are a missed opportunity to save consumer dollars and help the United States meet numerous public health and environmental goals.

In this report, we demonstrate how much more can be achieved by further updating efficiency standards. Our analysis estimates the energy savings, utility bill savings, peak electricity reductions, and pollutant emission reductions possible with adoption of new standards.

We first provide estimates for the United States as a whole and then present estimates broken down on a state-by-state basis. Table 2 provides information on existing standards and proposed levels for updated standards and the dates these standards would go into effect. The proposed standard levels are our estimates of sensible improvements that meet the legislated criteria, based on DOE and national lab analyses for each product. The proposed effective dates assume that DOE makes progress based on its current schedule for ongoing standards rulemakings. We limit the analysis to products that DOE has designated as “high priority” in its appliance standards

Table 2: Proposed New Standards for Targeted Appliances

Appliance	Old Standard	New Standard	Avg. Percent Improvement	Effective Date	Notes
Clothes washers	0.82 MEF	1.36 MEF	40%	2006	Assumes 5-year phase-in; includes dryer savings. New efficiency level can be achieved by most horizontal-axis machines as well as highly advanced vertical-axis units.
Fluorescent lamp ballasts	Energy Efficient Magnetic	Electronic	15%	2006	Analysis does not take credit for current electronic ballast sales. Effective date is weighted average.
Central A/C & heat pumps	10 SEER 6.8 HSPF	13 SEER 8.0 HSPF	23% 15%	2006	SEER 13 units typically feature improved compressors and heat exchangers relative to conventional models.
Water heaters	0.86 EF (elec.) 0.54 EF (gas)	0.91 EF (elec.) 0.61 EF (gas)	5% 11%	2004	These efficiencies can be achieved by high-efficiency models with conventional technologies.
Transformers (dry-type)	81 kWh/yr losses	65 kWh/yr losses	20%	2005	NEMA TP-1 assumed as new standard. This standard based on a 3-year simple payback.
Transformers (liquid-type)	29 kWh/yr losses	24 kWh/yr losses	17%	2007	Old standard based on typical equipment being sold; no old standard in effect. New standard based on average losses of the 3 products with lowest life cycle costs.
Commercial packaged A/C & heat pumps (1 st phase) (2 nd phase)	8.9 EER 10.3 EER	10.3 EER 11.0 EER	14% 6%	2002 2007	Assumes compromise on a 2-phase standard. First tier from ASHRAE 90.1-1999. Second tier from Consortium for Energy Efficiency.
Commercial furnaces & boilers	0.78 CE	0.82 CE	5%	2005	Based on minimum life cycle cost point in analysis for DOE.

review process. Additional savings could be achieved by revising standards on other products such as dishwashers, residential furnaces and boilers, and freezers (Geller and Goldstein 1998).

METHODOLOGY

We conducted our analysis in two stages. First, we calculated the national impact of proposed new standards and then allocated the national totals on a state-by-state basis to determine impacts for each state. We calculated both national and state impacts for the years 2010 and 2020. Each stage of the analysis involved multiple steps as described below.

We obtained national energy savings from proposed new standards by multiplying annual sales figures for each appliance by per-unit energy savings. We calculated electricity and natural gas savings separately, adjusted for electric generation losses, and then summed to obtain total primary energy savings.² To calculate peak generation savings, we multiplied electric generation savings by a peak factor (kilowatt per kilowatt-hour [kW/kWh]). The peak factor for each appliance is the average coincident power demand of the appliance during peak periods divided by the annual energy consumption of the appliance. We determined the financial savings by multiplying forecasted electricity and natural gas rates by the energy savings, while we calculated financial costs by multiplying the per-unit incremental cost for each product by the number of units sold. We derived emission reductions by multiplying emission factors (in pounds/kWh) to the total primary energy savings. For cumulative costs and savings, we discounted to 1999 using a 6 percent real discount rate. Cumulative costs and savings cover the period from the effective date of the standard to 2010 and 2020. The net present value of savings also includes savings after 2020 for equipment sold prior to 2020.

To calculate state-by-state impacts, we prorated the national numbers using a number of allocation factors. For residential products, we allocated impacts according to each state's portion of national households. For commercial products, we used each state's portion of sectoral energy consumption. We then adjusted these figures to reflect the saturation and usage rate of each appliance by census region and division (climate zone was used where appropriate for Alaska and Hawaii). For example, the number of households in Texas is 7 percent of the national total, but the estimated energy savings from central air conditioners and heat pumps is 16 percent, since Texas has a higher saturation and heavier usage of air conditioners and heat pumps compared to the national average. We adjusted financial savings based on utility rates in each state. We also adjusted emission reductions to account for the differences in fuel generation mix used by different regions. Appendix 1 provides a detailed, step-by-step description of our methodology.

² Primary energy includes the energy consumed by end users as well as energy losses associated with the generation, transmission, and distribution of electricity.

NATIONAL IMPACTS OF STRONGER EFFICIENCY STANDARDS

DOE is required to upgrade appliance efficiency standards when product innovations make efficiency improvements affordable to manufacturers and consumers. Standards for each product are scheduled for review every 5 years. These reviews generally lead to an upgrade unless a change is not warranted due to economic or technical considerations. However, due to delays in the standards-setting process, many product improvements have not been incorporated into the standards. For example, U.S. clothes washer manufacturers have developed clothes washer technologies that cut energy use by up to 50 percent. Innovative front-loading and top-loading designs, which are currently available, save energy by fine tuning temperature controls and reducing the amount of water needed to wash laundry. Accelerated spin-cycle speeds reduce the amount of energy needed to dry laundry. Water heater makers have reduced energy use in some models by fine tuning designs to reduce wasted heat and improving insulation. Air conditioner manufacturers incorporate improved compressors and heat exchangers into their top models to cut the energy required for space cooling. Updated standards will account for these innovations.

More efficient products sometimes cost more to purchase upfront, but the extra cost is made up within a few years through lower operating costs. Our analysis demonstrates the cost-effectiveness of new standards: for each dollar of increased purchase price, consumers save more than two dollars on their utility bills. Table 3 summarizes the costs and benefits associated with

Table 3: Cost-Effectiveness of Proposed Standards

Products	Cost (million \$)	Benefit (million \$)	Benefit- Cost Ratio	Net Savings (million \$)
Clothes washers	5,430	26,015	4.79	20,585
Fluorescent lamp ballasts	1,598	4,317	2.70	2,719
Central A/C & heat pumps	16,656	21,034	1.26	4,378
Water heaters	2,604	8,729	3.35	6,125
Transformers	1,333	2,856	2.14	1,522
Commercial packaged A/C & heat pumps	1,406	5,802	4.13	4,397
Commercial furnaces & boilers	2,319	4,212	1.82	1,894
TOTAL	31,347	72,965	2.33	41,619

Notes:

1. Costs are cumulative for units sold from the effective date of each standard through 2020 (based on standards listed in Table 2). Benefits are cumulative for the lifetime of units sold through 2020.
2. Dollar figures expressed as net present value assuming 6 percent real discount rate. Costs and savings discounted to 1999 and expressed in terms of 1997\$.

the proposed new standards. Overall, the benefit cost ratio of these standards would be 2.33:1. Cumulative net savings from modernized standards — utility bill savings less increased costs — will approach \$19 billion in 2010 and grow to more than \$41 billion in 2020.

Energy Savings

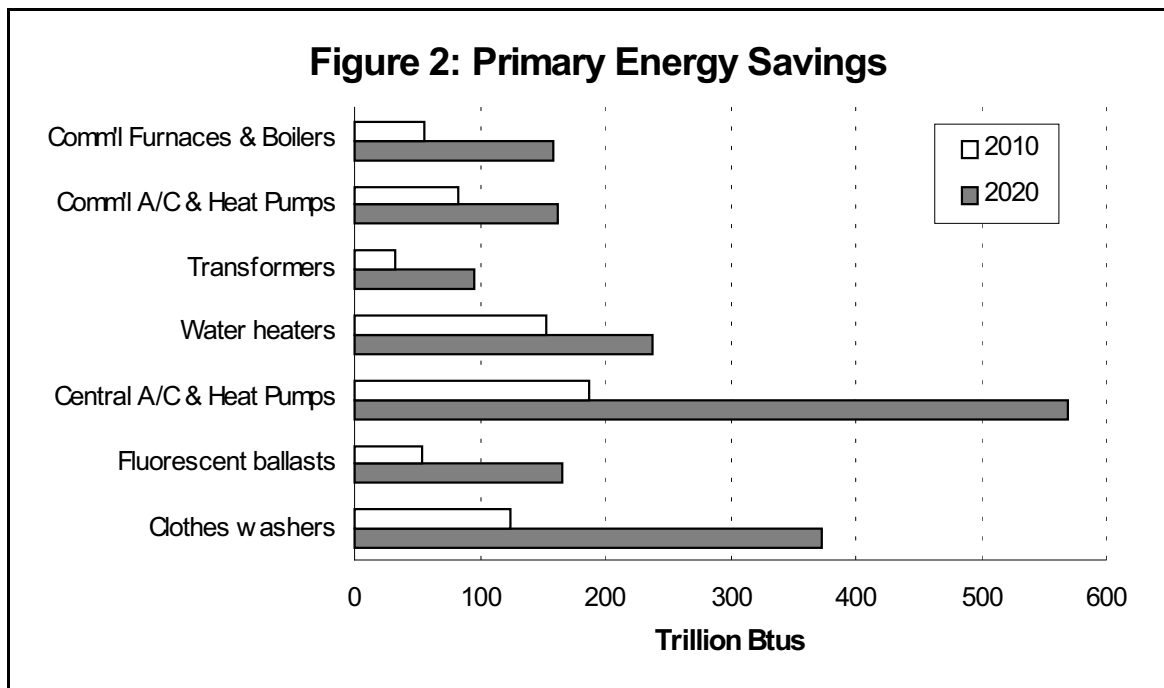
Overall, new efficiency standards (as outlined in Table 2) would produce estimated primary energy savings of 0.7 quads in 2010 and 1.8 quads in 2020, approximately 1.8 percent and 4.6 percent of projected U.S. residential and commercial energy use in 2010 and 2020, respectively (EIA 1999e). To put these numbers in perspective, one quad is equivalent to the annual energy usage of more than five million American households. Figure 2 summarizes the annual primary energy savings for each product included in our analysis. Energy savings vary from product to product depending on the number of units in use, how much time they are in use, and the amount of savings possible per unit. Total savings include electricity reductions of more than 50 billion kWh in 2010, increasing to 142 billion kWh in 2020. This electricity would provide enough power to light 40 million homes in 2010 and more than 113 million homes in 2020. Natural gas savings amount to 171 billion cubic feet in

Equity and Appliance Standards

The debate over strengthening appliance standards has raised questions about the equity of new standards — “who gets the savings?” Appliance standards act to distribute the benefits of technology advances to all users. While new technologies, including those that improve appliance efficiency, are usually introduced into high-end products first, standards force manufacturers to incorporate technical advances throughout their product lines. For example, seat belts were first introduced as an extra feature in some auto models; only after national safety standards mandated seat belts were they made available in all cars. Similarly, appliance standards ensure that all consumers appreciate the cost savings from increased appliance efficiency.

Saving energy is particularly important for low-income households that suffer from a high energy burden. Energy expenditures represent between 12% and 26% of total low-income household spending, while only 4% of median-income household spending (Pye 1996). And for the 60% of low-income households that rent, standards address the split-incentive inherent when the property owner purchases appliances and the renter pays the utility bills (U.S. Census Bureau 1999c). Property owners have no incentive to purchase more efficient appliances since the renter pays the energy bill. By improving appliance efficiency across the board, efficiency gains are built into all appliances and the tenant reaps the savings with each utility billing cycle.

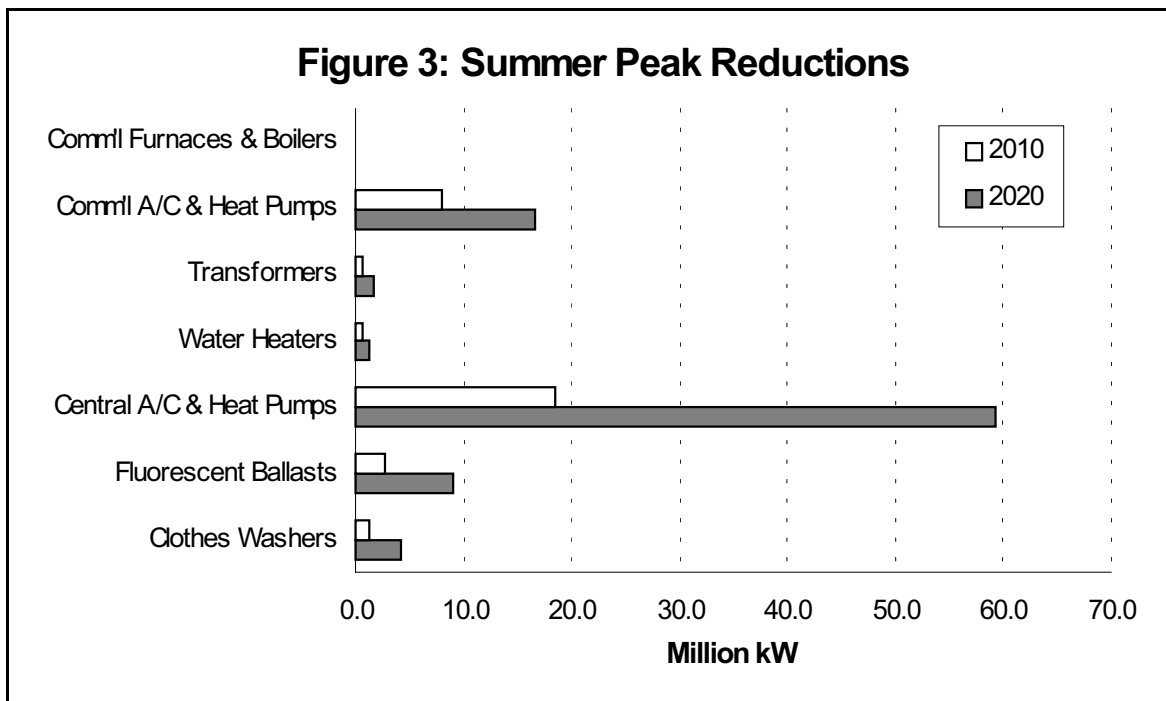
While standards typically do increase the purchase price of appliances, the additional cost is quickly recouped in lower energy bills. Since many low-income households rent, landlords will typically bear this cost as the renters get the energy savings benefits. Financing is also common for appliance purchases and can help to spread the extra costs over several years. While even a small price increase may put new appliances out of the reach of some low-income households, prices in the active used appliance market will remain unaffected by new standards. Efficiency gains will gradually permeate this market as well.



2010 and 373 billion cubic feet in 2020 — enough gas to heat 2.6 million homes in 2010 and 5.7 million homes in 2020.

In addition, new standards would eliminate the need for almost 32,000 megawatts (MW) of summer peak generating capacity in 2010, growing to more than 91,000 MW of peak capacity in 2020. Reductions in peak generating requirements can eliminate the need for additional power plants to meet the needs for electricity on the hottest days of the year. Figure 3 summarizes the peak reduction estimates for each product in our analysis. Air conditioners offer the greatest opportunity to cut peak electricity demand because they are used most intensively during peak demand periods. Fluorescent ballasts are another important source of peak savings — fluorescent lighting is used throughout the day in offices and other commercial buildings, thereby contributing to peak electricity demands.

The new standards proposed here would eliminate the need for at least 64 large (i.e., 500 MW) power plants in 2010 and more than 180 large plants in 2020 (or their equivalent). Cutting peak demand also improves the reliability of the generating system, decreasing the likelihood of blackouts and power shortages, which have become a growing problem in many parts of the country. See the box entitled “Standards and Electricity System Reliability” for a more detailed discussion of the relationship between appliance standards and electric system reliability. Reducing energy use and peak electricity demand through efficiency standards is a less expensive strategy than building additional power plants to serve growing energy needs. Peak shortages are estimated to reach 48,500 MW by 2007 (Electricity Daily 1999). To address the



Standards and Electric System Reliability

Recent summer blackouts, brownouts, and power outages have focused attention on issues of electric system reliability. Peak demand on generating facilities and transmission networks has hit record levels during recent summer heat waves as growing numbers of customers crank up their air conditioners to stay cool. Air conditioning typically accounts for more than half of household electricity consumption during summer months. The additional demand for air conditioning builds on the ordinary and growing electricity requirements of households, businesses, and industry.

Power system planners are calling for extensive construction of new capacity in the next few years as a way to avoid future shortages. Significant price increases could be required to pay for added generating capacity, which is needed only during brief intervals of high peak demand. For example, 15% of Florida’s generating capacity is needed less than 1 percent of the time to meet peak demands (Energy Insight 1998).

By cutting electricity consumption overall, and peak demand in particular, updated appliance standards can reduce the likelihood of future blackouts and power outages. DOE recently accelerated the schedule for new standards for central air conditioners and heat pumps in response to the growing incidence of power shortages. In announcing the proposed new standard, Energy Secretary Bill Richardson stated, “By increasing the efficiency of central air conditioning, we will help minimize the impact of future heat waves on the power grid and help consumers and business save money and energy” (Hamilton 1999).

anticipated capacity shortages, extensive power plant construction projects are being planned. In New England alone, developers have announced their intention to build nearly 30,000 MW of new capacity even though regional peak demand rarely exceeds 21,000 MW on the hottest days (Russell 1999). Although it is clear that these numbers include many competing proposals and not all of this capacity will be built, it does demonstrate a trend. While many of these plants will replace old, dirty coal and oil plants, some will become unnecessary with improvements in appliance efficiency. In addition, some conflicts and difficulties associated with the siting of new power generating facilities can be avoided as demand for additional power is lowered.

Water Savings

The energy savings from a new clothes washer standard result largely from the substantial reduction in water required by more efficient clothes washer designs. Less water in the wash cycle translates to lower water heater energy demands. Front-loading washers (also referred to as horizontal-axis or h-axis washers) and some advanced top-loading designs use 40 percent less water than the traditional top-loading (or vertical-axis) machines. Clothes washers are responsible for over 20 percent of average household indoor water use, therefore the new standard could eliminate close to 10 percent of household indoor water demand (Osann and Young 1998).

Savings of this magnitude are particularly important in parts of the country that are facing droughts or chronic water shortages or seeking ways to reduce water use as a means of meeting other environmental goals. In the Pacific Northwest, for example, water conservation plays a vital role in the protection of salmon habitat and in the continued viability of hydroelectric power services, which makes up 85 percent of regional electricity generation (EIA 1999a). Faced with a growing population and limited supplies, Denver's water service area hopes to meet increased water demand with conservation. A new washer standard would help the Denver area meet nearly 30 percent of its goal (Denver Board of Water 1997).

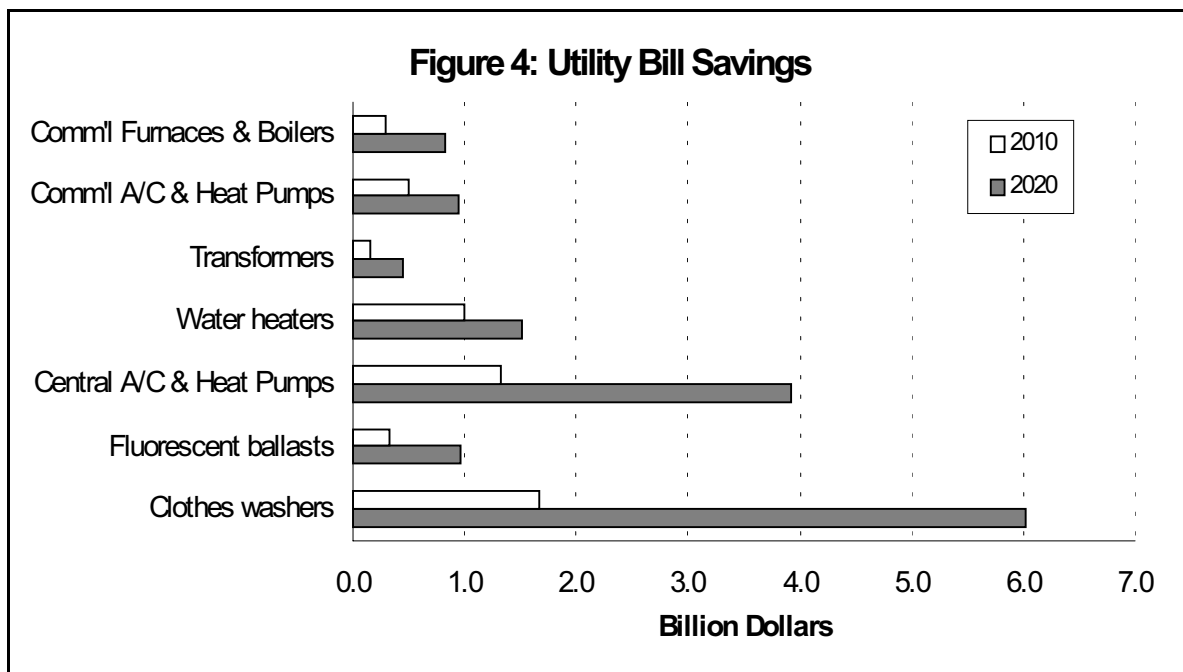
Even in places without water shortages, water conservation is important. Saving water helps avoid or delay the construction of new or expanded drinking water and wastewater treatment facilities. According to the American Water Works Association, the nation faces about \$325 billion in drinking water infrastructure investments to meet increased demand and requirements to improve drinking water quality (AWWA 1999). More demanding requirements to improve wastewater treatment will require additional investments. Table 4 summarizes water savings in each state from an updated clothes washer standard.

Table 4: Water Savings from Clothes Washer Standards

State	Annual Water Savings (million gallons)		Cumulative Water Savings (million gallons)	
	2010	2020	2010	2020
Alabama	3,808	12,271	10,578	95,204
Alaska	426	1,374	1,185	10,661
Arizona	3,362	10,832	9,338	84,044
Arkansas	2,230	7,186	6,194	55,750
California	22,122	71,280	61,449	553,038
Colorado	2,993	9,644	8,314	74,828
Connecticut	2,679	8,631	7,441	66,966
Delaware	647	2,085	1,798	16,180
Dist. of Columbia	542	1,745	1,505	13,542
Florida	13,244	42,675	36,789	331,102
Georgia	6,385	20,575	17,737	159,630
Hawaii	775	2,498	2,153	19,379
Idaho	857	2,761	2,380	21,422
Illinois	9,831	31,679	27,309	245,782
Indiana	4,990	16,079	13,862	124,754
Iowa	2,492	8,029	6,921	62,293
Kansas	2,218	7,148	6,162	55,459
Kentucky	3,466	11,168	9,627	86,645
Louisiana	3,686	11,878	10,239	92,155
Maine	1,051	3,387	2,919	26,275
Maryland	4,387	14,137	12,187	109,683
Massachusetts	5,053	16,281	14,035	126,316
Michigan	8,078	26,030	22,440	201,957
Minnesota	3,983	12,833	11,063	99,566
Mississippi	2,296	7,397	6,377	57,392
Missouri	4,636	14,937	12,876	115,888
Montana	680	2,190	1,888	16,988
Nebraska	1,425	4,593	3,960	35,636
Nevada	1,234	3,975	3,426	30,838
New Hampshire	955	3,078	2,653	23,881
New Jersey	6,286	20,256	17,462	157,161
New Mexico	1,234	3,975	3,426	30,838
New York	14,660	47,237	40,721	366,491
North Carolina	6,556	21,126	18,212	163,910
North Dakota	558	1,798	1,550	13,949
Ohio	9,623	31,009	26,732	240,586
Oklahoma	2,966	9,558	8,240	74,158
Oregon	2,489	8,020	6,914	62,224
Pennsylvania	9,997	32,211	27,768	249,913
Rhode Island	823	2,650	2,285	20,563
South Carolina	3,227	10,397	8,963	80,665
South Dakota	617	1,987	1,713	15,418
Tennessee	4,786	15,421	13,294	119,649
Texas	16,166	52,090	44,905	404,146
Utah	1,273	4,103	3,537	31,834
Vermont	494	1,592	1,372	12,349
Virginia	5,888	18,973	16,356	147,202
Washington	4,262	13,735	11,840	106,562
West Virginia	1,674	5,395	4,651	41,857
Wisconsin	4,389	14,143	12,192	109,732
Wyoming	367	1,181	1,019	9,167
U.S. TOTAL	218,840	705,150	607,888	5,470,990

Consumer Utility Bill Savings

As a result of the efficiency gains from stronger appliance standards, consumer utility bills — including energy, water, and sewer bills — would be reduced by \$5.3 billion in 2010 and \$14.6 billion in 2020. Energy bill savings amount to \$4.4 billion or approximately 1.7 percent of projected residential and commercial energy expenditures in 2010 and \$11 billion or 4.1 percent of expenditures in 2020 (EIA 1999e). Although water savings are associated with only one product in our analysis, the dollar savings are impressive: water and sewer bill savings from an updated clothes washer standard total \$825 million in 2010 and almost \$3.6 billion in 2020. Consumer water and sewer savings from new clothes washer standards alone account for 16 percent of total utility bill savings in 2010 and 25 percent in 2020. These numbers reflect the upward trend in water and sewer costs, which are expected to increase at a rate of 3 percent per year (DOE 1999). Energy bill savings may be even greater as time-of-use rates become more common, because these standards will disproportionately cut costly peak demand. Figure 4 shows consumer utility bill savings for each product included in our analysis.

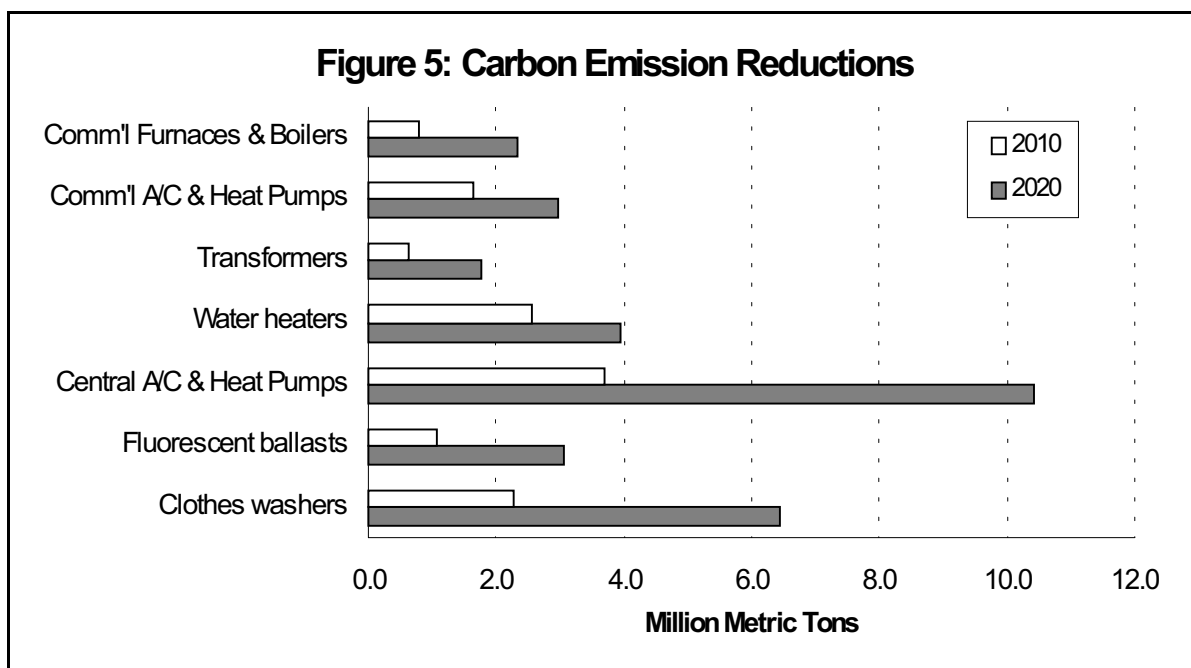


Pollutant Reductions

Along with the energy and utility bill savings from new standards, reduced electricity generation will yield significant reductions in pollutant emissions and, therefore, public health and environmental benefits. While this analysis does not attempt to quantify health and environmental benefits, reductions in carbon, sulfur dioxide, nitrogen oxides, and particulate matter (PM₁₀) in 2010 and 2020 are estimated.

Electricity generation is responsible for one-third of all U.S. emissions of carbon dioxide, the primary greenhouse gas (State Department 1997). By cutting electricity demand and, therefore carbon emissions, appliance standards can play an important part in U.S. efforts to meet the carbon emissions reduction targets set out in the Kyoto Protocol, an international agreement reached in December 1997. The agreement sets greenhouse gas emissions reduction targets for industrialized nations. Under the Protocol, which the Congress has yet to ratify, the United States needs to cut its carbon emissions by almost 530 MMT during the budget period of 2008 to 2012 (7 percent below 1990 emissions) (EIA 1999e; Geller, Bernow, and Dougherty 1999). Current standards will reduce carbon emissions by 65 MMT in 2010 and upgraded standards could raise the reduction by almost 13 MMT (Geller, Bernow, and Dougherty 1999). In other words, carbon emissions from efficiency standards are equal to 15 percent of the U.S. carbon emissions reduction target for 2010. In 2020, standards will be a much bigger contributor to carbon reductions as savings from upgraded standards approach 31 MMT. Figure 5 provides carbon reduction estimates.

Electric power generation is a leading source of air pollutants that pose threats to human health and the environment. Power plants are the largest source of sulfur dioxide (64 percent of total sulfur dioxide emissions) and mercury (33 percent) emissions, the second largest source of smog-forming nitrogen oxides (26 percent), and the fifth largest source of particulates (9 percent) (EPA 1998b). Direct combustion of natural gas and fuel oil in homes and commercial buildings contributes an additional 4 percent of nitrogen oxide and 3 percent of sulfur dioxide emissions (EPA 1998b).



While updated standards alone cannot cure our air pollution problems, they can be an important part of the solution, particularly if they are enacted now. New standards will reduce morbidity rates for illnesses related to air pollution, such as asthma and other respiratory and cardiopulmonary diseases (ALA 1996; 1997). In an analysis of the public health benefits of the new refrigerator standard set to take effect in 2001, the Natural Resources Defense Council estimated that the 30 percent improvement in refrigerator energy efficiency will prolong 500 lives every year by reducing air pollution (NRDC 1997). The upgraded standards proposed in our analysis will save 2.5 times the energy of the new refrigerator standard and, thus, further reduce mortality.

Updated standards can also help to alleviate the environmental problems related to air pollution. Ground-level ozone, commonly known as smog, is formed from nitrogen oxides and volatile organic compounds. Smog negatively impacts forests and crop lands by damaging plant tissues and leaving them vulnerable to pests, bad weather, and other environmental stressors. Crop losses related to smog damage are estimated at over a billion dollars a year (EPA 1997). Acid rain, which is formed from sulfur and nitrogen oxide emissions, continues to threaten lakes, streams, and forests in the northeastern United States. Updated standards will reduce nitrogen oxide emissions by 40,000 metric tons (MT) in 2010 and almost 89,000 MT in 2020. Sulfur dioxide emissions will be cut by 154,000 MT in 2010 and more than 348,000 MT in 2020.³

Particulate matter (or soot), largely from coal-burning power plants, is responsible for the haze that hangs over many urban areas and causes the widely reported declines in visibility in many of our national parks. Average visibility has declined by 60 percent in parts of the Appalachian Mountains; summertime visibility has fallen by 80 percent, leaving much of the scenery out of sight for most park visitors (DOI 1992). Particulates will be reduced by over 2,000 MT in 2010, increasing to more than 5,000 MT in 2020. Finally, mercury — a toxic heavy metal emitted by coal and oil burning power plants — is leached into lakes and streams where it accumulates in fish. Just as mercury can have serious health effects in humans, illnesses and disruptions to reproductive patterns have been documented in birds and other mammal populations (Coequyt et al 1999). Updated efficiency standards also will reduce mercury emissions.

STATE-BY-STATE IMPACTS OF STANDARDS

Appliance standards were first enacted in the 1970s when California adopted state level standards in response to regional concerns over electric system reliability and the environmental impacts of increased power consumption and power plant siting. By 1986, New York, Arizona,

³ Standards will cut power plant operations and direct emissions, but the overall level of sulfur dioxide emissions nationwide may not drop since they fall under the cap and trade system established by the Clean Air Amendments of 1990.

Florida, Kansas, and Massachusetts had adopted standards on some products, largely in response to delayed action on standards at the federal level. The growing number of state level standards prompted manufacturer interest in a single, unified set of federal efficiency standards.

At the state level, the impacts of efficiency standards differ according to climate, the predominance of electric or gas appliances, and the mix of fuels used to generate electricity. The following sections summarize the energy savings and pollutant reduction benefits of standards on a state-by-state basis. Appendix 2 contains individual data sheets for each state that provide information on the costs and benefits of standards broken down by each product included in this analysis.

Energy Savings

In general, new standards will produce the greatest savings in the most populous states. Energy savings in 2010 will be greatest in Texas (71.3 trillion Btus), Florida (59.2 trillion Btus), California (46.9 Btus), Illinois (28.6 trillion Btus), and Ohio (27.1 trillion Btus). Ten trillion Btus equals the annual consumption of approximately 50,000 households. Savings in New York and Pennsylvania, the third and fourth most populous states, are large (25.7 trillion Btu and 19.5 trillion Btu, respectively), but do not rank in the top five because of the products targeted in this analysis. For example, central air conditioners and heat pumps will generate the greatest energy savings of any product included and these products are less prevalent in New York and Pennsylvania due to their cooler climate and greater reliance on gas and oil heating. While total energy savings are greatest in Texas, Florida will realize the greatest electricity savings (5,600 gigawatt-hours [GWh] in 2010) due to its hot climate (and, therefore, high electric cooling load) and the limited use of natural gas. Gas savings will be greatest in California (21.5 trillion Btus in 2010) due to the large population and the predominance of gas water heating and space heating. Table 5 summarizes energy savings by state in 2010 and 2020.

Reductions in peak generation in 2010 are greatest in Texas (3.6 gigawatts [GW]), Florida (3.3 GW), California (1.8 GW), Illinois (1.4 GW), and Ohio (1.3 GW) — states with large peak electric loads due to climate and population. Peak reductions in these states will grow substantially by 2020 as follows: 11.0 GW in Texas, 10.2 GW in Florida, 5.6 GW in California, 3.8 GW in Illinois, and 3.6 GW in Ohio. As noted before, peak demand can seriously push the limits of system reliability. Recent summer power outages in Chicago, for example, disrupted business operations and contributed to heat-related deaths and associated health problems spurring regulatory investigations and lawsuits filed by elected officials. By reducing peak demand, standards — in particular those on air conditioning equipment that can account for more than half of household energy consumption in the summer months — can help to offset the need for additional peak generating capacity.

Consumer Utility Bill Savings

The dollar savings from appliance standards depend on overall energy, water, and sewer savings as well as utility prices in the state. Projected utility bill savings in 2010 are largest in California (\$465 million), Florida (\$463 million), Texas (\$442 million), New York (\$279 million), and Illinois (\$231 million). Average electricity prices in these states vary from a high of 11.1¢/kWh in New York to a low of 6.2¢/kWh in Texas, while average gas prices range from \$5.50 per thousand cubic feet (55.0¢/therm) in New York to \$2.24 per thousand cubic feet (22.4¢/therm) in Texas. Water and sewer savings, calculated using national average water and sewer costs, account for approximately 16 percent of total utility bill savings in 2010.

Cumulative net savings are largest in the most populous states. By 2010, consumers savings will be greatest in California (\$1.9 billion), Florida (\$1.4 billion), New York (1.3 billion), Texas (\$1.1 billion), and Illinois (\$930 million). Net savings will more than double by 2020 as most older appliances are replaced with new units that meet the upgraded standards. Savings by 2020 will be: California (\$4.3 billion), Florida (\$3.2 billion), New York (\$2.7 billion), Texas (\$2.4 billion), and Illinois (\$2.0 billion). State-by-state savings are provided in Table 6.

Pollutant Reductions

In general, carbon emissions are closely related to overall energy consumption — states with the largest energy use have the highest carbon emissions and will experience the greatest carbon reductions as a result of upgraded appliance standards. Carbon emissions reductions in 2010 will be greatest in Texas (1,273 MMT), Florida (1,119 MMT), California (951 MMT), Illinois (531 MMT), and New York (485 MMT). Emissions of nitrogen oxides, sulfur dioxide, and particulates are closely related to the fuel mix used to generate electricity. Coal- and oil-burning power plants produce a disproportionate share of carbon, mercury, and particulate emissions. Coal-fired plants are responsible for more than 90 percent of nitrogen oxides and 95 percent of sulfur dioxide from electricity generation (EIA 1999e). As a result, pollutant reductions from upgraded appliance standards will be largest in states that rely more on coal and oil and less on cleaner burning natural gas. Table 7 provides a detailed breakdown of state pollutant emissions reductions.

Air pollution reduction is an important issue at the state level, where many environmental laws are implemented. In addition to the broad environmental and public health concerns associated with carbon and other pollutant emissions, air quality figures into a number of political and economic issues facing the states. For example, Northeastern states have been engaged in long-standing disputes with many Midwestern states over cross-boundary transport of pollutants from coal-burning power plants in the Midwest. The Northeastern states argue that these emissions contribute to smog and acid rain throughout their region. Emissions reductions from new standards could also improve state compliance with federal Clean Air Act regulations.

Table 5: State-by-State Energy Savings

State	Total Primary (Trillion Btus)		Summer Generation (MW)	
	2010	2020	2010	2020
Alabama	15.9	42.3	726	2,147
Alaska	3.9	10.4	46	116
Arizona	11.0	26.4	576	1,518
Arkansas	8.5	22.8	443	1,374
California	46.9	111.1	1,847	5,594
Colorado	9.8	23.8	508	1,380
Connecticut	5.0	11.7	144	350
Delaware	2.5	6.7	108	322
Dist. of Columbia	2.8	7.6	143	407
Florida	59.2	164.5	3,325	10,151
Georgia	24.4	66.1	1,067	3,188
Hawaii	1.9	4.8	131	415
Idaho	3.3	7.9	174	460
Illinois	28.6	67.0	1,438	3,778
Indiana	14.3	33.9	660	1,774
Iowa	8.0	19.8	430	1,201
Kansas	8.4	20.7	454	1,221
Kentucky	14.2	37.9	658	1,949
Louisiana	17.5	47.5	779	2,397
Maine	1.9	4.5	46	113
Maryland	17.0	45.8	756	2,250
Massachusetts	9.6	22.6	264	643
Michigan	23.0	54.2	1,104	2,941
Minnesota	11.5	28.5	627	1,792
Mississippi	9.6	25.4	442	1,303
Missouri	15.0	36.1	925	2,499
Montana	2.3	5.6	116	316
Nebraska	5.1	12.5	296	794
Nevada	4.0	9.8	194	519
New Hampshire	1.6	3.9	44	109
New Jersey	13.6	32.4	491	1,349
New Mexico	4.4	10.8	200	533
New York	25.7	59.7	831	2,197
North Carolina	25.1	68.0	1,106	3,304
North Dakota	2.1	5.1	109	297
Ohio	27.1	63.8	1,339	3,558
Oklahoma	11.9	31.9	618	1,904
Oregon	7.5	19.0	223	641
Pennsylvania	19.5	46.3	692	1,935
Rhode Island	1.5	3.5	37	92
South Carolina	12.4	33.6	538	1,610
South Dakota	1.9	4.7	112	309
Tennessee	20.2	53.5	962	2,820
Texas	71.3	192.8	3,584	11,047
Utah	4.5	11.0	211	559
Vermont	0.9	2.0	23	57
Virginia	23.1	62.4	1,034	3,070
Washington	12.8	32.5	384	1,106
West Virginia	6.2	16.8	259	781
Wisconsin	12.0	28.3	575	1,547
Wyoming	1.7	4.3	73	194
U.S. TOTAL	691.7	1,763.9	31,875	91,932

Table 6: State-by-State Consumer Dollar Savings

State	Annual Utility (million\$)		Cumulative Net Savings (million\$)	
	2010	2020	2010	2020
Alabama	103	296	318	706
Alaska	22	59	73	150
Arizona	92	241	370	786
Arkansas	59	172	157	365
California	465	1,258	1,948	4,344
Colorado	69	186	246	536
Connecticut	56	142	276	567
Delaware	19	55	66	148
Dist. of Columbia	22	61	85	180
Florida	463	1,348	1,433	3,238
Georgia	187	537	635	1,415
Hawaii	31	77	136	292
Idaho	18	49	53	117
Illinois	231	606	930	1,994
Indiana	97	261	335	748
Iowa	56	151	191	420
Kansas	55	149	196	420
Kentucky	75	219	168	389
Louisiana	98	288	208	491
Maine	19	51	92	192
Maryland	136	390	487	1,078
Massachusetts	101	259	492	1,014
Michigan	178	471	686	1,492
Minnesota	77	215	249	562
Mississippi	64	184	205	455
Missouri	108	286	395	847
Montana	15	40	48	106
Nebraska	32	87	108	234
Nevada	29	77	102	222
New Hampshire	19	50	97	199
New Jersey	141	367	650	1,366
New Mexico	31	83	112	241
New York	279	707	1,314	2,731
North Carolina	191	549	646	1,440
North Dakota	13	36	45	97
Ohio	207	546	784	1,709
Oklahoma	74	216	172	401
Oregon	46	133	172	392
Pennsylvania	181	478	772	1,669
Rhode Island	16	40	75	156
South Carolina	83	243	249	564
South Dakota	14	37	49	107
Tennessee	126	361	377	835
Texas	442	1,292	1,059	2,464
Utah	27	75	89	195
Vermont	9	22	41	86
Virginia	168	484	555	1,236
Washington	72	212	255	594
West Virginia	41	119	115	264
Wisconsin	85	227	298	666
Wyoming	9	25	26	56
U.S. TOTAL	5,267	14,645	18,859	41,619

Appliance Standards: Impacts on Manufacturers and Workers

Appliance efficiency standards benefit U.S. manufacturers and workers by increasing demand for energy-saving products and lowering consumer utility bills. The growing demand for leading edge, energy-efficient technologies leads business to add jobs for highly skilled American workers. For example, to comply with the new refrigerator standard set to take effect in 2001, Maytag renovated and expanded its Galesburg, Illinois factory and increased its workforce to 2,400. Frigidaire and Whirlpool are upgrading their factories in Arkansas, Indiana, Michigan, and South Carolina to produce refrigerators to meet the new standards.

Lower utility bills free up household funds, increasing disposable income to be spent on other goods and services. Money spent on alternate goods — including food, housing, and entertainment — supports jobs in other sectors of the economy, which are more labor-intensive than electricity generation and transmission. Upgraded standards will save consumers more than \$40 billion over the next 20 years, leading to thousands of new jobs as these dollars are spent. In fact, DOE predicts that standards on clothes washers, water heaters, and fluorescent ballasts alone will generate more than 120,000 new jobs by 2020.

A handful of manufacturers have blamed standards for their decisions to move factories overseas. However, when Congress responded to their concerns and placed a moratorium on new standards in 1995, one company moved their factory to Mexico anyway. This example highlights the complexity of plant siting decisions, which are driven by strategic business concerns such as labor pool skills and wage costs, operating costs, transportation costs, and business plans, not energy efficiency standards. Although some manufacturers have hired lobbyists to stop or delay updated standards, a number of manufacturers have expanded research and development in anticipation of the new standards. Frigidaire, Maytag, and Whirlpool have invested in improved clothes washer designs and factories well in advance of the new clothes washer standard. These factories employ thousands of workers. Carrier has been a long-time supporter of efficiency standards and continues to invest in the development and production of improved efficiency heating and cooling equipment. Several manufacturers plan to increase domestic production to meet the surge in demand for electronic ballasts following adoption of a new ballast standard. To our knowledge, every U.S. water heater manufacturer intends to produce models meeting the new standards in existing U.S. factories. These firms are leaders in preserving U.S. manufacturing jobs, and providing consumers with improved products that will save energy, save money, and lead to widespread job growth throughout the U.S. economy.

The U.S. Environmental Protection Agency recently set a goal for 22 Eastern and Midwestern states to collectively cut smog-forming nitrogen oxide emissions by 25 percent.⁴ While most states will need to rely on pollution control technologies and switching from coal to less polluting energy sources to meet their nitrogen oxide reduction targets, improved

⁴ As of publication of this report, the nitrogen oxide reduction rule has been delayed by legal action.

appliance efficiency may help avoid the need for some more expensive or intrusive steps. For most states required to reduce sulfur dioxide emissions to help fight acid rain, appliance standards would reduce emissions by about 3 to 10 percent of their allowable emissions. Because EPA regulates sulfur dioxide by a cap and trade system, the reductions may be simply traded away by utility companies, allowing others to increase their sulfur dioxide pollution. While efficiency may not lead to any net reductions in the short term, it does reduce the cost of compliance with current caps and makes tighter caps possible in the future.

CONCLUSION

Appliance efficiency standards have been enormously successful in reducing energy consumption and cutting air pollution. Updated standards hold the promise of much greater savings as the latest product innovations become the norm with adoption of new standards. By upgrading the existing standards, DOE will save consumers money and enhance environmental protection. Furthermore, improved standards will reduce the burden on overtaxed electric systems, create additional manufacturing jobs, and help alleviate the public health problems associated with air pollution. The benefits of upgraded appliance standards will be realized throughout the economy and in every region of the country. DOE should act in the public interest and issue improved standards without further delay.

Table 7: State-by-State Pollutant Reductions

State	Carbon (Thousand Tons)		NOx (Tons)		PM ₁₀ (Tons)		SO ₂ (Tons)	
	2010	2020	2010	2020	2010	2020	2010	2020
Alabama	278	690	828	2,169	26	89	5,279	12,653
Alaska	33	99	164	481	13	40	113	292
Arizona	164	361	434	91	2	14	1,097	2,409
Arkansas	148	373	395	330	12	45	1,522	3,858
California	951	2,408	1,110	1,738	121	465	2,026	4,544
Colorado	144	321	370	79	1	13	903	1,992
Connecticut	102	231	323	936	19	46	350	1,036
Delaware	52	128	185	557	12	24	540	1,385
Dist. of Columbia	59	144	214	633	13	27	634	1,603
Florida	1,119	2,535	5,245	3,264	261	349	12,338	33,542
Georgia	434	1,090	1,314	3,485	40	138	8,562	20,847
Hawaii	40	111	42	120	6	14	92	278
Idaho	57	139	201	192	9	30	246	450
Illinois	531	1,228	1,016	3,567	84	256	6,680	13,680
Indiana	240	557	1,208	3,040	36	105	4,024	7,581
Iowa	164	406	712	562	42	112	1,489	3,147
Kansas	140	326	349	265	12	42	1,228	2,723
Kentucky	263	663	1,433	3,895	35	110	6,314	12,895
Louisiana	294	756	737	624	24	96	2,681	6,778
Maine	37	87	115	341	7	18	119	357
Maryland	355	873	1,277	3,826	79	166	3,744	9,576
Massachusetts	193	442	605	1,762	37	89	645	1,912
Michigan	388	894	1,972	4,916	59	167	6,661	12,419
Minnesota	238	588	1,040	824	60	162	2,167	4,635
Mississippi	168	416	501	1,309	16	54	3,196	7,652
Missouri	256	581	673	503	20	72	2,498	5,553
Montana	40	98	139	134	7	21	165	306
Nebraska	107	259	472	365	27	70	1,032	2,134
Nevada	70	171	248	239	11	37	299	554
New Hampshire	33	76	105	306	6	15	113	336
New Jersey	264	589	907	2,476	65	123	2,189	5,099
New Mexico	64	145	161	34	1	6	384	846
New York	485	720	1,541	4,684	336	231	3,009	9,993
North Carolina	447	1,123	1,357	3,597	41	142	8,858	21,564
North Dakota	42	104	180	141	11	29	380	791
Ohio	461	1,058	2,369	5,894	69	196	8,140	15,218
Oklahoma	206	521	549	458	16	63	2,117	5,346
Oregon	138	343	509	495	21	69	714	1,328
Pennsylvania	378	842	1,302	3,573	93	176	3,094	7,294
Rhode Island	29	68	91	267	6	14	95	284
South Carolina	220	554	666	1,771	20	70	4,340	10,586
South Dakota	40	98	179	139	10	26	388	813
Tennessee	356	878	1,069	2,785	33	112	6,883	16,442
Texas	1,273	3,269	2,425	5,358	101	399	8,433	22,323
Utah	77	190	270	260	13	42	321	591
Vermont	17	39	55	159	3	8	59	175
Virginia	411	1,031	1,249	3,304	38	130	8,162	19,832
Washington	236	588	876	851	36	119	1,231	2,291
West Virginia	115	295	630	1,741	15	49	2,801	5,819
Wisconsin	221	516	420	1,489	35	109	2,678	5,560
Wyoming	24	56	57	13	0	2	131	289
U.S. TOTAL	12,668	30,923	40,326	88,602	2,198	5,136	153,781	348,859

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APPENDIX 1: DETAILED METHODOLOGY

This appendix discusses each step of the analysis (explained in Chapter 1) in detail.

A. National Impacts

1) Obtaining annual sales figures for each appliance

The analysis is static and we assume equipment sales remain at 1998 levels for all products. We also assume that, in the absence of standards, efficiency levels remain at present levels. In actuality, product sales and efficiency are gradually increasing, even in the absence of standards. Thus, we implicitly assume that these factors counterbalance each other.

We obtained 1998 annual sales volume for residential products from Appliance (1999) magazine. Fluorescent ballast sales come from National Electrical Manufacturers Association (NEMA) data submitted to DOE (NEMA 1999). The analysis does not take credit for the portion of ballast sales which are presently electronic. Transformer sales are reported as kVA in Barnes et al (1997). Commercial HVAC sales are from Census Bureau and national laboratory data (U.S. Census Bureau 1999a; Chiu and Zaloudek 1987). Energy savings from efficient clothes washers come from savings in both water heating and clothes drying. We divide clothes washer sales into imaginary “all electric” and “all gas” units to account for electric and gas water heaters and clothes dryers (based on a 1998 DOE estimate of energy savings from a 1.36 MEF standard). We adjust for households with gas water heaters and electric dryers by allocating 0.8 million households from “all gas” to “all electric” based on energy savings for each.

2) Calculating energy savings

We calculate electricity savings in 2010 and 2020 using one of the following equations:

$$(a) \text{ Electricity savings} = \text{Annual sales volume} \times (\text{Years from effective date} - 0.5) \\ \times \text{Per-unit elec. savings} \div \text{T\&D loss factor}$$

$$(b) \text{ Electricity savings} = \text{Annual sales volume} \times \text{Average product life} \\ \times \text{Per-unit elec. savings} \div \text{T\&D loss factor}$$

Similarly, we calculate natural gas (NG) savings in 2010 and 2020 using one of the following equations:

$$(a) \text{ NG savings} = \text{Annual sales volume} \times (\text{Years from effective date} - 0.5) \\ \times \text{Per-unit NG savings}$$

$$(b) \text{ NG savings} = \text{Annual sales volume} \times \text{Average product life} \\ \times \text{Per-unit NG savings}$$

In each case, equation (a) is used when the average product lifetime is longer than the number of years from effective date. Otherwise, equation (b) is used in order to avoid double-counting the savings from replacements after 100 percent saturation. We subtract 0.5 from the number of effective years to account for sales throughout the year (2010 or 2020), so the *savings* from units installed during the year will be equivalent to only half-year sales times annual savings per unit. Equipment life and per-unit energy savings are from the most recent DOE or national lab analyses for each rulemaking. For the T&D loss factor, we use 0.935 for 2010 and 0.939 for 2020 (EIA 1998b).

We calculate total primary energy savings using the following equation:

$$\text{Total primary energy savings} = \text{Elec. generation savings} \div \text{Elec. generation efficiency} \\ + \text{Natural gas savings}$$

For electric generation efficiency, we use 0.334 for 2010 and 0.352 for 2020 (EIA 1998b).

Peak generation savings is calculated as:

$$\text{Peak generation savings} = \text{Electricity savings} \times \text{Peak factor} \div \text{Reserve factor}$$

We assume a conservative 10 percent reserve margin, thus the reserve factor in the formula is 0.9. Historically, a reserve margin of 20 percent has been used, but utilities have been cutting down their margins with the recent restructuring of the electric utility industry. We obtained peak factors from a review of regional data on the ratio of annual energy use to average coincident peak demand by end-use. Most of these data are summarized in Neme, Proctor, and Nadel (1999). For central air conditioners, revised figures for Florida and Texas come from data provided by Parker (1999) and Brooks (1999). These data were used for the southern states. For climate sensitive products, these ratios vary by region.

3) Calculating financial costs and savings

We calculate consumer bill savings using the following formula:

$$\text{Consumer bill savings} = \text{Elec. savings} \times \text{T\&D loss factor} \times \text{National avg. elec. price} \\ + \text{NG savings} \times \text{National avg. NG price}$$

The same T&D loss factor is used for electricity savings and bill savings calculations. We subtract T&D losses in order to calculate bill savings at the consumer level. National average retail prices for electricity and natural gas differ significantly by sector. Therefore, we use

residential prices for clothes washers, central A/C and heat pumps, and water heaters; and commercial prices for ballasts, commercial packaged A/C and heat pumps, and commercial furnaces and boilers. We use the average of commercial and industrial prices for transformers. Energy bill savings are based on projected 2010 and 2020 energy prices as reported in the 1999 Annual Energy Outlook (EIA 1998).

Net present value (NPV) is calculated as:

$$NPV \text{ expected investment} = \{PV(\text{Annual sales volume} \times \text{Per-unit incremental cost})\}$$

$$NPV \text{ savings for sales} = \{PV(\text{Installed volume} \times \text{Per-unit energy savings} \\ \times \text{Energy price})\}$$

Present value (PV) calculations are discounted to 1999 assuming a 6 percent real discount rate and expressed in terms of 1997 dollars. The NPV of expected investment aggregates the present value of annual investments from the effective date of each standard through 2010 and 2020. The NPV of savings aggregates the present value of annual utility bill savings from the effective date of the standard through the year in which products installed through 2010 and 2020 die out. Essentially, these two measures give us the cumulative costs and benefits of standard-complying products installed through 2010 or 2020.

Per-unit incremental costs were obtained from the most recent DOE or national lab analyses for each rulemaking. Costs are expressed in 1998 dollars. For clothes washers, DOE reverse engineering analysis is used (DOE 1999). For water heaters, incremental costs are based on Oregon Office of Energy data (Stephens 1999). For commercial A/C, incremental costs are based on current costs as reported in a New England Energy Efficiency Partnerships survey (Wall 1999). For A/C, we increase electricity prices by 10 percent since savings are primarily in summer when electricity prices are higher. The clothes washer analysis includes the value of water savings (i.e. water and sewage treatment costs) per the DOE analysis (DOE 1999c).

4) Calculating emission reductions

We calculate carbon, nitrogen oxides, sulfur dioxide, and particulate emissions reductions from electric products using the following equation:

$$\text{Emission reductions} = \text{Electricity savings} \times \text{Marginal emission factors}$$

We use marginal emission factors rather than straight emissions factors from the projected generation fuel mix. This gives a more accurate estimate of emissions reductions from new standards. For example, coal-fired power plants are often non-marginal — they are the dirtiest, but also the cheapest, and will most likely remain in operation. Marginal emissions factors will be discussed in more detail in section B2. For natural gas products, we consider only carbon

reductions since other emissions are relatively small. Carbon emissions savings for natural gas are based on DOE projections (EIA 1998). Nitrogen oxides, sulfur dioxide, and particulate emissions reductions are based on data from the EPA Office of Air Quality Planning and Standards (EPA 1998a).

B. State-by-state Impacts

1) Calculating state-by-state allocation factors

We calculated allocation factors for each state in order to prorate national impacts on a state-by-state basis. For residential products, the state allocation factor is the ratio of households in the state to total national households (U.S. Census Bureau 1999b). For commercial products, the allocation factor is the ratio of state energy use to national energy use by sector (EIA 1999b).

The allocation factors are adjusted by the saturation and usage of each appliance by census region and division (climate zone is sometimes used for Alaska and Hawaii). For example, the number of households in Texas is 7 percent of the national total, but the allocation factor for central A/C and heat pumps for Texas is 16 percent due to a higher saturation and usage compared to the national average. Saturation and usage rates are from the Residential Energy Consumption Survey (EIA1999d) and the Commercial Building Energy Consumption Survey (EIA 1999c).

We derive allocation factors using the following formulas:

For residential products:

$$(a) \text{ Allocation factor} = (\text{state households} \div \text{national households}) \\ \times (\text{saturation\% in region/division} \div \text{national avg. saturation\%}) \\ \times (\text{usage in region/division} \div \text{national avg. usage})$$

For commercial products:

$$(b) \text{ Allocation factor} = (\text{state comm'l energy consumption} \div \text{national} \\ \text{comm'l energy consumption}) \\ \times (\text{saturation\% in region/division} \div \text{national avg. saturation\%}) \\ \times (\text{usage in region/division} \div \text{national avg. usage})$$

For clothes washers, both clothes washer saturation and electric/gas water heater saturation are used to account for the water heater energy savings from efficient clothes washers. California saturation rates are used for Hawaii and North Pacific (Washington and Oregon) saturation rates are used for Alaska. Climate zones are used to determine space conditioning usage in Alaska and Hawaii.

2) Allocating national savings to each state

In general, we calculated state savings, costs, and emissions reductions using the following formula:

$$\text{State impact} = \text{National impact} \times \text{Allocation factor}$$

However, some adjustments were made as follows:

- Consumer bill savings and the NPV of savings figures are adjusted using the ratio of state to national average electricity and natural gas prices in 1995 (EIA 1998a). We assume the ratio will remain relatively the same in 2010 and 2020.
- Peak reduction figures are calculated using regional peak factors. National peak figures are calculated by weighted average of state figures when peak factor varies by region.
- Emissions reductions are adjusted using the ratio of regional emissions factors to national emissions factors (Dougherty and Bernow 1999).

Projections from the National Energy Modeling System (NEMS) were used to develop the emissions factors used in the analysis. We calculate emissions factors as the change in total emissions divided by the change in total generation when moving from the NEMS base case to an ACEEE policy case based on upgraded appliance standards and other policies (Geller, Bernow, and Dougherty 1999). Emissions factors through 2010 are calculated based on the following:

- For carbon, direct NEMS outputs are used (regional emissions and regional generation).
- NEMS does not report regional emissions for particulate matter. We calculate an average national emissions factor by applying a national emissions factor (determined by dividing actual national emissions by fuel by actual fuel consumption) to regional fuel consumption. Consumption by new coal units was tracked.
- For nitrogen oxide, the NEMS version used does not report regional emissions. Marginal emissions factors were calculated based on regional outputs from the reference and low growth cases of the 1999 Annual Energy Outlook (EIA 1998a).
- For sulfur dioxide, NEMS does not report regional emissions. Marginal emissions factors were calculated based on regional outputs from the reference and low growth cases of the 1999 Annual Energy Outlook (EIA 1998). However, to ignore sulfur dioxide cap and trade system effects, regional sulfur dioxide emissions in the low demand case are computed using the average regional e-factor from the reference case (i.e., emissions are

calculated based on fossil generation only; total sulfur dioxide emitted divided by coal, oil, and natural gas generation as reported by EIA 1998a).

Emissions factors beyond 2010 are calculated based on:

- The percentage of regional fuel and electric generation savings in 2010 apply in 2020.
- The emissions levels of carbon and particulates are calculated based on estimated fuel consumption
- For nitrogen oxide, marginal emissions factors are calculated based on regional outputs from the reference and low growth cases of the 1999 Annual Energy Outlook (EIA 1998a).
- For sulfur dioxide, marginal emissions factors are calculated based on regional outputs from the reference and low growth cases of the 1999 Annual Energy Outlook (EIA 1998a), except for those low growth case emissions calculated by the same method as the 2010 emissions factors.

APPENDIX 2: STATE DATA SHEETS

National Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

United States

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	1,670	7,600	8,851	34	125	1,328	2,274	7,416	398	26,927
	2020	6,026	20,585	27,419	105	374	4,113	6,455	19,075	1,104	67,165
Fluorescent Ballasts	2010	331	1,366	5,359	0	55	2,787	1,077	3,612	170	16,298
	2020	969	2,719	17,194	0	167	8,941	3,049	9,133	463	42,101
Central A/C & Heatpumps	2010	1,318	1,928	18,310	0	187	18,496	3,679	12,343	581	55,683
	2020	3,917	4,378	58,747	0	569	59,343	10,418	31,204	1,583	143,842
Water Heaters	2010	996	3,597	6,743	83	154	712	2,569	8,099	501	20,530
	2020	1,521	6,125	12,396	114	238	1,308	3,936	11,505	732	30,383
Transformers	2010	156	840	3,114	0	32	540	626	2,099	99	9,471
	2020	446	1,522	9,886	0	96	1,713	1,753	5,251	266	24,205
Commercial Packaged A/C & HP	2010	504	2,606	8,174	0	83	8,014	1,642	5,510	259	24,857
	2020	946	4,397	16,794	0	163	16,513	2,978	8,921	453	41,121
Commercial Furnaces & Boilers	2010	292	921	0	54	56	0	801	1,247	190	15
	2020	822	1,894	0	154	158	0	2,333	3,514	534	42
TOTAL	2010	5,267	18,859	50,551	171	692	31,875	12,668	40,326	2,198	153,781
	2020	14,645	41,619	142,436	373	1,764	91,932	30,923	88,602	5,136	348,859

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Alabama

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	33.7	153.9	261.4	0.3	3.0	39.2	53.4	162.5	5.0	1,029.9
	2020	121.0	413.9	809.9	1.1	9.0	121.5	146.4	471.6	18.9	2,673.7
Fluorescent Ballasts	2010	4.6	16.8	94.0	0.0	1.0	48.9	17.5	53.9	1.6	370.3
	2020	13.6	32.6	301.6	0.0	2.9	156.8	48.9	158.5	6.0	995.6
Central A/C & Heatpumps	2010	33.1	24.8	574.0	0.0	5.9	465.1	106.8	328.9	9.6	2,260.7
	2020	98.3	46.7	1,841.6	0.0	17.8	1,492.3	298.6	967.5	36.7	6,078.6
Water Heaters	2010	17.8	66.0	224.1	0.8	3.1	23.7	52.4	157.1	5.2	882.9
	2020	28.7	110.3	412.0	1.1	5.1	43.5	81.9	262.6	11.0	1,360.1
Transformers	2010	2.4	10.0	59.7	0.0	0.6	10.3	11.1	34.2	1.0	235.0
	2020	7.0	16.9	194.6	0.0	1.9	33.7	31.6	102.2	3.9	642.4
Commercial Packaged A/C & HP	2010	6.3	29.5	126.8	0.0	1.3	139.1	23.6	72.7	2.1	499.5
	2020	12.3	50.5	273.2	0.0	2.6	299.7	44.3	143.5	5.5	901.9
Commercial Furnaces & Boilers	2010	5.4	17.1	0.0	1.0	1.0	0.0	13.5	19.3	1.8	0.4
	2020	15.1	35.2	0.0	2.8	2.9	0.0	38.8	63.2	7.2	1.0
TOTAL	2010	103.3	318.2	1,340.0	2.1	15.9	726.3	278.2	828.5	26.2	5,278.5
	2020	296.0	706.2	3,833.0	5.0	42.2	2,147.5	690.5	2,169.2	89.2	12,653.3

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Alaska

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	5.7	28.7	35.3	0.0	0.4	5.3	3.9	27.2	1.2	29.2
	2020	19.2	70.8	109.5	0.1	1.1	16.4	12.3	85.2	3.9	90.3
Fluorescent Ballasts	2010	1.3	6.3	14.4	0.0	0.1	7.5	1.5	10.6	0.5	11.8
	2020	3.8	12.7	46.1	0.0	0.4	24.0	4.9	34.1	1.5	38.0
Central A/C & Heatpumps	2010	2.2	9.8	21.2	0.0	0.2	9.7	2.3	15.7	0.7	17.5
	2020	6.7	20.6	68.1	0.0	0.7	31.3	7.3	50.4	2.2	56.2
Water Heaters	2010	3.5	15.6	31.0	0.1	0.4	3.3	3.8	25.9	1.2	25.6
	2020	5.8	26.3	57.0	0.1	0.6	6.0	6.8	47.3	2.2	47.0
Transformers	2010	0.5	3.1	6.3	0.0	0.1	1.1	0.7	4.7	0.2	5.2
	2020	1.3	5.8	19.4	0.0	0.2	3.4	2.1	14.4	0.6	16.0
Commercial Packaged A/C & HP	2010	2.6	15.0	28.7	0.0	0.3	18.9	3.1	21.3	0.9	23.7
	2020	4.4	24.2	53.3	0.0	0.5	35.1	5.7	39.4	1.7	43.9
Commercial Furnaces & Boilers	2010	6.2	-5.0	0.0	2.3	2.4	0.0	18.2	58.7	8.4	0.2
	2020	17.4	-10.3	0.0	6.6	6.8	0.0	60.1	210.0	27.9	0.6
TOTAL	2010	22.0	73.5	136.9	2.4	3.9	45.8	33.4	164.1	13.2	113.1
	2020	58.7	150.2	353.4	6.7	10.4	116.1	99.1	480.9	40.1	292.0

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Arizona

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	27.2	124.6	117.3	0.6	1.8	17.6	26.7	70.4	0.3	158.9
	2020	97.9	336.4	363.3	1.9	5.5	54.5	73.1	18.5	3.1	403.4
Fluorescent Ballasts	2010	7.5	32.4	110.5	0.0	1.1	57.5	18.1	49.5	0.2	149.8
	2020	22.0	64.9	354.7	0.0	3.4	184.4	48.9	12.6	1.8	393.6
Central A/C & Heatpumps	2010	16.1	28.3	202.9	0.0	2.1	230.1	33.2	90.9	0.3	274.8
	2020	47.7	66.3	650.9	0.0	6.3	738.2	89.8	23.2	3.2	722.3
Water Heaters	2010	20.1	73.9	91.0	1.7	2.7	9.6	35.1	88.9	0.4	123.5
	2020	29.8	127.5	167.4	2.3	4.0	17.7	50.6	12.7	2.3	186.0
Transformers	2010	3.3	18.9	59.3	0.0	0.6	10.3	9.7	26.6	0.1	80.4
	2020	9.2	34.8	186.3	0.0	1.8	32.3	25.7	6.6	0.9	206.8
Commercial Packaged A/C & HP	2010	15.5	83.2	228.4	0.0	2.3	250.5	37.4	102.3	0.3	309.4
	2020	27.7	137.4	447.2	0.0	4.3	490.4	61.7	15.9	2.2	496.3
Commercial Furnaces & Boilers	2010	2.3	9.0	0.0	0.3	0.4	0.0	4.2	5.3	0.1	0.0
	2020	6.5	18.5	0.0	1.0	1.0	0.0	11.6	1.5	0.6	0.1
TOTAL	2010	91.9	370.4	809.4	2.7	11.0	575.5	164.3	433.9	1.6	1,096.8
	2020	240.8	785.9	2,169.7	5.3	26.4	1,517.6	361.4	91.0	14.2	2,408.5

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Arkansas

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	16.4	72.6	82.9	0.4	1.3	12.4	21.4	57.3	1.7	194.7
	2020	60.5	202.0	256.9	1.3	3.8	38.5	60.1	53.8	7.8	508.0
Fluorescent Ballasts	2010	2.4	9.5	42.4	0.0	0.4	22.0	8.0	22.2	0.6	99.4
	2020	7.0	18.7	135.9	0.0	1.3	70.7	22.2	20.2	2.5	268.5
Central A/C & Heatpumps	2010	25.6	22.9	387.4	0.0	4.0	350.3	73.1	203.3	5.3	909.3
	2020	76.0	52.4	1,243.1	0.0	12.0	1,123.9	203.5	185.1	22.8	2,456.9
Water Heaters	2010	9.2	30.6	64.4	1.0	1.7	6.8	25.9	67.2	2.4	151.4
	2020	14.0	51.8	118.4	1.4	2.6	12.5	38.7	34.3	5.4	234.3
Transformers	2010	1.3	6.4	29.1	0.0	0.3	5.0	5.5	15.3	0.4	68.3
	2020	3.9	11.4	95.1	0.0	0.9	16.5	15.6	14.2	1.7	188.0
Commercial Packaged A/C & HP	2010	2.4	11.4	42.3	0.0	0.4	46.4	8.0	22.2	0.6	99.3
	2020	5.3	20.9	102.4	0.0	1.0	112.3	16.8	15.3	1.9	202.4
Commercial Furnaces & Boilers	2010	1.8	3.9	0.0	0.4	0.4	0.0	5.6	7.3	0.6	0.1
	2020	5.0	8.0	0.0	1.2	1.2	0.0	16.2	7.4	2.7	0.3
TOTAL	2010	59.1	157.2	648.6	1.8	8.5	443.0	147.5	394.7	11.5	1,522.4
	2020	171.7	365.1	1,951.9	3.8	22.8	1,374.4	373.0	330.2	44.9	3,858.4

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

California

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	158.7	709.4	356.6	5.4	9.2	53.5	178.5	207.2	24.2	290.9
	2020	582.8	1,968.5	1,104.6	16.9	28.1	165.7	578.0	419.3	123.2	705.1
Fluorescent Ballasts	2010	50.1	239.0	565.4	0.0	5.8	294.0	134.0	166.7	14.4	460.7
	2020	146.8	485.6	1,814.2	0.0	17.6	943.4	411.1	307.7	68.1	1,156.0
Central A/C & Heatpumps	2010	63.8	189.1	617.4	0.0	6.3	1,144.5	146.3	182.0	15.7	503.0
	2020	189.7	440.4	1,980.8	0.0	19.2	3,672.0	448.8	336.0	74.3	1,262.2
Water Heaters	2010	124.8	436.5	254.8	13.7	16.7	26.9	298.0	333.2	44.7	208.6
	2020	179.0	760.6	468.5	19.0	24.1	49.5	474.9	340.4	109.6	299.9
Transformers	2010	18.7	123.1	260.8	0.0	2.7	45.2	61.8	76.9	6.6	212.5
	2020	52.8	233.1	815.1	0.0	7.9	141.3	184.7	138.3	30.6	519.4
Commercial Packaged A/C & HP	2010	38.1	210.7	429.7	0.0	4.4	283.1	101.8	126.7	10.9	350.1
	2020	76.4	372.2	943.8	0.0	9.1	621.9	213.9	160.1	35.4	601.4
Commercial Furnaces & Boilers	2010	11.0	40.7	0.0	1.8	1.8	0.0	30.6	17.7	4.9	0.1
	2020	31.0	83.6	0.0	5.0	5.1	0.0	96.6	36.4	24.1	0.4
TOTAL	2010	465.4	1,948.5	2,484.7	20.9	46.9	1,847.2	951.0	1,110.3	121.4	2,026.0
	2020	1,258.4	4,344.0	7,127.0	40.9	111.1	5,593.6	2,408.0	1,738.2	465.3	4,544.2

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Colorado

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	21.9	97.4	104.4	0.6	1.6	15.7	23.8	62.7	0.2	141.5
	2020	80.5	270.3	323.4	1.7	4.9	48.5	65.1	16.5	2.7	359.1
Fluorescent Ballasts	2010	4.6	17.7	83.5	0.0	0.9	43.4	13.7	37.4	0.1	113.2
	2020	13.4	34.8	268.0	0.0	2.6	139.4	37.0	9.5	1.3	297.5
Central A/C & Heatpumps	2010	11.5	6.0	180.6	0.0	1.8	243.9	29.6	80.9	0.3	244.7
	2020	34.3	14.5	579.5	0.0	5.6	782.5	79.9	20.6	2.9	643.1
Water Heaters	2010	14.9	50.8	81.1	1.5	2.4	8.6	31.2	79.2	0.4	110.0
	2020	22.0	87.2	149.0	2.1	3.6	15.7	45.1	11.3	2.1	165.6
Transformers	2010	1.9	9.9	43.7	0.0	0.4	7.6	7.2	19.6	0.1	59.2
	2020	5.5	17.3	136.6	0.0	1.3	23.7	18.8	4.9	0.7	151.6
Commercial Packaged A/C & HP	2010	9.4	47.8	172.6	0.0	1.8	189.3	28.3	77.3	0.2	233.8
	2020	16.9	78.4	338.0	0.0	3.3	370.6	46.6	12.0	1.7	375.0
Commercial Furnaces & Boilers	2010	4.9	16.2	0.0	0.9	0.9	0.0	10.4	13.2	0.1	0.1
	2020	13.7	33.3	0.0	2.4	2.5	0.0	28.8	3.7	1.6	0.3
TOTAL	2010	69.1	245.7	666.0	2.9	9.8	508.4	144.0	370.3	1.4	902.5
	2020	186.2	535.8	1,794.5	6.2	23.8	1,380.4	321.4	78.6	12.9	1,992.3

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Connecticut

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	19.4	95.1	88.5	0.2	1.2	13.3	23.7	77.2	4.4	83.2
	2020	66.4	241.0	274.1	0.8	3.4	41.1	67.7	283.5	13.6	302.0
Fluorescent Ballasts	2010	4.4	21.3	47.1	0.0	0.5	24.5	10.5	34.9	1.8	44.3
	2020	12.9	43.5	151.0	0.0	1.5	78.5	30.1	127.5	5.5	166.4
Central A/C & Heatpumps	2010	2.8	11.3	25.2	0.0	0.3	18.2	5.6	18.7	1.0	23.7
	2020	8.2	24.3	81.0	0.0	0.8	58.3	16.2	68.3	2.9	89.2
Water Heaters	2010	12.9	54.0	63.0	0.6	1.2	6.6	23.2	73.4	4.8	59.3
	2020	19.8	92.8	115.8	0.8	1.9	12.2	36.5	151.3	7.9	127.6
Transformers	2010	2.5	16.7	32.8	0.0	0.3	5.7	7.3	24.3	1.3	30.9
	2020	7.0	31.7	102.6	0.0	1.0	17.8	20.5	86.6	3.7	113.0
Commercial Packaged A/C & HP	2010	10.8	62.1	115.0	0.0	1.2	75.8	25.6	85.3	4.4	108.2
	2020	18.4	101.0	215.8	0.0	2.1	142.2	43.1	182.2	7.8	237.7
Commercial Furnaces & Boilers	2010	3.3	15.7	0.0	0.4	0.4	0.0	5.8	9.0	1.5	0.0
	2020	9.3	32.2	0.0	1.0	1.0	0.0	17.3	36.8	4.7	0.1
TOTAL	2010	55.9	276.3	371.6	1.2	5.0	144.0	101.8	322.8	19.2	349.6
	2020	142.0	566.6	940.2	2.6	11.7	350.2	231.4	936.1	46.2	1,036.0

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

District of Columbia

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	5.6	26.9	38.2	0.0	0.4	5.7	9.0	32.7	2.0	93.9
	2020	19.6	69.5	118.3	0.1	1.3	17.7	24.3	107.0	4.7	256.7
Fluorescent Ballasts	2010	2.9	12.0	45.1	0.0	0.5	23.5	9.9	36.0	2.1	111.0
	2020	8.4	23.9	144.8	0.0	1.4	75.3	27.1	120.0	5.0	314.3
Central A/C & Heatpumps	2010	5.9	10.5	80.2	0.0	0.8	55.7	17.5	64.0	3.8	197.2
	2020	17.6	23.4	257.2	0.0	2.5	178.8	48.1	213.1	8.9	558.1
Water Heaters	2010	3.0	12.5	27.5	0.1	0.4	2.9	7.4	26.5	1.8	67.6
	2020	4.8	21.2	50.5	0.1	0.6	5.3	11.4	50.1	2.3	109.7
Transformers	2010	1.0	6.0	19.4	0.0	0.2	3.4	4.2	15.5	0.9	47.8
	2020	2.7	10.7	58.2	0.0	0.6	10.1	10.9	48.2	2.0	126.3
Commercial Packaged A/C & HP	2010	3.0	15.1	47.3	0.0	0.5	51.9	10.3	37.8	2.2	116.4
	2020	6.3	27.1	109.6	0.0	1.1	120.2	20.5	90.8	3.8	237.8
Commercial Furnaces & Boilers	2010	0.4	2.0	0.0	0.0	0.0	0.0	0.7	1.2	0.2	0.0
	2020	1.2	4.2	0.0	0.1	0.1	0.0	1.9	4.3	0.5	0.0
TOTAL	2010	21.9	84.9	257.7	0.2	2.8	143.1	59.1	213.5	13.1	633.9
	2020	60.6	180.0	738.7	0.4	7.5	407.4	144.2	633.5	27.3	1,602.8

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Delaware

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	6.3	29.8	45.6	0.1	0.5	6.8	10.8	39.0	2.4	112.2
	2020	22.2	77.7	141.3	0.2	1.5	21.2	29.0	127.8	5.6	306.7
Fluorescent Ballasts	2010	1.1	4.4	17.4	0.0	0.2	9.1	3.8	13.9	0.8	42.9
	2020	3.2	8.8	55.9	0.0	0.5	29.1	10.5	46.3	1.9	121.4
Central A/C & Heatpumps	2010	6.9	11.2	95.8	0.0	1.0	66.6	20.9	76.4	4.5	235.6
	2020	20.5	24.9	307.3	0.0	3.0	213.6	57.5	254.6	10.6	666.8
Water Heaters	2010	2.9	11.7	32.8	0.1	0.4	3.5	8.9	31.6	2.1	80.8
	2020	4.8	19.6	60.4	0.1	0.7	6.4	13.7	59.9	2.8	131.0
Transformers	2010	0.5	2.6	9.7	0.0	0.1	1.7	2.1	7.7	0.5	23.9
	2020	1.4	4.7	30.9	0.0	0.3	5.4	5.8	25.6	1.1	67.1
Commercial Packaged A/C & HP	2010	1.1	5.6	18.3	0.0	0.2	20.0	4.0	14.6	0.9	45.0
	2020	2.4	10.1	42.3	0.0	0.4	46.4	7.9	35.1	1.5	91.9
Commercial Furnaces & Boilers	2010	0.4	0.9	0.0	0.1	0.1	0.0	1.2	2.1	0.4	0.0
	2020	1.0	1.9	0.0	0.2	0.2	0.0	3.4	7.7	1.0	0.1
TOTAL	2010	19.2	66.3	219.7	0.2	2.5	107.7	51.7	185.4	11.6	540.3
	2020	55.4	147.8	638.3	0.5	6.7	322.0	127.7	557.0	24.4	1,385.0

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Florida

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	140.3	670.0	1,086.5	0.6	11.7	163.0	220.3	1,033.5	51.8	2,393.7
	2020	487.3	1,726.2	3,365.9	1.9	34.6	504.9	530.2	684.0	73.9	6,848.4
Fluorescent Ballasts	2010	23.9	99.5	383.0	0.0	3.9	199.2	74.6	351.6	17.2	843.7
	2020	70.1	198.1	1,228.8	0.0	11.9	639.0	184.6	238.8	25.1	2,500.0
Central A/C & Heatpumps	2010	204.9	242.8	2,811.3	0.0	28.7	2,412.6	547.4	2,581.2	126.3	6,193.4
	2020	608.8	585.6	9,020.0	0.0	87.4	7,740.9	1,355.1	1,752.6	184.6	18,351.5
Water Heaters	2010	56.7	236.6	721.4	0.9	8.3	76.1	152.9	713.6	36.7	1,589.5
	2020	95.1	394.1	1,326.2	1.2	14.1	140.0	214.8	276.7	30.3	2,698.4
Transformers	2010	9.9	55.2	196.4	0.0	2.0	34.0	38.2	180.3	8.8	432.7
	2020	28.1	99.9	615.0	0.0	6.0	106.6	92.4	119.5	12.6	1,251.3
Commercial Packaged A/C & HP	2010	25.1	125.1	401.5	0.0	4.1	440.3	78.2	368.6	18.0	884.5
	2020	53.0	225.2	929.9	0.0	9.0	1,019.8	139.7	180.7	19.0	1,891.9
Commercial Furnaces & Boilers	2010	2.1	4.1	0.0	0.5	0.5	0.0	7.3	16.0	2.5	0.1
	2020	5.9	8.4	0.0	1.4	1.5	0.0	18.7	12.1	3.8	0.3
TOTAL	2010	462.9	1,433.2	5,600.1	2.0	59.2	3,325.2	1,118.9	5,245.0	261.4	12,337.6
	2020	1,348.2	3,237.5	16,485.7	4.6	164.4	10,151.1	2,535.4	3,264.4	349.4	33,541.8

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Georgia

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	62.0	291.7	450.1	0.5	5.1	67.5	90.6	276.5	8.4	1,773.0
	2020	217.9	763.3	1,394.3	1.6	15.1	209.2	248.0	799.7	31.9	4,602.9
Fluorescent Ballasts	2010	10.3	41.6	174.4	0.0	1.8	90.7	32.4	99.9	2.9	686.8
	2020	30.2	82.5	559.5	0.0	5.4	290.9	90.7	293.9	11.2	1,846.7
Central A/C & Heatpumps	2010	65.2	90.7	945.0	0.0	9.6	656.8	175.8	541.5	15.8	3,722.0
	2020	193.6	200.3	3,032.0	0.0	29.4	2,107.2	491.7	1,592.9	60.5	10,007.8
Water Heaters	2010	30.1	119.4	324.0	1.1	4.4	34.2	74.6	224.1	7.3	1,276.5
	2020	48.5	200.8	595.6	1.5	7.3	62.9	116.8	374.9	15.6	1,966.4
Transformers	2010	4.7	24.2	97.4	0.0	1.0	16.9	18.1	55.8	1.6	383.6
	2020	13.4	43.5	310.6	0.0	3.0	53.8	50.4	163.2	6.2	1,025.3
Commercial Packaged A/C & HP	2010	10.8	52.9	182.8	0.0	1.9	200.5	34.0	104.7	3.1	720.0
	2020	22.8	95.0	423.4	0.0	4.1	464.3	68.7	222.4	8.4	1,397.5
Commercial Furnaces & Boilers	2010	3.8	14.4	0.0	0.6	0.6	0.0	8.1	11.6	1.1	0.2
	2020	10.7	29.5	0.0	1.7	1.7	0.0	23.4	38.2	4.3	0.6
TOTAL	2010	186.8	634.9	2,173.7	2.2	24.4	1,066.5	433.8	1,314.2	40.2	8,562.1
	2020	537.2	1,414.9	6,315.5	4.7	66.1	3,188.3	1,089.7	3,485.3	138.1	20,847.3

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Hawaii

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	8.5	42.2	12.5	0.2	0.3	1.9	6.3	6.4	1.1	9.8
	2020	29.3	108.1	38.7	0.6	1.0	5.8	21.3	22.6	3.1	30.5
Fluorescent Ballasts	2010	1.8	8.7	17.4	0.0	0.2	9.1	4.1	4.6	0.6	13.7
	2020	5.2	17.8	55.9	0.0	0.5	29.1	13.3	14.6	1.5	44.0
Central A/C & Heatpumps	2010	6.6	22.2	56.1	0.0	0.6	110.0	13.4	14.7	1.8	44.1
	2020	19.7	52.2	180.1	0.0	1.7	353.0	42.8	47.1	4.9	141.6
Water Heaters	2010	11.8	48.9	10.3	0.5	0.6	1.1	11.0	10.9	2.0	8.1
	2020	16.5	87.0	18.9	0.7	0.9	2.0	18.4	19.4	2.9	14.9
Transformers	2010	0.7	4.9	8.9	0.0	0.1	1.5	2.1	2.3	0.3	7.0
	2020	2.1	9.5	28.3	0.0	0.3	4.9	6.7	7.4	0.8	22.3
Commercial Packaged A/C & HP	2010	1.2	6.3	11.6	0.0	0.1	7.6	2.8	3.0	0.4	9.1
	2020	2.9	12.7	31.3	0.0	0.3	20.6	7.4	8.2	0.8	24.6
Commercial Furnaces & Boilers	2010	0.4	2.3	0.0	0.0	0.0	0.0	0.4	0.2	0.1	0.0
	2020	1.1	4.7	0.0	0.1	0.1	0.0	1.2	0.7	0.2	0.0
TOTAL	2010	31.0	135.6	116.8	0.7	1.9	131.2	40.0	42.1	6.2	91.9
	2020	76.7	292.1	353.1	1.3	4.8	415.3	111.2	120.0	14.2	277.9

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Idaho

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	5.7	24.4	29.9	0.2	0.5	4.5	8.0	29.1	1.3	32.2
	2020	21.4	70.0	92.6	0.5	1.4	13.9	24.0	34.6	5.4	68.3
Fluorescent Ballasts	2010	1.2	3.3	33.8	0.0	0.3	17.6	6.5	24.6	1.0	36.4
	2020	3.6	6.0	108.4	0.0	1.1	56.4	19.3	28.3	3.8	80.0
Central A/C & Heatpumps	2010	2.2	-5.9	51.7	0.0	0.5	69.8	10.0	37.6	1.5	55.6
	2020	6.5	-13.6	165.9	0.0	1.6	224.0	29.5	43.3	5.8	122.3
Water Heaters	2010	3.9	12.5	23.2	0.4	0.7	2.4	10.5	36.8	2.0	25.0
	2020	5.7	21.5	42.7	0.6	1.0	4.5	16.6	23.7	4.2	31.5
Transformers	2010	0.6	1.6	19.7	0.0	0.2	3.4	3.8	14.3	0.6	21.3
	2020	1.7	2.1	63.2	0.0	0.6	10.9	11.2	16.5	2.2	46.6
Commercial Packaged A/C & HP	2010	2.5	10.8	69.8	0.0	0.7	76.6	13.5	50.7	2.0	75.1
	2020	4.5	17.4	136.7	0.0	1.3	149.9	24.3	35.7	4.8	100.8
Commercial Furnaces & Boilers	2010	1.9	6.5	0.0	0.3	0.3	0.0	4.4	7.8	1.0	0.0
	2020	5.2	13.5	0.0	0.9	0.9	0.0	13.5	10.0	4.0	0.1
TOTAL	2010	18.0	53.2	228.2	0.9	3.3	174.3	56.7	200.8	9.3	245.6
	2020	48.6	116.8	609.5	2.0	7.9	459.7	138.5	192.1	30.1	449.6

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Illinois

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	71.4	318.5	245.6	2.1	4.7	36.8	85.6	169.7	13.9	979.7
	2020	261.9	882.7	760.9	6.6	14.2	114.1	254.3	780.6	55.4	2,393.9
Fluorescent Ballasts	2010	14.0	60.7	203.2	0.0	2.1	105.7	43.3	90.3	5.9	809.8
	2020	40.9	121.7	651.9	0.0	6.3	339.0	124.7	391.8	22.3	2,049.0
Central A/C & Heatpumps	2010	27.8	49.8	346.6	0.0	3.5	641.8	73.8	154.0	10.0	1,381.2
	2020	82.6	117.0	1,112.0	0.0	10.8	2,059.2	212.6	668.3	38.1	3,495.0
Water Heaters	2010	52.1	180.4	187.7	5.6	7.6	19.8	126.8	241.4	23.2	750.0
	2020	76.0	311.8	345.0	7.7	11.3	36.4	192.4	582.9	45.9	1,087.1
Transformers	2010	7.5	43.9	135.3	0.0	1.4	23.5	28.8	60.1	3.9	539.3
	2020	21.4	80.9	425.9	0.0	4.1	73.8	81.4	256.0	14.6	1,338.6
Commercial Packaged A/C & HP	2010	38.3	207.9	556.8	0.0	5.7	610.6	118.6	247.5	16.1	2,219.0
	2020	66.1	337.9	1,054.0	0.0	10.2	1,155.8	201.5	633.5	36.1	3,312.6
Commercial Furnaces & Boilers	2010	20.1	68.9	0.0	3.5	3.6	0.0	54.3	52.6	11.1	1.3
	2020	56.6	141.7	0.0	9.8	10.1	0.0	160.9	254.4	43.4	3.5
TOTAL	2010	231.1	930.1	1,675.2	11.2	28.6	1,438.2	531.1	1,015.7	84.2	6,680.1
	2020	605.5	1,993.7	4,349.7	24.2	67.0	3,778.4	1,227.9	3,567.5	256.0	13,679.6

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Indiana

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	33.1	142.8	124.7	1.1	2.4	18.7	39.9	212.4	6.1	646.5
	2020	123.9	407.9	386.2	3.4	7.2	57.9	116.9	687.8	22.6	1,428.5
Fluorescent Ballasts	2010	3.9	13.5	83.3	0.0	0.9	43.3	16.3	91.3	2.1	431.6
	2020	11.4	26.0	267.3	0.0	2.6	139.0	46.3	278.8	7.4	987.6
Central A/C & Heatpumps	2010	9.6	-6.0	175.9	0.0	1.8	325.8	34.4	192.8	4.4	911.5
	2020	28.5	-13.1	564.4	0.0	5.5	1,045.2	97.8	588.8	15.5	2,085.5
Water Heaters	2010	24.0	78.2	95.3	2.8	3.9	10.1	59.0	302.2	10.2	494.9
	2020	34.5	135.5	175.1	3.9	5.7	18.5	88.4	513.6	18.7	648.7
Transformers	2010	2.6	10.1	68.6	0.0	0.7	11.9	13.4	75.2	1.7	355.7
	2020	7.7	16.4	225.2	0.0	2.2	39.0	39.0	234.9	6.2	832.0
Commercial Packaged A/C & HP	2010	10.7	51.7	228.3	0.0	2.3	250.3	44.6	250.2	5.7	1,182.8
	2020	18.5	83.2	432.1	0.0	4.2	473.9	74.8	450.8	11.9	1,596.6
Commercial Furnaces & Boilers	2010	13.0	44.8	0.0	2.3	2.3	0.0	32.2	83.8	6.2	1.1
	2020	36.6	92.0	0.0	6.3	6.5	0.0	94.2	285.3	22.5	2.6
TOTAL	2010	96.9	335.0	776.1	6.2	14.3	660.1	239.8	1,207.8	36.4	4,024.1
	2020	261.1	748.0	2,050.3	13.6	33.9	1,773.5	557.4	3,040.0	104.8	7,581.4

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Iowa

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	17.2	76.2	82.0	0.4	1.3	12.3	26.7	123.2	6.7	247.4
	2020	63.2	212.0	253.9	1.4	3.9	38.1	79.4	119.0	22.1	602.5
Fluorescent Ballasts	2010	2.7	10.3	50.1	0.0	0.5	26.1	11.7	56.1	2.6	151.3
	2020	7.9	20.2	160.9	0.0	1.6	83.7	34.4	52.4	8.3	381.5
Central A/C & Heatpumps	2010	9.1	2.6	145.5	0.0	1.5	252.2	34.0	162.8	7.5	438.8
	2020	27.1	6.9	466.7	0.0	4.5	809.1	99.7	152.1	23.9	1,106.6
Water Heaters	2010	11.3	39.0	70.0	1.1	1.8	7.4	34.6	154.7	9.7	211.4
	2020	16.9	66.8	128.6	1.5	2.8	13.6	54.6	81.0	16.4	305.4
Transformers	2010	1.3	6.1	30.2	0.0	0.3	5.2	7.1	33.8	1.6	91.2
	2020	3.8	10.7	98.0	0.0	0.9	17.0	20.9	31.9	5.0	232.4
Commercial Packaged A/C & HP	2010	6.2	31.6	115.5	0.0	1.2	126.7	27.0	129.3	6.0	348.6
	2020	10.7	51.0	218.3	0.0	2.1	239.4	46.6	71.1	11.2	517.5
Commercial Furnaces & Boilers	2010	7.7	25.6	0.0	1.4	1.4	0.0	23.4	52.0	7.7	0.4
	2020	21.6	52.6	0.0	3.9	4.0	0.0	70.6	54.2	25.5	1.0
TOTAL	2010	55.5	191.4	493.3	2.9	8.0	429.9	164.4	711.9	41.8	1,489.1
	2020	151.3	420.2	1,326.4	6.7	19.8	1,200.8	406.3	561.8	112.4	3,147.0

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Kansas

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	15.2	67.4	73.0	0.4	1.1	10.9	19.2	51.4	1.6	171.4
	2020	56.0	187.2	226.1	1.2	3.4	33.9	54.1	48.4	7.0	447.1
Fluorescent Ballasts	2010	4.0	15.9	67.6	0.0	0.7	35.1	12.8	35.5	0.9	158.6
	2020	11.6	31.5	216.8	0.0	2.1	112.7	35.5	32.3	4.0	428.5
Central A/C & Heatpumps	2010	8.9	7.4	129.5	0.0	1.3	224.5	24.4	67.9	1.8	303.9
	2020	26.3	18.0	415.5	0.0	4.0	720.3	68.0	61.9	7.6	821.2
Water Heaters	2010	9.2	31.3	62.3	1.0	1.6	6.6	24.9	64.6	2.3	146.4
	2020	14.0	53.0	114.5	1.3	2.5	12.1	37.2	32.9	5.2	226.7
Transformers	2010	1.7	8.8	34.9	0.0	0.4	6.1	6.6	18.3	0.5	82.0
	2020	4.7	15.7	109.8	0.0	1.1	19.0	18.0	16.4	2.0	217.1
Commercial Packaged A/C & HP	2010	9.1	47.6	155.7	0.0	1.6	170.7	29.4	81.7	2.1	365.4
	2020	15.7	77.0	294.1	0.0	2.8	322.5	48.1	43.8	5.4	581.3
Commercial Furnaces & Boilers	2010	7.4	18.1	0.0	1.7	1.7	0.0	22.8	29.4	2.5	0.3
	2020	21.0	37.3	0.0	4.7	4.8	0.0	65.2	29.8	11.0	1.0
TOTAL	2010	55.5	196.4	523.0	3.0	8.4	454.0	140.0	348.8	11.6	1,228.0
	2020	149.2	419.7	1,376.9	7.2	20.7	1,220.7	326.2	265.5	42.3	2,722.8

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Kentucky

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	27.0	118.3	237.9	0.3	2.8	35.7	51.0	282.9	6.8	1,233.1
	2020	99.6	330.5	737.1	1.0	8.2	110.6	142.3	852.3	23.8	2,724.0
Fluorescent Ballasts	2010	3.1	8.2	84.0	0.0	0.9	43.7	16.4	92.0	2.1	435.2
	2020	9.0	14.8	269.5	0.0	2.6	140.1	46.7	281.2	7.4	995.8
Central A/C & Heatpumps	2010	22.2	-32.6	522.4	0.0	5.3	423.3	102.1	572.4	13.1	2,706.7
	2020	65.9	-82.3	1,676.0	0.0	16.2	1,358.1	290.3	1,748.6	46.1	6,192.8
Water Heaters	2010	13.0	42.5	203.9	0.7	2.8	21.5	50.1	273.4	7.1	1,057.1
	2020	20.7	70.3	374.9	1.0	4.7	39.6	79.6	474.7	13.8	1,385.7
Transformers	2010	1.7	3.9	56.9	0.0	0.6	9.9	11.1	62.3	1.4	294.8
	2020	5.0	4.2	187.7	0.0	1.8	32.5	32.5	195.8	5.2	693.6
Commercial Packaged A/C & HP	2010	4.1	16.6	113.3	0.0	1.2	124.3	22.1	124.2	2.8	587.1
	2020	8.1	27.7	244.1	0.0	2.4	267.7	42.3	254.7	6.7	902.0
Commercial Furnaces & Boilers	2010	3.7	11.6	0.0	0.7	0.7	0.0	9.9	25.9	1.9	0.3
	2020	10.4	23.7	0.0	2.0	2.0	0.0	29.1	88.1	7.0	0.8
TOTAL	2010	74.8	168.4	1,218.5	1.7	14.2	658.3	262.8	1,433.2	35.3	6,314.3
	2020	218.6	389.0	3,489.4	3.9	37.9	1,948.7	662.8	3,895.3	109.9	12,894.7

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Louisiana

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	25.3	108.6	137.1	0.7	2.1	20.6	35.3	94.8	2.9	321.9
	2020	94.3	308.8	424.7	2.1	6.3	63.7	99.3	88.9	12.8	839.8
Fluorescent Ballasts	2010	5.0	18.9	97.1	0.0	1.0	50.5	18.3	50.9	1.3	227.8
	2020	14.8	37.0	311.4	0.0	3.0	161.9	51.0	46.4	5.7	615.5
Central A/C & Heatpumps	2010	38.9	14.1	640.5	0.0	6.5	579.0	120.9	336.0	8.7	1,503.0
	2020	115.5	31.9	2,054.9	0.0	19.9	1,857.8	336.3	306.0	37.7	4,061.2
Water Heaters	2010	11.8	34.7	106.5	1.6	2.8	11.2	42.8	111.0	3.9	250.2
	2020	18.3	57.3	195.7	2.3	4.2	20.7	64.0	56.7	9.0	387.3
Transformers	2010	2.7	12.1	63.7	0.0	0.6	11.0	12.0	33.4	0.9	149.4
	2020	7.8	20.9	206.4	0.0	2.0	35.8	33.8	30.7	3.8	407.9
Commercial Packaged A/C & HP	2010	5.0	23.1	97.0	0.0	1.0	106.3	18.3	50.9	1.3	227.6
	2020	11.1	42.2	234.7	0.0	2.3	257.4	38.4	35.0	4.3	463.9
Commercial Furnaces & Boilers	2010	9.5	-3.2	0.0	3.4	3.5	0.0	46.4	59.9	5.0	0.7
	2020	26.6	-6.6	0.0	9.5	9.8	0.0	133.0	60.8	22.5	2.1
TOTAL	2010	98.2	208.2	1,141.7	5.7	17.5	778.7	294.1	736.9	24.0	2,680.6
	2020	288.4	491.3	3,427.8	13.9	47.5	2,397.3	755.8	624.4	95.8	6,777.7

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Maine

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	7.1	34.5	34.7	0.1	0.5	5.2	9.3	30.3	1.7	32.7
	2020	24.7	88.4	107.5	0.3	1.4	16.1	26.6	111.2	5.3	118.5
Fluorescent Ballasts	2010	1.1	5.4	13.5	0.0	0.1	7.0	3.0	10.0	0.5	12.7
	2020	3.3	10.9	43.3	0.0	0.4	22.5	8.6	36.5	1.6	47.6
Central A/C & Heatpumps	2010	1.0	3.7	9.9	0.0	0.1	7.1	2.2	7.3	0.4	9.3
	2020	2.9	7.9	31.8	0.0	0.3	22.9	6.3	26.8	1.2	35.0
Water Heaters	2010	4.5	18.5	24.7	0.2	0.5	2.6	9.1	28.8	1.9	23.3
	2020	7.0	31.8	45.4	0.3	0.8	4.8	14.3	59.3	3.1	50.1
Transformers	2010	0.7	4.6	10.8	0.0	0.1	1.9	2.4	8.0	0.4	10.1
	2020	2.1	8.9	34.5	0.0	0.3	6.0	6.9	29.2	1.3	38.0
Commercial Packaged A/C & HP	2010	2.8	15.8	32.9	0.0	0.3	21.7	7.3	24.4	1.3	31.0
	2020	4.8	25.7	61.8	0.0	0.6	40.7	12.3	52.2	2.2	68.1
Commercial Furnaces & Boilers	2010	2.0	9.2	0.0	0.3	0.3	0.0	4.1	6.3	1.1	0.0
	2020	5.8	18.8	0.0	0.7	0.7	0.0	12.1	25.7	3.3	0.1
TOTAL	2010	19.3	91.7	126.5	0.6	1.9	45.5	37.4	115.1	7.3	119.0
	2020	50.5	192.3	324.3	1.3	4.5	113.0	87.2	341.0	18.0	357.4

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Maryland

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	44.1	209.5	309.3	0.3	3.5	46.4	73.2	264.5	16.4	760.7
	2020	154.1	544.0	958.1	1.1	10.4	143.7	196.6	866.4	38.0	2,079.0
Fluorescent Ballasts	2010	8.4	35.1	133.8	0.0	1.4	69.6	29.2	106.7	6.3	329.1
	2020	24.7	69.9	429.3	0.0	4.2	223.2	80.3	355.6	14.9	931.5
Central A/C & Heatpumps	2010	47.6	82.3	649.3	0.0	6.6	451.3	141.9	518.0	30.7	1,597.0
	2020	141.6	183.3	2,083.3	0.0	20.2	1,447.9	389.7	1,725.9	72.2	4,520.3
Water Heaters	2010	22.0	89.0	222.6	0.7	3.0	23.5	60.2	214.4	14.3	547.7
	2020	35.5	150.0	409.2	1.0	5.0	43.2	92.6	406.2	18.6	888.2
Transformers	2010	3.4	19.2	66.9	0.0	0.7	11.6	14.6	53.4	3.2	164.5
	2020	9.6	34.7	208.2	0.0	2.0	36.1	38.9	172.5	7.2	451.8
Commercial Packaged A/C & HP	2010	8.8	44.1	140.3	0.0	1.4	153.8	30.7	111.9	6.6	345.0
	2020	18.7	79.4	324.9	0.0	3.1	356.3	60.8	269.1	11.3	704.9
Commercial Furnaces & Boilers	2010	2.1	8.1	0.0	0.3	0.3	0.0	4.9	8.2	1.6	0.1
	2020	5.8	16.7	0.0	0.9	0.9	0.0	13.7	30.6	3.8	0.2
TOTAL	2010	136.4	487.3	1,522.2	1.4	17.0	756.2	354.6	1,277.1	79.0	3,744.1
	2020	389.8	1,078.0	4,413.0	2.9	45.8	2,250.4	872.5	3,826.3	166.0	9,575.8

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Massachusetts

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	35.3	171.8	166.9	0.5	2.2	25.0	44.7	145.6	8.4	157.0
	2020	121.5	437.9	517.0	1.4	6.5	77.6	127.8	534.8	25.6	569.7
Fluorescent Ballasts	2010	7.7	36.9	85.5	0.0	0.9	44.5	19.0	63.4	3.3	80.4
	2020	22.6	75.1	274.3	0.0	2.7	142.7	54.8	231.6	10.0	302.2
Central A/C & Heatpumps	2010	5.0	20.1	47.6	0.0	0.5	34.3	10.6	35.3	1.8	44.8
	2020	14.9	43.0	152.7	0.0	1.5	110.0	30.5	128.9	5.6	168.2
Water Heaters	2010	22.3	92.8	118.8	1.1	2.3	12.5	43.8	138.5	9.1	111.8
	2020	34.7	159.2	218.4	1.5	3.6	23.1	68.8	285.3	14.9	240.8
Transformers	2010	4.3	28.3	58.2	0.0	0.6	10.1	13.0	43.2	2.2	54.8
	2020	11.9	53.4	180.8	0.0	1.8	31.3	36.1	152.6	6.6	199.2
Commercial Packaged A/C & HP	2010	18.8	108.1	208.9	0.0	2.1	137.7	46.5	154.9	8.0	196.5
	2020	32.3	175.7	392.0	0.0	3.8	258.3	78.2	330.9	14.3	431.8
Commercial Furnaces & Boilers	2010	7.6	34.0	0.0	1.0	1.0	0.0	15.5	24.0	4.0	0.1
	2020	21.5	69.8	0.0	2.7	2.8	0.0	46.0	97.8	12.6	0.3
TOTAL	2010	101.1	491.9	686.0	2.5	9.6	264.1	193.2	604.8	36.9	645.4
	2020	259.3	1,014.0	1,735.3	5.6	22.6	642.9	442.2	1,762.0	89.4	1,912.2

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Michigan

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	57.3	253.2	201.8	1.8	3.9	30.3	64.5	343.8	9.9	1,046.6
	2020	211.1	707.0	625.2	5.5	11.7	93.8	189.3	1,113.4	36.6	2,312.4
Fluorescent Ballasts	2010	9.2	38.3	145.6	0.0	1.5	75.7	28.4	159.5	3.7	754.2
	2020	26.9	76.3	467.0	0.0	4.5	242.9	80.9	487.2	12.8	1,725.6
Central A/C & Heatpumps	2010	20.9	27.7	284.8	0.0	2.9	527.3	55.7	312.1	7.1	1,475.6
	2020	62.2	65.5	913.7	0.0	8.9	1,692.0	158.3	953.2	25.1	3,376.1
Water Heaters	2010	41.5	141.5	154.2	4.6	6.3	16.3	95.6	489.2	16.5	801.2
	2020	60.4	244.6	283.5	6.3	9.3	29.9	143.2	831.4	30.3	1,050.1
Transformers	2010	5.1	27.8	99.3	0.0	1.0	17.2	19.4	108.9	2.5	514.7
	2020	14.5	50.6	314.3	0.0	3.0	54.5	54.4	327.9	8.6	1,161.3
Commercial Packaged A/C & HP	2010	25.1	133.6	398.9	0.0	4.1	437.4	78.0	437.1	10.0	2,066.7
	2020	43.4	216.8	755.0	0.0	7.3	828.0	130.8	787.7	20.8	2,789.7
Commercial Furnaces & Boilers	2010	18.7	63.8	0.0	3.3	3.4	0.0	46.8	121.9	9.0	1.5
	2020	52.8	131.1	0.0	9.2	9.5	0.0	137.0	414.9	32.8	3.8
TOTAL	2010	177.8	685.8	1,284.6	9.6	23.0	1,104.2	388.4	1,972.4	58.7	6,660.5
	2020	471.2	1,491.9	3,358.8	21.0	54.2	2,941.0	893.8	4,915.8	167.0	12,419.1

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Minnesota

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	26.6	116.5	131.0	0.7	2.1	19.7	42.6	196.9	10.8	395.5
	2020	98.4	327.3	405.9	2.2	6.2	60.9	126.9	190.2	35.3	963.0
Fluorescent Ballasts	2010	3.0	11.0	61.0	0.0	0.6	31.7	14.2	68.3	3.1	184.0
	2020	8.9	21.5	195.7	0.0	1.9	101.8	41.8	63.8	10.0	464.1
Central A/C & Heatpumps	2010	13.5	-3.2	232.5	0.0	2.4	403.1	54.3	260.2	12.0	701.4
	2020	40.2	-5.9	746.0	0.0	7.2	1,293.2	159.4	243.1	38.3	1,768.8
Water Heaters	2010	16.8	56.3	111.9	1.7	2.9	11.8	55.3	247.2	15.4	337.9
	2020	25.1	96.1	205.6	2.4	4.4	21.7	87.3	129.5	26.2	488.2
Transformers	2010	1.7	6.8	40.9	0.0	0.4	7.1	9.6	45.8	2.1	123.4
	2020	4.9	11.4	135.1	0.0	1.3	23.4	28.9	44.0	6.9	320.4
Commercial Packaged A/C & HP	2010	7.0	34.8	140.5	0.0	1.4	154.1	32.8	157.3	7.3	424.0
	2020	12.1	56.0	265.5	0.0	2.6	291.2	56.7	86.5	13.6	629.5
Commercial Furnaces & Boilers	2010	8.8	27.1	0.0	1.7	1.7	0.0	28.7	63.9	9.5	0.5
	2020	24.8	55.8	0.0	4.7	4.9	0.0	86.8	66.6	31.4	1.3
TOTAL	2010	77.5	249.3	717.8	4.1	11.5	627.5	237.6	1,039.6	60.3	2,166.8
	2020	214.5	562.2	1,953.8	9.3	28.5	1,792.2	587.8	823.8	161.8	4,635.2

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Mississippi

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	20.7	95.2	157.6	0.2	1.8	23.6	32.2	98.0	3.0	620.8
	2020	74.0	254.4	488.3	0.7	5.4	73.2	88.3	284.3	11.4	1,611.8
Fluorescent Ballasts	2010	3.2	12.1	58.6	0.0	0.6	30.5	10.9	33.6	1.0	230.9
	2020	9.3	23.8	188.1	0.0	1.8	97.8	30.5	98.8	3.8	621.0
Central A/C & Heatpumps	2010	21.8	27.5	346.0	0.0	3.5	280.4	64.4	198.3	5.8	1,362.8
	2020	64.7	56.6	1,110.2	0.0	10.8	899.6	180.0	583.2	22.1	3,664.4
Water Heaters	2010	10.5	39.5	135.1	0.5	1.9	14.3	31.6	94.7	3.1	532.2
	2020	17.2	65.6	248.3	0.7	3.1	26.2	49.4	158.3	6.6	819.9
Transformers	2010	1.5	7.2	34.9	0.0	0.4	6.1	6.5	20.0	0.6	137.6
	2020	4.4	12.6	112.7	0.0	1.1	19.5	18.3	59.2	2.2	372.0
Commercial Packaged A/C & HP	2010	4.3	20.8	79.1	0.0	0.8	86.7	14.7	45.3	1.3	311.5
	2020	8.4	35.7	170.4	0.0	1.7	186.9	27.6	89.5	3.4	562.5
Commercial Furnaces & Boilers	2010	2.0	2.9	0.0	0.6	0.6	0.0	7.5	10.7	1.0	0.2
	2020	5.7	5.9	0.0	1.6	1.6	0.0	21.6	35.2	4.0	0.6
TOTAL	2010	64.0	205.2	811.4	1.2	9.6	441.6	167.8	500.6	15.8	3,196.2
	2020	183.7	454.5	2,318.0	2.9	25.4	1,303.3	415.7	1,308.7	53.6	7,652.1

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Missouri

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	32.8	146.8	152.5	0.8	2.4	22.9	40.1	107.5	3.3	358.1
	2020	120.1	405.4	472.4	2.6	7.2	70.9	113.1	101.1	14.7	934.2
Fluorescent Ballasts	2010	7.4	29.0	133.5	0.0	1.4	69.4	25.2	70.0	1.8	313.3
	2020	21.8	57.2	428.3	0.0	4.2	222.7	70.1	63.8	7.9	846.6
Central A/C & Heatpumps	2010	17.6	9.0	270.6	0.0	2.8	469.1	51.1	142.0	3.7	635.1
	2020	52.2	22.8	868.2	0.0	8.4	1,505.2	142.1	129.3	15.9	1,715.9
Water Heaters	2010	22.5	79.6	130.2	2.0	3.4	13.7	52.0	134.9	4.7	306.0
	2020	33.5	136.6	239.3	2.8	5.2	25.3	77.8	68.8	10.9	473.6
Transformers	2010	3.1	16.0	69.7	0.0	0.7	12.1	13.2	36.6	0.9	163.6
	2020	8.9	28.2	219.6	0.0	2.1	38.1	35.9	32.7	4.0	433.9
Commercial Packaged A/C & HP	2010	17.1	88.1	307.6	0.0	3.1	337.3	58.1	161.4	4.2	721.9
	2020	29.5	142.4	581.1	0.0	5.6	637.2	95.1	86.5	10.7	1,148.4
Commercial Furnaces & Boilers	2010	7.2	26.3	0.0	1.2	1.2	0.0	16.2	20.9	1.8	0.2
	2020	20.3	54.0	0.0	3.3	3.4	0.0	46.4	21.2	7.8	0.7
TOTAL	2010	107.8	394.8	1,064.1	4.0	15.0	924.6	255.8	673.2	20.4	2,498.1
	2020	286.4	846.6	2,809.0	8.6	36.1	2,499.4	580.6	503.5	71.9	5,553.4

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Montana

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	4.8	21.0	23.7	0.1	0.4	3.6	6.4	23.1	1.1	25.5
	2020	17.8	59.2	73.4	0.4	1.1	11.0	19.0	27.5	4.3	54.2
Fluorescent Ballasts	2010	0.8	2.5	19.3	0.0	0.2	10.0	3.7	14.0	0.5	20.7
	2020	2.4	4.7	61.8	0.0	0.6	32.1	11.0	16.1	2.2	45.6
Central A/C & Heatpumps	2010	2.0	-3.0	41.0	0.0	0.4	55.4	7.9	29.8	1.2	44.1
	2020	5.9	-6.7	131.6	0.0	1.3	177.6	23.4	34.3	4.6	97.0
Water Heaters	2010	3.6	12.1	18.4	0.3	0.5	1.9	8.3	29.1	1.6	19.8
	2020	5.2	20.9	33.8	0.5	0.8	3.6	13.2	18.8	3.3	25.0
Transformers	2010	0.4	1.4	11.2	0.0	0.1	1.9	2.2	8.1	0.3	12.1
	2020	1.1	2.1	35.8	0.0	0.3	6.2	6.4	9.3	1.2	26.4
Commercial Packaged A/C & HP	2010	1.7	7.6	39.8	0.0	0.4	43.7	7.7	28.9	1.1	42.8
	2020	3.0	12.3	77.9	0.0	0.8	85.5	13.9	20.3	2.7	57.5
Commercial Furnaces & Boilers	2010	1.7	6.8	0.0	0.3	0.3	0.0	3.5	6.2	0.8	0.0
	2020	4.8	13.9	0.0	0.7	0.7	0.0	10.7	7.9	3.2	0.1
TOTAL	2010	14.9	48.3	153.4	0.7	2.3	116.5	39.7	139.2	6.6	165.1
	2020	40.1	106.4	414.4	1.6	5.6	316.1	97.6	134.3	21.5	305.7

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

North Carolina

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	63.4	298.1	462.2	0.5	5.3	69.3	93.1	283.9	8.7	1,820.5
	2020	223.1	780.8	1,431.7	1.6	15.5	214.8	254.7	821.1	32.7	4,726.3
Fluorescent Ballasts	2010	10.9	43.7	185.5	0.0	1.9	96.4	34.5	106.3	3.1	730.5
	2020	31.8	86.6	595.1	0.0	5.8	309.4	96.5	312.6	11.9	1,964.1
Central A/C & Heatpumps	2010	66.3	89.3	970.3	0.0	9.9	674.4	180.5	556.0	16.2	3,821.8
	2020	197.1	196.9	3,113.3	0.0	30.2	2,163.7	504.9	1,635.6	62.1	10,276.1
Water Heaters	2010	30.7	121.8	332.7	1.1	4.5	35.1	76.6	230.1	7.5	1,310.7
	2020	49.6	204.8	611.6	1.5	7.5	64.6	120.0	384.9	16.1	2,019.1
Transformers	2010	4.9	25.4	103.7	0.0	1.1	18.0	19.3	59.4	1.7	408.4
	2020	14.2	45.5	330.8	0.0	3.2	57.3	53.6	173.8	6.6	1,091.7
Commercial Packaged A/C & HP	2010	11.4	55.6	194.4	0.0	2.0	213.2	36.2	111.4	3.2	765.8
	2020	24.1	99.9	450.3	0.0	4.4	493.8	73.0	236.6	9.0	1,486.3
Commercial Furnaces & Boilers	2010	3.3	12.4	0.0	0.5	0.5	0.0	6.9	9.9	0.9	0.2
	2020	9.2	25.4	0.0	1.4	1.5	0.0	19.9	32.5	3.7	0.5
TOTAL	2010	190.9	646.3	2,248.8	2.1	25.1	1,106.4	447.1	1,357.0	41.4	8,857.8
	2020	549.1	1,439.9	6,532.7	4.6	68.0	3,303.6	1,122.6	3,597.2	142.0	21,564.2

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

North Dakota

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	3.8	16.5	18.4	0.1	0.3	2.8	6.0	27.6	1.5	55.4
	2020	13.9	46.3	56.9	0.3	0.9	8.5	17.8	26.6	4.9	134.9
Fluorescent Ballasts	2010	0.8	2.9	15.5	0.0	0.2	8.0	3.6	17.3	0.8	46.6
	2020	2.3	5.7	49.6	0.0	0.5	25.8	10.6	16.2	2.5	117.6
Central A/C & Heatpumps	2010	1.9	-0.2	32.6	0.0	0.3	56.5	7.6	36.5	1.7	98.3
	2020	5.7	-0.2	104.5	0.0	1.0	181.2	22.3	34.1	5.4	247.8
Water Heaters	2010	2.4	8.1	15.7	0.2	0.4	1.7	7.7	34.6	2.2	47.3
	2020	3.6	13.9	28.8	0.3	0.6	3.0	12.2	18.1	3.7	68.4
Transformers	2010	0.3	1.6	8.3	0.0	0.1	1.4	1.9	9.3	0.4	25.0
	2020	1.0	2.7	26.3	0.0	0.3	4.6	5.6	8.6	1.3	62.4
Commercial Packaged A/C & HP	2010	1.8	9.1	35.6	0.0	0.4	39.1	8.3	39.8	1.8	107.4
	2020	3.1	14.6	67.3	0.0	0.7	73.8	14.4	21.9	3.4	159.5
Commercial Furnaces & Boilers	2010	2.1	6.8	0.0	0.4	0.4	0.0	6.8	15.2	2.3	0.1
	2020	6.0	13.9	0.0	1.1	1.2	0.0	20.6	15.8	7.5	0.3
TOTAL	2010	13.2	44.8	126.0	0.7	2.0	109.4	42.0	180.3	10.7	380.2
	2020	35.7	96.9	333.3	1.8	5.0	296.9	103.5	141.3	28.8	790.9

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Nebraska

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	9.5	41.5	46.9	0.3	0.7	7.0	15.3	70.5	3.8	141.5
	2020	35.2	116.8	145.3	0.8	2.2	21.8	45.4	68.1	12.6	344.7
Fluorescent Ballasts	2010	2.2	7.6	44.9	0.0	0.5	23.3	10.5	50.2	2.3	135.4
	2020	6.3	14.8	144.0	0.0	1.4	74.9	30.8	46.9	7.4	341.5
Central A/C & Heatpumps	2010	4.7	-2.3	83.2	0.0	0.8	144.3	19.4	93.1	4.3	251.1
	2020	13.9	-4.9	267.0	0.0	2.6	462.9	57.1	87.0	13.7	633.1
Water Heaters	2010	6.1	20.4	40.0	0.6	1.0	4.2	19.8	88.5	5.5	121.0
	2020	9.1	34.9	73.6	0.8	1.6	7.8	31.2	46.3	9.4	174.7
Transformers	2010	0.9	4.1	23.6	0.0	0.2	4.1	5.5	26.4	1.2	71.2
	2020	2.6	6.9	74.5	0.0	0.7	12.9	15.9	24.3	3.8	176.6
Commercial Packaged A/C & HP	2010	5.0	24.4	103.4	0.0	1.1	113.4	24.2	115.7	5.3	312.0
	2020	8.6	39.2	195.4	0.0	1.9	214.2	41.7	63.7	10.0	463.2
Commercial Furnaces & Boilers	2010	3.9	12.7	0.0	0.7	0.7	0.0	12.3	27.3	4.1	0.2
	2020	11.1	26.1	0.0	2.0	2.1	0.0	37.1	28.4	13.4	0.5
TOTAL	2010	32.2	108.4	342.0	1.6	5.1	296.4	106.9	471.8	26.6	1,032.4
	2020	86.7	233.8	899.7	3.7	12.5	794.5	259.2	364.8	70.3	2,134.3

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Nevada

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	9.1	40.4	43.0	0.2	0.7	6.5	11.5	41.9	1.9	46.3
	2020	33.3	112.1	133.3	0.7	2.0	20.0	34.6	49.9	7.8	98.4
Fluorescent Ballasts	2010	1.9	7.2	34.4	0.0	0.4	17.9	6.6	25.0	1.0	37.0
	2020	5.5	14.3	110.5	0.0	1.1	57.4	19.6	28.8	3.8	81.5
Central A/C & Heatpumps	2010	4.7	2.4	74.4	0.0	0.8	84.4	14.3	54.1	2.1	80.1
	2020	14.1	5.8	238.8	0.0	2.3	270.9	42.5	62.3	8.3	176.1
Water Heaters	2010	6.3	21.6	33.4	0.6	1.0	3.5	15.1	52.9	2.9	36.0
	2020	9.3	37.1	61.4	0.9	1.5	6.5	24.0	34.1	6.0	45.4
Transformers	2010	0.9	4.4	21.0	0.0	0.2	3.6	4.1	15.3	0.6	22.6
	2020	2.7	7.8	67.9	0.0	0.7	11.8	12.1	17.7	2.4	50.0
Commercial Packaged A/C & HP	2010	3.9	19.6	71.1	0.0	0.7	78.0	13.7	51.7	2.0	76.5
	2020	6.9	32.2	139.3	0.0	1.3	152.7	24.8	36.3	4.8	102.7
Commercial Furnaces & Boilers	2010	1.8	6.2	0.0	0.3	0.3	0.0	4.3	7.6	1.0	0.0
	2020	5.0	12.7	0.0	0.9	0.9	0.0	13.2	9.7	3.9	0.1
TOTAL	2010	28.6	101.9	277.5	1.2	4.0	194.0	69.8	248.4	11.5	298.7
	2020	76.8	221.9	751.1	2.4	9.8	519.3	170.7	238.9	37.1	554.1

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

New Hampshire

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	7.2	35.4	31.6	0.1	0.4	4.7	8.5	27.5	1.6	29.7
	2020	24.4	89.1	97.8	0.3	1.2	14.7	24.2	101.1	4.8	107.7
Fluorescent Ballasts	2010	1.4	7.1	13.6	0.0	0.1	7.1	3.0	10.1	0.5	12.8
	2020	4.2	14.5	43.6	0.0	0.4	22.7	8.7	36.8	1.6	48.1
Central A/C & Heatpumps	2010	1.1	4.8	9.0	0.0	0.1	6.5	2.0	6.7	0.3	8.5
	2020	3.3	10.4	28.9	0.0	0.3	20.8	5.8	24.4	1.1	31.8
Water Heaters	2010	4.5	19.3	22.5	0.2	0.4	2.4	8.3	26.2	1.7	21.1
	2020	7.1	33.1	41.3	0.3	0.7	4.4	13.0	53.9	2.8	45.5
Transformers	2010	0.8	5.7	9.8	0.0	0.1	1.7	2.2	7.3	0.4	9.2
	2020	2.3	11.0	30.8	0.0	0.3	5.3	6.1	26.0	1.1	33.9
Commercial Packaged A/C & HP	2010	3.5	20.4	33.2	0.0	0.3	21.9	7.4	24.6	1.3	31.3
	2020	5.9	33.2	62.4	0.0	0.6	41.1	12.4	52.6	2.3	68.7
Commercial Furnaces & Boilers	2010	0.9	3.8	0.0	0.1	0.1	0.0	1.8	2.8	0.5	0.0
	2020	2.5	7.8	0.0	0.3	0.3	0.0	5.4	11.6	1.5	0.0
TOTAL	2010	19.4	96.6	119.6	0.4	1.6	44.3	33.2	105.2	6.3	112.6
	2020	49.7	199.0	304.7	0.9	3.8	108.9	75.7	306.5	15.2	335.8

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

New Jersey

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	43.8	205.8	152.9	1.0	2.6	22.9	49.3	172.5	12.4	376.2
	2020	154.9	543.4	473.5	3.1	7.8	71.0	138.1	599.5	30.2	1,028.2
Fluorescent Ballasts	2010	13.3	64.2	142.3	0.0	1.5	74.0	31.1	113.5	6.7	350.1
	2020	38.8	130.6	456.7	0.0	4.4	237.5	85.4	378.3	15.8	990.8
Central A/C & Heatpumps	2010	15.5	53.5	142.9	0.0	1.5	203.9	31.2	114.0	6.7	351.5
	2020	46.1	121.0	458.5	0.0	4.4	654.1	85.8	379.8	15.9	994.8
Water Heaters	2010	31.4	122.4	121.0	2.3	3.6	12.8	63.2	213.6	17.6	298.1
	2020	47.2	211.2	222.4	3.2	5.4	23.5	92.6	397.9	21.9	483.4
Transformers	2010	6.2	41.8	82.2	0.0	0.8	14.2	18.0	65.5	3.9	202.1
	2020	17.3	79.0	254.6	0.0	2.5	44.1	47.6	210.9	8.8	552.4
Commercial Packaged A/C & HP	2010	23.1	132.5	248.3	0.0	2.5	163.6	54.3	198.1	11.7	610.7
	2020	41.1	219.5	483.1	0.0	4.7	318.3	90.4	400.2	16.7	1,048.2
Commercial Furnaces & Boilers	2010	7.5	30.0	0.0	1.1	1.1	0.0	17.3	29.4	5.6	0.2
	2020	21.0	61.7	0.0	3.1	3.1	0.0	49.0	109.1	13.7	0.7
TOTAL	2010	140.8	650.2	889.5	4.4	13.6	491.4	264.3	906.6	64.7	2,188.8
	2020	366.6	1,366.3	2,348.8	9.3	32.4	1,348.6	588.8	2,475.7	123.0	5,098.6

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

New Mexico

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	9.1	40.4	43.0	0.2	0.7	6.5	9.8	25.8	0.1	58.3
	2020	33.2	111.7	133.3	0.7	2.0	20.0	26.8	6.8	1.1	148.0
Fluorescent Ballasts	2010	2.3	9.3	36.8	0.0	0.4	19.1	6.0	16.5	0.1	49.8
	2020	6.6	18.4	118.1	0.0	1.1	61.4	16.3	4.2	0.6	131.0
Central A/C & Heatpumps	2010	5.3	6.4	74.4	0.0	0.8	84.4	12.2	33.3	0.1	100.8
	2020	15.8	15.0	238.8	0.0	2.3	270.9	32.9	8.5	1.2	265.0
Water Heaters	2010	5.6	18.9	33.4	0.6	1.0	3.5	12.9	32.6	0.1	45.3
	2020	8.5	32.2	61.4	0.9	1.5	6.5	18.6	4.7	0.9	68.3
Transformers	2010	1.0	5.3	19.5	0.0	0.2	3.4	3.2	8.8	0.0	26.5
	2020	2.7	9.6	61.2	0.0	0.6	10.6	8.4	2.2	0.3	67.9
Commercial Packaged A/C & HP	2010	4.6	24.3	76.0	0.0	0.8	83.4	12.4	34.1	0.1	103.0
	2020	8.3	40.0	148.9	0.0	1.4	163.2	20.5	5.3	0.7	165.2
Commercial Furnaces & Boilers	2010	2.9	7.0	0.0	0.6	0.6	0.0	7.5	9.6	0.1	0.1
	2020	8.1	14.5	0.0	1.8	1.8	0.0	21.0	2.7	1.1	0.2
TOTAL	2010	30.7	111.6	283.2	1.5	4.4	200.3	64.1	160.7	0.6	383.9
	2020	83.2	241.3	761.7	3.3	10.8	532.6	144.6	34.4	5.9	845.7

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

New York

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	81.5	380.8	222.0	2.2	4.5	33.3	81.8	263.5	59.1	430.7
	2020	290.6	1,014.8	687.8	6.7	13.6	103.2	158.0	1,060.8	54.2	1,703.0
Fluorescent Ballasts	2010	29.8	146.6	302.5	0.0	3.1	157.3	65.1	221.6	39.0	586.4
	2020	87.4	299.1	970.6	0.0	9.4	504.7	121.4	836.2	33.9	2,400.8
Central A/C & Heatpumps	2010	18.5	65.6	160.8	0.0	1.6	245.6	34.6	117.8	20.7	311.6
	2020	54.9	149.7	515.8	0.0	5.0	787.9	64.5	444.4	18.0	1,275.9
Water Heaters	2010	67.2	256.4	166.8	5.4	7.2	17.6	120.7	374.1	97.7	324.2
	2020	98.0	446.8	306.6	7.5	10.6	32.4	118.3	784.6	44.3	760.4
Transformers	2010	13.7	94.4	171.8	0.0	1.8	29.8	37.0	125.8	22.1	332.9
	2020	38.2	178.9	530.1	0.0	5.1	91.9	66.3	456.7	18.5	1,311.3
Commercial Packaged A/C & HP	2010	52.0	300.9	527.8	0.0	5.4	347.7	113.6	386.7	68.1	1,023.1
	2020	92.4	498.6	1,026.8	0.0	10.0	676.6	128.5	884.6	35.8	2,539.9
Commercial Furnaces & Boilers	2010	16.0	69.5	0.0	2.1	2.1	0.0	32.6	51.4	29.2	0.4
	2020	45.0	142.8	0.0	5.8	6.0	0.0	62.5	216.3	26.2	1.6
TOTAL	2010	278.7	1,314.1	1,551.6	9.6	25.7	831.3	485.4	1,541.0	336.0	3,009.4
	2020	706.5	2,730.7	4,037.8	20.0	59.7	2,196.7	719.6	4,683.5	230.9	9,992.9

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Ohio

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	67.9	299.9	240.4	2.1	4.6	36.1	76.9	409.6	11.8	1,246.8
	2020	251.0	840.2	744.8	6.5	13.9	111.7	225.5	1,326.3	43.6	2,754.8
Fluorescent Ballasts	2010	10.0	39.2	179.3	0.0	1.8	93.2	35.0	196.5	4.5	929.1
	2020	29.3	77.2	575.3	0.0	5.6	299.2	99.6	600.2	15.8	2,125.8
Central A/C & Heatpumps	2010	22.1	13.3	339.2	0.0	3.5	628.2	66.3	371.8	8.5	1,757.8
	2020	65.7	32.5	1,088.5	0.0	10.5	2,015.6	188.5	1,135.6	29.9	4,021.8
Water Heaters	2010	52.5	180.3	183.7	5.5	7.5	19.4	113.9	582.8	19.6	954.5
	2020	75.5	313.3	337.7	7.6	11.0	35.6	170.6	990.4	36.1	1,251.0
Transformers	2010	6.2	29.8	136.0	0.0	1.4	23.6	26.6	149.0	3.4	704.6
	2020	17.9	52.8	439.4	0.0	4.3	76.2	76.1	458.5	12.1	1,623.7
Commercial Packaged A/C & HP	2010	27.4	141.1	491.4	0.0	5.0	538.9	96.0	538.5	12.3	2,546.0
	2020	47.4	228.3	930.1	0.0	9.0	1,020.0	161.1	970.4	25.6	3,436.7
Commercial Furnaces & Boilers	2010	21.0	79.9	0.0	3.3	3.4	0.0	46.6	121.3	9.0	1.5
	2020	59.1	164.3	0.0	9.2	9.5	0.0	136.4	413.0	32.6	3.8
TOTAL	2010	207.1	783.6	1,570.1	10.8	27.1	1,339.4	461.3	2,369.4	69.2	8,140.3
	2020	546.0	1,708.7	4,115.9	23.2	63.8	3,558.4	1,057.8	5,894.4	195.7	15,217.6

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Oklahoma

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	20.9	90.6	110.3	0.5	1.7	16.5	28.4	76.3	2.3	259.0
	2020	77.6	256.1	341.7	1.7	5.1	51.3	79.9	71.5	10.3	675.8
Fluorescent Ballasts	2010	3.7	13.2	73.4	0.0	0.7	38.2	13.9	38.5	1.0	172.3
	2020	10.7	25.8	235.5	0.0	2.3	122.5	38.5	35.1	4.3	465.4
Central A/C & Heatpumps	2010	29.9	1.8	515.4	0.0	5.3	466.0	97.3	270.4	7.0	1,209.5
	2020	88.8	3.7	1,653.6	0.0	16.0	1,495.0	270.7	246.2	30.3	3,268.1
Water Heaters	2010	11.3	35.7	85.7	1.3	2.2	9.0	34.5	89.3	3.1	201.4
	2020	17.1	60.3	157.5	1.8	3.4	16.6	51.5	45.6	7.2	311.7
Transformers	2010	1.8	7.9	43.6	0.0	0.4	7.6	8.2	22.9	0.6	102.3
	2020	5.0	13.5	138.5	0.0	1.3	24.0	22.7	20.6	2.5	273.8
Commercial Packaged A/C & HP	2010	3.6	16.4	73.3	0.0	0.7	80.4	13.8	38.5	1.0	172.1
	2020	8.1	29.8	177.5	0.0	1.7	194.7	29.1	26.4	3.3	350.8
Commercial Furnaces & Boilers	2010	3.0	6.0	0.0	0.7	0.7	0.0	9.9	12.8	1.1	0.2
	2020	8.4	12.3	0.0	2.0	2.1	0.0	28.4	13.0	4.8	0.4
TOTAL	2010	74.1	171.7	901.7	2.6	11.9	617.7	206.0	548.6	16.1	2,116.7
	2020	215.6	401.4	2,704.4	5.6	31.9	1,904.0	520.8	458.4	62.8	5,346.1

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Oregon

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	22.0	99.4	206.3	0.1	2.2	30.9	41.6	155.9	6.3	222.0
	2020	79.6	269.8	639.1	0.4	6.6	95.9	119.8	175.3	24.0	471.3
Fluorescent Ballasts	2010	3.7	11.5	88.7	0.0	0.9	46.1	17.1	64.4	2.5	95.5
	2020	10.8	21.7	284.6	0.0	2.8	148.0	50.6	74.3	9.9	209.9
Central A/C & Heatpumps	2010	4.0	1.7	82.8	0.0	0.8	75.0	16.0	60.2	2.4	89.1
	2020	11.9	1.5	265.7	0.0	2.6	240.5	47.3	69.3	9.3	196.0
Water Heaters	2010	10.6	37.5	173.3	0.3	2.1	18.3	38.2	141.6	6.0	186.5
	2020	17.3	61.9	318.6	0.5	3.6	33.6	63.8	93.0	13.2	235.0
Transformers	2010	1.5	5.5	45.1	0.0	0.5	7.8	8.7	32.8	1.3	48.5
	2020	4.4	8.4	143.9	0.0	1.4	24.9	25.6	37.6	5.0	106.1
Commercial Packaged A/C & HP	2010	2.8	12.1	67.4	0.0	0.7	44.4	13.0	49.0	1.9	72.5
	2020	5.6	20.6	148.1	0.0	1.4	97.6	26.3	38.6	5.2	109.2
Commercial Furnaces & Boilers	2010	1.2	3.9	0.0	0.2	0.2	0.0	3.0	5.3	0.7	0.0
	2020	3.3	8.0	0.0	0.6	0.6	0.0	9.2	6.8	2.7	0.1
TOTAL	2010	45.8	171.6	663.6	0.7	7.5	222.6	137.6	509.1	21.0	714.2
	2020	133.0	391.9	1,800.0	1.5	19.0	640.5	342.6	494.9	69.3	1,327.5

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Pennsylvania

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	64.6	297.6	243.1	1.6	4.1	36.5	78.3	274.3	19.7	598.2
	2020	232.3	802.1	753.0	4.9	12.4	112.9	219.5	953.4	48.0	1,635.0
Fluorescent Ballasts	2010	12.3	54.2	174.0	0.0	1.8	90.5	38.0	138.8	8.2	428.0
	2020	36.1	108.9	558.4	0.0	5.4	290.4	104.4	462.6	19.3	1,211.6
Central A/C & Heatpumps	2010	18.8	44.0	227.2	0.0	2.3	324.2	49.7	181.3	10.7	558.9
	2020	55.7	98.5	729.1	0.0	7.1	1,040.2	136.4	604.0	25.2	1,581.9
Water Heaters	2010	48.1	180.9	192.4	3.7	5.7	20.3	100.5	339.6	28.0	474.1
	2020	70.8	313.6	353.7	5.1	8.6	37.3	147.3	632.7	34.9	768.7
Transformers	2010	6.7	38.8	117.1	0.0	1.2	20.3	25.6	93.4	5.5	288.1
	2020	19.4	72.4	375.4	0.0	3.6	65.1	70.2	311.0	13.0	814.5
Commercial Packaged A/C & HP	2010	21.5	116.7	303.6	0.0	3.1	200.1	66.4	242.2	14.3	746.8
	2020	38.2	192.4	590.7	0.0	5.7	389.2	110.5	489.4	20.5	1,281.7
Commercial Furnaces & Boilers	2010	9.1	39.4	0.0	1.2	1.2	0.0	19.2	32.5	6.2	0.3
	2020	25.8	81.0	0.0	3.4	3.5	0.0	54.1	120.5	15.1	0.8
TOTAL	2010	181.1	771.5	1,257.5	6.4	19.5	691.8	377.6	1,302.2	92.7	3,094.3
	2020	478.3	1,668.8	3,360.3	13.4	46.3	1,935.1	842.4	3,573.4	176.0	7,294.1

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Rhode Island

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	5.8	28.0	27.2	0.1	0.4	4.1	7.3	23.7	1.4	25.6
	2020	19.8	71.4	84.2	0.2	1.1	12.6	20.8	87.1	4.2	92.7
Fluorescent Ballasts	2010	1.1	5.1	11.4	0.0	0.1	5.9	2.5	8.4	0.4	10.7
	2020	3.1	10.3	36.4	0.0	0.4	18.9	7.3	30.7	1.3	40.1
Central A/C & Heatpumps	2010	0.8	3.4	7.7	0.0	0.1	5.6	1.7	5.7	0.3	7.3
	2020	2.5	7.3	24.9	0.0	0.2	17.9	5.0	21.0	0.9	27.4
Water Heaters	2010	3.5	14.7	19.3	0.2	0.4	2.0	7.1	22.6	1.5	18.2
	2020	5.5	25.2	35.6	0.2	0.6	3.8	11.2	46.4	2.4	39.2
Transformers	2010	0.6	3.9	7.9	0.0	0.1	1.4	1.7	5.8	0.3	7.4
	2020	1.7	7.5	24.5	0.0	0.2	4.2	4.9	20.7	0.9	27.0
Commercial Packaged A/C & HP	2010	2.6	14.8	27.7	0.0	0.3	18.3	6.2	20.6	1.1	26.1
	2020	4.4	24.0	52.1	0.0	0.5	34.3	10.4	43.9	1.9	57.3
Commercial Furnaces & Boilers	2010	1.2	5.1	0.0	0.2	0.2	0.0	2.7	4.2	0.7	0.0
	2020	3.4	10.5	0.0	0.5	0.5	0.0	8.1	17.2	2.2	0.1
TOTAL	2010	15.6	75.1	101.2	0.4	1.5	37.2	29.3	91.0	5.7	95.2
	2020	40.4	156.3	257.6	0.9	3.5	91.8	67.6	267.1	13.8	283.8

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

South Carolina

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	28.9	133.0	227.4	0.3	2.6	34.1	45.8	139.7	4.3	895.9
	2020	103.1	354.9	704.6	0.8	7.6	105.7	125.3	404.1	16.1	2,326.0
Fluorescent Ballasts	2010	4.4	16.2	87.0	0.0	0.9	45.3	16.2	49.9	1.5	342.8
	2020	12.9	31.6	279.2	0.0	2.7	145.2	45.3	146.7	5.6	921.6
Central A/C & Heatpumps	2010	28.2	13.4	477.5	0.0	4.9	331.9	88.8	273.6	8.0	1,880.8
	2020	83.9	27.0	1,532.2	0.0	14.8	1,064.8	248.5	804.9	30.6	5,057.2
Water Heaters	2010	13.2	49.6	163.7	0.5	2.2	17.3	37.7	113.3	3.7	645.0
	2020	21.3	83.0	301.0	0.7	3.7	31.8	59.0	189.4	7.9	993.7
Transformers	2010	2.3	9.7	54.8	0.0	0.6	9.5	10.2	31.4	0.9	215.7
	2020	6.6	16.6	178.7	0.0	1.7	31.0	29.0	93.9	3.6	589.9
Commercial Packaged A/C & HP	2010	4.6	21.4	91.2	0.0	0.9	100.1	17.0	52.3	1.5	359.3
	2020	9.8	38.0	211.3	0.0	2.0	231.7	34.3	111.0	4.2	697.4
Commercial Furnaces & Boilers	2010	1.8	6.2	0.0	0.3	0.3	0.0	4.4	6.2	0.6	0.1
	2020	5.2	12.8	0.0	0.9	0.9	0.0	12.5	20.4	2.3	0.3
TOTAL	2010	83.4	249.5	1,101.7	1.1	12.4	538.1	220.1	666.3	20.4	4,339.7
	2020	242.8	564.0	3,207.0	2.4	33.6	1,610.2	553.9	1,770.5	70.3	10,586.1

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

South Dakota

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	4.3	19.3	20.3	0.1	0.3	3.0	6.6	30.5	1.7	61.2
	2020	15.8	53.3	62.9	0.3	1.0	9.4	19.6	29.4	5.5	149.1
Fluorescent Ballasts	2010	0.8	3.1	14.3	0.0	0.1	7.4	3.3	16.0	0.7	43.2
	2020	2.3	6.1	45.9	0.0	0.4	23.9	9.8	15.0	2.4	108.8
Central A/C & Heatpumps	2010	2.3	1.1	36.0	0.0	0.4	62.4	8.4	40.3	1.9	108.6
	2020	6.9	2.7	115.5	0.0	1.1	200.3	24.7	37.7	5.9	273.9
Water Heaters	2010	2.9	10.2	17.3	0.3	0.4	1.8	8.6	38.3	2.4	52.3
	2020	4.3	17.4	31.8	0.4	0.7	3.4	13.5	20.1	4.1	75.6
Transformers	2010	0.3	1.7	7.7	0.0	0.1	1.3	1.8	8.6	0.4	23.3
	2020	1.0	3.0	24.5	0.0	0.2	4.2	5.2	8.0	1.3	58.1
Commercial Packaged A/C & HP	2010	1.8	9.3	33.0	0.0	0.3	36.1	7.7	36.9	1.7	99.4
	2020	3.1	15.1	62.3	0.0	0.6	68.3	13.3	20.3	3.2	147.6
Commercial Furnaces & Boilers	2010	1.3	4.6	0.0	0.2	0.2	0.0	3.8	8.5	1.3	0.1
	2020	3.7	9.4	0.0	0.6	0.7	0.0	11.6	8.9	4.2	0.2
TOTAL	2010	13.8	49.3	128.6	0.6	1.9	112.2	40.3	179.1	10.0	388.1
	2020	37.2	107.2	342.9	1.3	4.7	309.4	97.8	139.3	26.4	813.4

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Tennessee

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	41.5	188.4	328.6	0.4	3.8	49.3	67.1	204.3	6.3	1,294.3
	2020	149.6	509.7	1,017.9	1.4	11.3	152.7	184.0	592.7	23.8	3,360.3
Fluorescent Ballasts	2010	6.6	22.8	142.5	0.0	1.5	74.1	26.5	81.6	2.4	561.1
	2020	19.4	44.0	457.1	0.0	4.4	237.7	74.1	240.1	9.1	1,508.8
Central A/C & Heatpumps	2010	39.1	14.1	721.4	0.0	7.4	584.5	134.2	413.3	12.0	2,841.2
	2020	116.3	20.1	2,314.5	0.0	22.4	1,875.4	375.3	1,215.9	46.2	7,639.4
Water Heaters	2010	22.0	80.4	281.6	1.0	3.9	29.7	65.8	197.4	6.5	1,109.6
	2020	35.2	134.4	517.7	1.4	6.4	54.6	102.9	330.1	13.8	1,709.4
Transformers	2010	3.1	12.7	81.2	0.0	0.8	14.1	15.1	46.5	1.4	319.8
	2020	8.8	20.9	259.6	0.0	2.5	45.0	42.1	136.4	5.2	856.8
Commercial Packaged A/C & HP	2010	8.9	41.0	192.2	0.0	2.0	210.8	35.8	110.1	3.2	756.9
	2020	17.6	69.9	414.1	0.0	4.0	454.1	67.1	217.5	8.3	1,366.8
Commercial Furnaces & Boilers	2010	4.9	17.4	0.0	0.8	0.8	0.0	11.2	16.1	1.5	0.3
	2020	13.8	35.7	0.0	2.3	2.4	0.0	32.3	52.7	6.0	0.9
TOTAL	2010	126.2	376.8	1,747.4	2.2	20.2	962.5	355.7	1,069.4	33.3	6,883.3
	2020	360.8	834.8	4,980.9	5.1	53.5	2,819.6	877.9	2,785.5	112.4	16,442.2

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Texas

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	111.1	480.8	570.8	3.0	8.9	85.6	155.6	305.9	12.8	942.4
	2020	412.5	1,358.8	1,768.2	9.4	26.8	265.2	441.8	754.5	56.9	2,570.0
Fluorescent Ballasts	2010	24.1	93.6	438.0	0.0	4.5	227.7	86.2	175.6	6.2	722.8
	2020	70.7	184.3	1,405.2	0.0	13.6	730.7	241.5	419.6	26.9	2,041.2
Central A/C & Heatpumps	2010	189.2	131.4	2,944.6	0.0	30.1	2,697.1	579.4	1,180.6	41.7	4,859.5
	2020	562.2	302.7	9,447.7	0.0	91.5	8,653.6	1,623.6	2,820.8	180.5	13,723.4
Water Heaters	2010	55.6	170.3	450.0	7.3	12.2	47.5	194.2	368.4	17.8	743.7
	2020	85.5	283.7	827.2	10.2	18.5	87.3	291.9	493.0	40.9	1,203.2
Transformers	2010	12.0	58.4	267.7	0.0	2.7	46.4	52.7	107.3	3.8	441.7
	2020	34.4	103.0	855.8	0.0	8.3	148.3	147.1	255.5	16.4	1,243.1
Commercial Packaged A/C & HP	2010	24.1	113.0	437.6	0.0	4.5	479.9	86.1	175.4	6.2	722.1
	2020	53.3	207.3	1,059.3	0.0	10.3	1,161.7	182.0	316.3	20.2	1,538.6
Commercial Furnaces & Boilers	2010	25.9	11.6	0.0	8.2	8.5	0.0	118.4	111.9	12.8	1.2
	2020	72.9	23.8	0.0	23.2	23.9	0.0	341.3	298.2	57.2	3.8
TOTAL	2010	441.9	1,059.2	5,108.6	18.6	71.3	3,584.2	1,272.6	2,425.1	101.2	8,433.5
	2020	1,291.6	2,463.6	15,363.4	42.7	192.8	11,046.9	3,269.2	5,357.8	398.9	22,323.2

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Utah

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	8.7	37.8	44.4	0.2	0.7	6.7	11.9	43.2	2.0	47.8
	2020	32.4	107.1	137.6	0.7	2.1	20.6	35.7	51.5	8.1	101.5
Fluorescent Ballasts	2010	1.9	6.5	39.3	0.0	0.4	20.4	7.6	28.6	1.1	42.3
	2020	5.5	12.7	126.2	0.0	1.2	65.6	22.4	32.9	4.4	93.0
Central A/C & Heatpumps	2010	4.3	-1.9	76.8	0.0	0.8	87.2	14.8	55.8	2.2	82.7
	2020	12.7	-4.2	246.5	0.0	2.4	279.6	43.8	64.3	8.6	181.8
Water Heaters	2010	5.4	17.1	34.5	0.6	1.0	3.6	15.6	54.6	3.0	37.2
	2020	8.0	29.2	63.4	0.9	1.5	6.7	24.7	35.2	6.2	46.8
Transformers	2010	0.8	3.6	21.5	0.0	0.2	3.7	4.1	15.6	0.6	23.1
	2020	2.3	6.1	67.7	0.0	0.7	11.7	12.0	17.7	2.4	49.9
Commercial Packaged A/C & HP	2010	3.9	18.6	81.2	0.0	0.8	89.1	15.7	59.0	2.3	87.4
	2020	6.9	30.3	159.1	0.0	1.5	174.5	28.3	41.5	5.5	117.3
Commercial Furnaces & Boilers	2010	2.5	6.7	0.0	0.5	0.6	0.0	7.6	13.2	1.7	0.1
	2020	7.2	13.8	0.0	1.5	1.6	0.0	23.0	17.0	6.8	0.1
TOTAL	2010	27.5	88.5	297.8	1.4	4.5	210.7	77.3	270.1	12.9	320.6
	2020	75.0	195.0	800.5	3.1	11.0	558.7	190.1	260.1	41.9	590.6

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Vermont

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	3.3	15.9	16.3	0.0	0.2	2.4	4.4	14.2	0.8	15.3
	2020	11.4	40.9	50.5	0.1	0.6	7.6	12.5	52.3	2.5	55.7
Fluorescent Ballasts	2010	0.6	2.8	7.1	0.0	0.1	3.7	1.6	5.3	0.3	6.7
	2020	1.8	5.7	22.8	0.0	0.2	11.8	4.5	19.2	0.8	25.1
Central A/C & Heatpumps	2010	0.5	1.7	4.7	0.0	0.0	3.4	1.0	3.4	0.2	4.4
	2020	1.4	3.7	14.9	0.0	0.1	10.8	3.0	12.6	0.5	16.4
Water Heaters	2010	2.0	8.3	11.6	0.1	0.2	1.2	4.3	13.5	0.9	10.9
	2020	3.1	14.2	21.4	0.1	0.4	2.3	6.7	27.9	1.5	23.5
Transformers	2010	0.4	2.3	5.3	0.0	0.1	0.9	1.2	3.9	0.2	5.0
	2020	1.0	4.4	16.8	0.0	0.2	2.9	3.4	14.2	0.6	18.5
Commercial Packaged A/C & HP	2010	1.5	8.3	17.3	0.0	0.2	11.4	3.9	12.9	0.7	16.3
	2020	2.5	13.5	32.5	0.0	0.3	21.4	6.5	27.5	1.2	35.8
Commercial Furnaces & Boilers	2010	0.4	1.7	0.0	0.1	0.1	0.0	0.9	1.4	0.2	0.0
	2020	1.1	3.5	0.0	0.2	0.2	0.0	2.6	5.6	0.7	0.0
TOTAL	2010	8.6	41.0	62.3	0.2	0.8	23.1	17.2	54.6	3.3	58.6
	2020	22.4	85.8	159.0	0.4	2.0	56.8	39.2	159.3	7.8	175.2

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Virginia

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	55.7	260.4	415.1	0.5	4.7	62.3	83.6	254.9	7.8	1,634.9
	2020	196.8	685.8	1,285.8	1.5	14.0	192.9	228.7	737.4	29.4	4,244.5
Fluorescent Ballasts	2010	10.6	41.5	190.0	0.0	1.9	98.8	35.4	108.9	3.2	748.4
	2020	31.1	81.9	609.7	0.0	5.9	317.0	98.9	320.3	12.2	2,012.4
Central A/C & Heatpumps	2010	56.8	60.9	871.4	0.0	8.9	605.6	162.1	499.3	14.5	3,432.2
	2020	168.8	132.7	2,796.0	0.0	27.1	1,943.2	453.4	1,468.9	55.8	9,228.7
Water Heaters	2010	26.9	105.0	298.8	1.0	4.0	31.5	68.8	206.7	6.8	1,177.1
	2020	43.2	176.6	549.2	1.3	6.7	58.0	107.7	345.7	14.4	1,813.3
Transformers	2010	4.4	22.8	97.7	0.0	1.0	16.9	18.2	56.0	1.6	384.6
	2020	12.5	40.2	305.9	0.0	3.0	53.0	49.6	160.7	6.1	1,009.8
Commercial Packaged A/C & HP	2010	11.1	53.4	199.2	0.0	2.0	218.5	37.1	114.1	3.3	784.6
	2020	23.5	95.6	461.4	0.0	4.5	506.0	74.8	242.4	9.2	1,522.9
Commercial Furnaces & Boilers	2010	2.9	11.4	0.0	0.4	0.5	0.0	6.0	8.6	0.8	0.2
	2020	8.3	23.4	0.0	1.3	1.3	0.0	17.4	28.4	3.2	0.5
TOTAL	2010	168.5	555.4	2,072.1	1.9	23.1	1,033.6	411.1	1,248.6	38.0	8,162.1
	2020	484.2	1,236.2	6,008.0	4.1	62.4	3,070.0	1,030.6	3,303.9	130.3	19,832.1

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Washington

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	35.8	158.3	353.3	0.2	3.8	53.0	71.2	266.9	10.7	380.2
	2020	130.6	436.8	1,094.5	0.7	11.3	164.2	205.1	300.1	41.2	807.2
Fluorescent Ballasts	2010	5.7	15.4	154.4	0.0	1.6	80.3	29.8	112.2	4.4	166.2
	2020	16.6	28.1	495.5	0.0	4.8	257.6	88.1	129.3	17.2	365.4
Central A/C & Heatpumps	2010	6.1	-2.6	141.8	0.0	1.4	128.4	27.3	103.0	4.0	152.6
	2020	18.1	-9.7	455.1	0.0	4.4	411.9	80.9	118.8	15.8	335.6
Water Heaters	2010	16.4	54.9	296.8	0.6	3.6	31.3	65.4	242.5	10.2	319.4
	2020	26.7	90.1	545.6	0.8	6.1	57.6	109.3	159.3	22.6	402.4
Transformers	2010	2.4	6.8	80.4	0.0	0.8	13.9	15.5	58.4	2.3	86.6
	2020	6.9	8.7	258.0	0.0	2.5	44.7	45.9	67.3	9.0	190.2
Commercial Packaged A/C & HP	2010	4.3	17.3	117.3	0.0	1.2	77.3	22.6	85.3	3.3	126.3
	2020	8.7	29.1	257.8	0.0	2.5	169.8	45.8	67.3	9.0	190.1
Commercial Furnaces & Boilers	2010	1.6	5.2	0.0	0.3	0.3	0.0	4.1	7.2	0.9	0.0
	2020	4.5	10.7	0.0	0.8	0.8	0.0	12.5	9.2	3.7	0.1
TOTAL	2010	72.3	255.3	1,144.2	1.1	12.8	384.3	236.0	875.5	35.9	1,231.3
	2020	212.2	593.9	3,106.4	2.3	32.5	1,105.9	587.7	851.3	118.5	2,291.0

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Wisconsin

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	29.5	128.1	109.7	1.0	2.1	16.4	38.2	75.8	6.2	437.4
	2020	110.2	364.5	339.7	3.0	6.3	51.0	113.5	348.5	24.8	1,068.8
Fluorescent Ballasts	2010	3.5	12.2	72.1	0.0	0.7	37.5	15.4	32.1	2.1	287.5
	2020	10.1	23.6	231.5	0.0	2.2	120.4	44.3	139.1	7.9	727.5
Central A/C & Heatpumps	2010	8.6	-3.9	154.7	0.0	1.6	286.5	33.0	68.8	4.5	616.7
	2020	25.7	-8.3	496.5	0.0	4.8	919.3	94.9	298.4	17.0	1,560.4
Water Heaters	2010	22.0	72.9	83.8	2.5	3.4	8.8	56.6	107.8	10.3	334.8
	2020	31.6	126.4	154.0	3.4	5.0	16.3	85.9	260.3	20.5	485.4
Transformers	2010	2.1	8.7	53.4	0.0	0.5	9.3	11.4	23.7	1.5	212.8
	2020	6.0	14.5	171.8	0.0	1.7	29.8	32.9	103.3	5.9	540.0
Commercial Packaged A/C & HP	2010	9.5	46.2	197.7	0.0	2.0	216.8	42.1	87.9	5.7	787.8
	2020	16.4	74.5	374.2	0.0	3.6	410.4	71.6	224.9	12.8	1,176.0
Commercial Furnaces & Boilers	2010	9.5	34.2	0.0	1.6	1.6	0.0	24.5	23.7	5.0	0.6
	2020	26.8	70.4	0.0	4.4	4.6	0.0	72.7	114.9	19.6	1.6
TOTAL	2010	84.7	298.5	671.4	5.0	12.0	575.4	221.1	419.7	35.4	2,677.6
	2020	226.8	665.5	1,767.7	10.8	28.3	1,547.0	515.7	1,489.3	108.5	5,559.6

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

West Virginia

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	14.7	67.1	118.0	0.1	1.3	17.7	25.0	138.6	3.3	611.6
	2020	52.6	180.3	365.6	0.4	4.0	54.8	69.5	416.4	11.5	1,351.1
Fluorescent Ballasts	2010	1.6	5.6	33.6	0.0	0.3	17.5	6.6	36.8	0.8	174.0
	2020	4.7	10.9	107.7	0.0	1.0	56.0	18.7	112.4	3.0	398.0
Central A/C & Heatpumps	2010	13.8	0.8	247.8	0.0	2.5	172.2	48.4	271.5	6.2	1,283.9
	2020	40.9	0.1	795.0	0.0	7.7	552.5	137.7	829.4	21.9	2,937.6
Water Heaters	2010	6.8	25.1	85.0	0.3	1.2	9.0	20.5	112.4	2.9	440.3
	2020	10.8	42.0	156.2	0.4	1.9	16.5	32.7	195.2	5.7	577.2
Transformers	2010	0.8	3.3	21.1	0.0	0.2	3.7	4.1	23.1	0.5	109.1
	2020	2.4	5.4	68.7	0.0	0.7	11.9	11.9	71.6	1.9	253.7
Commercial Packaged A/C & HP	2010	1.7	7.5	35.2	0.0	0.4	38.6	6.9	38.6	0.9	182.4
	2020	3.5	13.4	81.5	0.0	0.8	89.4	14.1	85.0	2.2	301.2
Commercial Furnaces & Boilers	2010	1.5	5.9	0.0	0.2	0.2	0.0	3.5	9.0	0.7	0.1
	2020	4.4	12.1	0.0	0.7	0.7	0.0	10.1	30.7	2.4	0.3
TOTAL	2010	40.9	115.3	540.6	0.7	6.2	258.6	115.0	630.0	15.4	2,801.4
	2020	119.4	264.1	1,574.7	1.5	16.8	781.2	294.7	1,740.8	48.6	5,819.0

State Savings from Updated Appliance Energy Efficiency Standards in 2010 and 2020

Wyoming

Appliance	Year	Economic Savings		Energy and Generation Savings				Emission Reductions			
		In-Year Utility Bill Savings (Million\$)	Cumulative Net Savings (Million\$)	Electric Generation Savings (Million kWh)	Natural Gas Savings (Billion Cubic Feet)	Primary Energy Savings (Trillion Btus)	Summer Peak Generation Savings (MW)	Carbon Reductions (Thousand Metric Tons)	NOx Reductions (Metric Tons)	PM10 Reductions (Metric Tons)	SO2 Reductions (Metric Tons)
Clothes Washers	2010	2.4	10.1	12.8	0.1	0.2	1.9	2.9	7.7	0.0	17.3
	2020	9.0	29.3	39.6	0.2	0.6	5.9	8.0	2.0	0.3	44.0
Fluorescent Ballasts	2010	0.5	1.6	13.9	0.0	0.1	7.2	2.3	6.2	0.0	18.8
	2020	1.6	2.9	44.6	0.0	0.4	23.2	6.2	1.6	0.2	49.5
Central A/C & Heatpumps	2010	1.0	-2.1	22.1	0.0	0.2	29.9	3.6	9.9	0.0	30.0
	2020	3.0	-4.9	71.0	0.0	0.7	95.9	9.8	2.5	0.4	78.8
Water Heaters	2010	1.5	4.4	9.9	0.2	0.3	1.0	3.8	9.7	0.0	13.5
	2020	2.2	7.6	18.3	0.3	0.4	1.9	5.5	1.4	0.3	20.3
Transformers	2010	0.3	0.8	9.2	0.0	0.1	1.6	1.5	4.1	0.0	12.5
	2020	0.9	1.1	30.1	0.0	0.3	5.2	4.2	1.1	0.1	33.4
Commercial Packaged A/C & HP	2010	1.1	4.9	28.7	0.0	0.3	31.5	4.7	12.9	0.0	38.9
	2020	2.0	7.9	56.2	0.0	0.5	61.7	7.8	2.0	0.3	62.4
Commercial Furnaces & Boilers	2010	2.2	6.0	0.0	0.5	0.5	0.0	5.4	6.9	0.1	0.1
	2020	6.1	12.2	0.0	1.3	1.3	0.0	15.1	2.0	0.8	0.2
TOTAL	2010	9.0	25.7	96.7	0.7	1.7	73.2	24.3	57.4	0.2	131.0
	2020	24.7	56.0	259.8	1.7	4.3	193.8	56.4	12.5	2.4	288.5