EXECUTIVE SUMMARY

Appliance and equipment efficiency standards have been one of the most successful policies used by state governments and the federal government to save energy. These standards prohibit the production and import or sale of appliances and other energy-consuming products less efficient than the minimum requirements. These standards not only save energy but also reduce pollutants, improve electric system reliability, and save consumers and business owners significant amounts of money over the life of the equipment.

In the United States, minimum-efficiency standards for appliances and other equipment were initiated at the state level. California adopted the first appliance standards law in 1974 and in the early and mid-1980s, other states (including Florida, Kansas, Massachusetts, and New York) adopted standards on various products. These state standards led to acceptance of national standards, which were adopted by Congress in 1987, 1988, and 1992 and signed by Presidents Reagan and Bush to address market failures and replace a patchwork of state standards. These initial efficiency standards focused on the "low-hanging fruit"—major residential appliances (e.g., refrigerators, air conditioners, water heaters, washers and dryers, etc.) as well as the most common commercial equipment (e.g., fluorescent lamps, motors, furnaces, etc.) Since then, technology and programmatic advances provide the opportunity to extend the standards programs to additional products that are now "ripe" for the harvest of energy and economic savings. These developments include widespread availability of more advanced products; work on new standards by several states and Canada; development of ENERGY STAR® and other voluntary specifications for many products; updates of key industry (trade association) standards; and additional research on the energy savings potential, usage, cost, and availability of these products.

While the efficiency standards established to date have provided significant energy and economic savings, the United States is still experiencing overall growth in energy demand and an increasingly tight supply. Some other regions might become "the next California"—growth in electricity use is exceeding power plant construction in these regions and existing power surpluses could soon evaporate. Savings from new products that are now "ripe" for appliance and efficiency standards could reduce the need for additional power plants and ease electric load on already stressed transmission lines and transformers, significantly contributing to improved system reliability. In addition, natural gas prices have skyrocketed in the past year (e.g., average residential prices of $11.69 per million Btu in the first 9 months of 2004, up 34% relative to the same period in 2001). ACEEE researchers discovered that markets are so tight that just a modest 2–4% reduction in national gas use can reduce natural gas prices by 20% or more. Such savings can be achieved with the use of more efficient gas-fired equipment as well as through reduced electricity use, since in many regions of the United States, natural gas is the marginal fuel used for power generation. Coal prices have also been rising in the past year, which is affecting electricity prices. Prices have been increasing because demand is up (due in part to high oil and natural gas prices) and supplies are tight. Appliance and equipment efficiency standards, along with other efficiency actions, can reduce demand, softening markets and reducing energy prices as a result.

In 2001, ACEEE published a report entitled *Opportunities for New Appliance and Equipment Efficiency Standards: Energy and Economic Savings Beyond Current Standards Programs.* In that report we examined opportunities for state appliance and equipment efficiency standards for 14 products. Many states took advantage of it as they considered new appliance standards and regulations. Since its publication, legislation or regulations have been adopted in three states (California, Connecticut, and Maryland) based in substantial part on its recommendations. In addition, consensus national efficiency standards have been negotiated between manufacturers and efficiency supporters on nine products and the consensus agreements incorporated into pending federal energy legislation. However, this legislation has not passed due to controversies regarding other parts of the bill. Given the paralysis at the national level, we recommend that states adopt most of the consensus national standards as state standards. In addition, there are another nine products not included in federal legislation for which state standards are justified. The current report is intended to update the earlier one and present information on most of the current best opportunities for new state efficiency standards.

In this report, we describe opportunities for state governments to set minimum-efficiency standards for 18 appliances and other types of equipment currently not covered by federal standards. These are ceiling fan lights; commercial clothes washers; commercial refrigerators and freezers; commercial unit heaters; dehumidifiers; digital cable and satellite boxes; digital television adapters; exit signs; external power supplies; commercial ice-makers; incandescent reflector lamps; large commercial packaged air conditioners and heat pumps; low- and medium-voltage dry-type distribution transformers; metal halide lamp fixtures; pre-rinse spray valves; torchiere lighting fixtures; and traffic signals.

Table ES.1 summarizes the potential for energy and economic savings from adopting national minimum-efficiency standards for the above 18 products. Table ES.2 shows the potential peak load and emission reductions in 2020 and 2030 from adopting these standards (information on savings in 2010 can be found in Appendix B).

On a national basis, these new standards would save 65 terawatt-hours (TWh)[1] of electricity and about 0.8 quads[2] of primary energy[3] in the year 2020, while generating $59 billion in net savings for consumers and business owners for equipment purchased through 2030. The electricity savings amount to 2% of projected residential and commercial sector U.S. electricity use in 2020. Stated another way, these standards would reduce projected growth in residential and commercial electricity use over the next 2 decades by about 6%. These standards would also save natural gas, including, in 2020, about 100 billion cubic feet of direct natural gas use in buildings (i.e., savings from reduced gas use for space and water heating) and an additional 336 billion cubic feet of natural gas used in power plants. The

[1] One TWh is a billion kWh.

[2] A "quad" is a quadrillion Btus, where a quadrillion is 1,000 trillion. By way of comparison, the entire United States currently uses a total of just under 100 quads annually in all sectors of the economy.

[3] "Primary" energy includes the energy content of the fuel burned at the power plant and not just the energy content of electricity as it enters a home or factory. Typically, about three units of energy are consumed at the power plant in order to deliver one unit of energy to a home. The remaining energy is lost as waste heat from the power plant and losses along the transmission and distribution system.

primary energy savings (savings in all fuels) from new standards would be about one-fifth the savings from all existing federal standards, with an overall benefit-cost ratio of 9.3 to 1—far better than the 3 to 1 ratio for existing standards. All appliance and equipment efficiency standards are also incredibly cost-effective from a government perspective, with net benefits to consumers and businesses more than 2,000 times greater than the cost to state and federal governments to administer a standards program. In fact, the direct savings to state governments (due to more efficient products in state facilities) are generally greater than the government cost of these programs. Because nearly all of the standards recommended have already been adopted in at least one state, the cost for additional states to establish and implement such standards will be very small.

Table ES.1. Estimated Energy Savings and Economics of Proposed New Standards

Products	Effective Date	National Energy Savings in 2020		National Energy Savings in 2030		Cumulative Savings for Products Purchased thru 2030	NPV for Purchases thru 2030	Benefit-Cost Ratio
	(year)	(TWh)	(tril. Btu)	(TWh)	(tril. Btu)	(quads)	($ billion)	
Ceiling fan lights	2007	18.9	197	18.9	190	3.4	13.0	18.3
Commercial clothes washers	2007	0.3	9	0.3	9	0.2	0.9	3.7
Commercial ice-makers	2007	0.6	7	0.6	6	0.1	0.4	7.9
Commercial refrigerators & freezers	2010	2.4	25	2.4	24	0.4	1.3	10.9
Commercial unit heaters	2007	NA	39	NA	55	0.8	3.0	9.6
Dehumidifiers	2007	1.0	10	1.1	11	0.2	0.7	133.3
Digital cable & satellite boxes	2007	1.4	14	1.4	14	0.4	1.2	4.1
Digital television adapters	2007	0.3	3	0.0	0	0.2	1.1	7.4
Exit signs	2007	1.7	18	2.9	29	0.4	1.4	11.9
External power supplies	2007	4.9	51	4.9	49	1.0	3.3	4.6
Large commercial packaged AC & heat pumps	2010	1.5	16	2.2	22	0.3	0.9	6.6
Low-voltage dry-type transformers	2007	3.1	32	5.4	54	0.7	2.6	8.2
Medium-voltage dry-type transformers	2007	2.7	28	4.7	47	0.6	2.4	5.5
Metal halide lamp fixtures	2008	9.0	93	14.4	144	1.9	7.3	10.8
Pre-rinse spray valves	2007	NA	56	NA	56	1.2	8.0	428.0
Reflector lamps	2007	3.9	40	3.9	39	0.9	2.6	4.1
Torchiere lighting fixtures	2007	11.8	123	11.8	119	2.3	8.4	10.0
Traffic signals	2007	1.3	13	1.3	13	0.3	0.6	3.2
Total		64.8	772.6	76.2	879.9	15.4	59.3	9.3

Note: NPV is the value of energy savings due to standards minus the additional cost of more efficient products expressed in current dollars. A 5% real discount rate is used for these calculations.

Another significant benefit from appliance standards is their impact on summer peak load. We estimate that the proposed standards would save a total of over 19 gigawatts (GW)[4] of power in the year 2020. This is roughly equal to the generating capacity of 64 average power plants (i.e., 300 MW each). These standards would also save a significant amount of water by 2020, including 120 billion gallons of direct water savings per year from efficient commercial clothes washers and pre-rinse spray valves as well as an additional 32 billion gallons of water saved per year at power plants.

Emissions reductions from the reduced energy consumption would also be significant. In the year 2020, 14 million metric tons (MMT) of carbon would be reduced, which is equivalent to

[4] 19 GW = 19,000 MW.

the annual carbon emissions from over nine million "average" passenger cars.[5] In addition to carbon, emissions would be reduced significantly for smog-forming nitrogen oxides (NOx), sulfur oxides (SOx; the main component of acid rain), fine particulate matter, and mercury (the latter two contribute to substantial health problems).

Table ES.2. Estimated Summer Peak Load, Water and Pollutant Reductions from New Standards

	Summer Peak Load Reduction		Water Savings	Pollutant Reductions in 2020			
	In 2020 (GW)	In 2030 (GW)	In 2020 (billion gal)	Carbon (MMT)	NOx (1000 MT)	SOx (1000 MT)	PM_{10} (1000 MT)
Ceiling fan lights	6.2	6.2	9.5	3.6	10.0	47.4	0.5
Commercial clothes washers	0.1	0.1	16.3	0.1	0.4	0.8	0.0
Commercial ice-makers	0.1	0.1	0.3	0.1	0.4	1.5	0.0
Commercial refrigerators & freezers	0.6	0.6	1.2	0.5	1.4	5.8	0.1
Commercial unit heaters	NA	NA	NA	0.6	1.8	0.0	0.1
Dehumidifiers	0.3	0.4	0.5	0.2	0.5	2.4	0.0
Digital cable & satellite boxes	0.2	0.2	0.7	0.3	0.8	3.3	0.0
Digital television adapters	0.0	0.0	0.1	0.0	0.1	0.6	0.0
Exit signs	0.2	0.4	0.8	0.3	1.0	4.4	0.0
External power supplies	0.7	0.7	2.4	0.9	2.8	11.7	0.2
Large commercial packaged AC & heat pumps	1.6	2.3	0.8	0.3	0.7	3.8	0.0
Low-voltage dry-type transformers	0.4	0.7	1.6	0.6	1.8	8.1	0.1
Medium-voltage dry-type transformers	0.4	0.7	1.4	0.5	1.5	6.5	0.1
Metal halide lamp fixtures	2.9	4.7	4.5	1.7	5.1	21.3	0.3
Pre-rinse spray valves	NA	NA	103.5	0.8	2.2	0.0	0.2
Reflector lamps	1.3	1.3	1.9	0.8	2.2	9.1	0.1
Torchiere lighting fixtures	3.9	3.9	5.9	2.2	7.3	31.0	0.4
Traffic signals	0.2	0.2	0.6	0.2	0.8	3.3	0.0
Total	19.2	22.4	152.1	13.8	40.8	161.1	2.3

Note: Water savings include direct savings at the point of use as well as reductions in power plant water use.

Clearly, significant savings potential exists for these products at a small increase in first cost, resulting in large energy savings, economic savings, peak load reductions, water savings, and emission reductions over the life of the equipment. Given these benefits, we recommend that states adopt new efficiency standards on these products. This report provides specific recommendations that can be used to craft the appropriate legislation and regulations.

[5] A typical vehicle emits 12,000 lbs. of carbon dioxide each year (about 1,500 kg carbon), based on an average on-road fuel economy of 20 miles per gallon and average vehicle use of 12,000 miles per year.