EXECUTIVE SUMMARY

New standards will soon be drawn up by the U.S. Department of Energy (DOE) increasing or establishing new minimum energy efficiency requirements for

- residential furnaces and boilers
- commercial central air conditioning
- distribution transformers

As this report seeks to demonstrate, the stakes are high in DOE's rulemaking process for these priority products. Important opportunities to save energy, reduce energy-related pollution, avoid power outages, and save consumers money will be considered and decided upon during the course of these regulatory proceedings.

Major Benefits from Energy Efficiency

If finalized in 2006, new standards for these products have the potential to provide cumulative energy savings worth **at least $22 *billion* (2004$)** to consumers and businesses. About 22,000 megawatts (MW) of summertime peak demand for electricity could be avoided by 2030, an amount equivalent to the output of over 70 average-size new power plants. Annual natural gas savings will grow steadily as well, reaching about 190 billion cubic feet in 2020 and about 300 billion cubic feet in 2030. These 2030 natural gas savings are equal to about 10% of current U.S. total natural gas imports.

Table ES-1. Energy and Economic Savings of Proposed Standards

Product Category	Annual Energy Savings (All Fuels) in 2030 (T. Btu)*	Summer Peak Electric Capacity Reduction in 2030 (MW)	Net Present Value ($ billion)
Residential Furnaces and Boilers	507	7,000	14.7
Commercial Air Conditioners and Heat Pumps	120	12,600	2.3
Distribution Transformers	186	2,600	5.4
Total—Three Product Categories	813	22,200	22.4

* T. Btu = trillion British thermal units. This measure enables us to combine electricity and natural gas savings into a single figure. For perspective, households in the United States used about 11,000 trillion Btus of energy in 2001, so the total savings estimated here (813 T. Btus) equal about 7% of all energy used in households in 2001.

Tables A-1 through A3 in the appendix show detailed state-by-state and overall national energy, economic, and environmental impacts for each of the three standards. Appendix Table A-4 shows the state-by-state and national impacts of the three priority standards taken together.

These savings are predicated upon prompt action by DOE to set standards that are both ambitious and readily attainable. If the Department opts for unnecessarily weak standards, or delays the standard-setting process further, these savings will be reduced. For example, we estimate that each year of delay locks in increased annual electricity use of 3.3 million megawatt hours (MWh) and increased annual natural gas use of 11 billion cubic feet for at least 15 years. On a cumulative basis (i.e., over the lifetimes of the additional inefficient products sold due to a delay), a year of delay increases energy consumption by 66 billion kilowatt-hours of electricity and 186 billion cubic feet of natural gas. At current prices, this much energy is worth about $7.1 billion.

As substantial as these savings appear to be, the economic benefits estimate is quite conservative. Real economic savings are likely to be greater for several reasons. First, for ease of analysis, energy costs were assumed to hold constant at 2003 levels. The cost of natural gas has already increased somewhat in 2004, and if energy costs were maintained or increased in future years, the monetary savings from efficiency standards would be greater than projected here. Secondly, there has been no attempt to monetize the substantial environmental benefits provided by efficiency standards. Similarly, the monetary benefit resulting from improved electric reliability has not been included in this estimate. Additionally, the savings from efficient commercial air conditioners is understated, since savings estimates are based upon average electricity prices, and the summer rates and demand charges typical for commercial customers were not included. Finally, these projected savings will be higher if the actual costs of achieving any of the standards are lower than forecast, as is likely to be the case.

In addition to saving consumers money, improvements in the energy efficiency of appliances and commercial equipment will aid in the resolution of several key energy-related concerns now facing the United States. For example, reducing peak electricity demand could help relieve overloaded electric grids. Since air conditioning is a leading contributor to peak demand during times of system vulnerability, improved central air conditioning efficiency must be a key part of the solution to reliability problems.

Improved energy efficiency will also help ease the looming natural gas supply problems that are projected to keep consumer gas bills high and threaten manufacturing job losses in the years ahead. Saving peak electricity is one of the fastest ways to reduce natural gas consumption. Because gas is disproportionately used for peak electricity generation, reducing electric cooling loads could have a significant impact on gas usage and price. Additionally, since half of all residential energy use is for space heating and most homes heat with natural gas, efficiency standards for new residential furnaces and boilers will have a positive impact on natural gas supplies.

Air pollution and climate change also remain important national concerns. Some 120 metropolitan areas are in nonattainment status for particulates, sulfur dioxide (SO_2), or ground-level ozone, or some combination of the three. Improving the energy efficiency of appliances and commercial equipment will help reduce these continuing threats to public health from criteria pollutants and will reduce emissions that contribute to global warming as well.

Energy Efficiency Standards Are Key to Energy Savings

Just as energy efficiency is an important tool for addressing current energy-related problems, energy efficiency standards for new appliances and equipment are a key strategy for securing major energy savings. Minimum efficiency standards ensure that energy-saving improvements are incorporated into all newly manufactured products, thereby removing the most inefficient models from the marketplace.

In its *Annual Energy Outlook for 2004*, the U.S. Energy Information Administration (EIA) cited appliance and equipment efficiency standards as one of four key factors that have contributed to slowing growth in electricity use over the past thirty years. Looking ahead, EIA cites the promulgation of additional efficiency standards as a key policy for keeping electricity demand growth in check between now and 2025. Based on analysis of U.S. Department of Energy (DOE) data, the national efficiency standards adopted to date cut U.S. electricity use by 2.5% in 2000, and these savings are predicted to reach 6.5 and 7.8% of total projected electricity use in 2010 and 2020, respectively. Estimates of peak load reductions are similarly impressive, with a 2.8% reduction achieved in 2000 and reductions of 7.6 and 12.6% estimated for 2010 and 2020, respectively. These remarkable savings will be worth about $186 billion to U.S. consumers for products purchased through 2030, or about $1,750 per household.

Support for Efficiency Standards Is Widespread

A broad consensus exists in support of energy efficiency standards for new appliances and commercial equipment. Efficiency standards began as state policy in the 1970s, with numerous states including Arizona, California, Connecticut, Florida, Massachusetts, and New York establishing their own standards. The adoption of standards by these states precipitated the development of national standards. The original statute establishing national energy efficiency standards was signed into law by President Reagan in 1987. New and revised standards have been issued under successive Republican and Democratic administrations. New efficiency standards have also drawn bipartisan support in Congress.

Most recently, the National Association of Regulatory Utility Commissioners (NARUC) adopted resolutions in support of both expanded state efficiency standards and upgraded national efficiency standards. NARUC specifically urged DOE "to expeditiously promulgate and implement new national standards for commercial air conditioners and heat pumps; residential furnaces and boilers; and electric distribution transformers that achieve the greatest level of cost-effective energy savings."

New Efficiency Standards Are Overdue

The current standards for residential furnaces and boilers were originally adopted in 1987 and have been in effect since 1992. Their initial revision was due in 1994, to take effect in 2002. The current standards for commercial air conditioners were contained in the Energy Policy Act of 1992 (EPAct). Subsequently, the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) published revised efficiency standards for commercial air conditioners in 1999, and under the law, DOE is directed to follow with a national standard either affirming the ASHRAE standard or strengthening it. EPAct also called for new standards for distribution transformers to be published by 1996. These statutory calls to action have all come and gone, without even a *draft* standard having been proposed by DOE.

Delays in setting standards for priority products are all the more unacceptable when viewed in the context of commercially available technology. None of the standards proposed here will require additional research and development to achieve or new technological breakthroughs to bring to market. To the contrary, products from most major manufacturers are on the market today that will meet the standards proposed here to take effect five years from now, at the earliest.

The recommendations and energy savings estimates contained in this report anticipate final efficiency standards for all three priority products in 2006, with effective dates of 2009 for distribution transformers, 2010 for commercial air conditioners, and 2011 for residential furnaces and boilers. In light of previous delays, these dates represent the most expeditious implementation schedule possible consistent with the terms of the appliance standards laws and regulations.

Key Findings and Recommendations

The following are the key findings and recommendations of this report.

Standards for Residential Furnaces and Boilers

Space heating comprises a large portion of energy use in most American homes. Nationwide, about 50% of residential energy use is devoted to space heating, and altogether, about 70% of U.S. households heat with a furnace or boiler. Each year, over 3 million new furnaces and boilers are sold. Furnaces sold today can be expected to remain in service for an average of 18 years, and boilers last 25 years on average. Prompt action to strengthen efficiency standards for residential furnaces and boilers will quickly bring savings to millions of households. And since the vast majority (about 85%) of furnaces and boilers sold use natural gas or propane, stronger standards for these products will help temper future fluctuations in the supply and price of natural gas.

Energy efficiency standards for new residential furnaces and boilers should be set as follows:

- Raise the minimum efficiency for most types of furnaces and boilers by 4 to 9% (to 81 to 86% AFUE), varying by product type as noted in Table 3 (p. 22).
- Set a 90% AFUE standard (a 15% improvement that is readily achieved by condensing furnaces on the market today) for all gas and propane furnaces sold in 30 cold-weather states, as illustrated in Figure 3 (p. 21).
- Set a national standard for furnace fans that will reduce fan energy use by an average of about 60%.

Standards for Commercial Air Conditioners

Space cooling has been found to be the largest use of electricity in commercial buildings, comprising over 25% of their electric consumption in 1999. The energy savings potential of the commercial air conditioning market is significant, since there are more than four million commercial buildings in the United States. Over half of all commercial buildings (by square footage) and over two-thirds of all buildings with electric space cooling were served by packaged air conditioners in 1999. What's more, commercial air conditioners are a major contributor to peak demand levels. Summer peak demand is currently forecast to continue growing at an average rate of approximately 14,500 MW per year, or about 1.9% annually, through 2012. This *annual* growth is equivalent to the capacity of nearly 50 power plants of 300 MW each.

Energy efficiency standards for new commercial central air conditioners and heat pumps should be set approximately at the minimum life-cycle cost point, as follows.

- Standards for equipment with cooling capacity of 65,000 Btu/hr up to 135,000 Btu/hr should be increased by about 13% over current ASHRAE levels, as follows.
  - Air conditioner only or unit with electric resistance heat—11.7 EER
  - Air conditioner with gas or other heating—11.5 EER
  - Heat pump—11.5 EER

- Standards for equipment with cooling capacity of 135,000 Btu/hr up to 240,000 Btu/hr should be increased by about 19% over current ASHRAE levels, as follows.
  - Air conditioner only or unit with electric resistance heat—11.5 EER
  - Air conditioner with gas or other heating—11.3 EER
  - Heat pump—11.1 EER

Standards for Distribution Transformers

Distribution transformers reduce the voltage of an electric utility's power distribution line to the lower voltages suitable for most of the equipment, lighting, and appliances in businesses and homes. In 1996, an estimated 40 million distribution transformers were located within utilities' electric distribution systems, and about 16 million additional transformers were located on private commercial and industrial premises. More than 1.5 million new distribution transformers are purchased and installed each year, many of them by construction contractors equipping new commercial buildings for which they will never pay the electric bills. Distribution transformers are constantly energized, and they constantly experience some energy losses. Even small changes in transformer efficiency can add up to large energy savings. Improving transformer efficiency means that a larger portion of the power generated in power plants will reach the point in the electric system where it is put to work.

Energy efficiency standards for new distribution transformers should be set at the following efficiency levels.

- Low-voltage dry-type (single-phase and three-phase): levels in NEMA standard TP-1
- Medium-voltage dry-type (three-phase): levels of NEMA TP-1 plus 0.3%
- Medium-voltage liquid-immersed (three-phase): levels of NEMA TP-1 plus 0.2%
- Medium-voltage liquid-immersed (single-phase): levels of NEMA TP-1 plus 0.1%.

Other Products and Standards

In addition to the three product categories featured in this report, there are several other existing federal efficiency standards that should be upgraded without delay. Opportunities and recommendations for residential refrigerators and dishwashers, reflector incandescent lamps, commercial boilers, packaged terminal air conditioners, and small commercial central air conditioners are discussed in the final section of this report.