Efficiency Saves: Cutting Energy Waste Can Save $31,000 per Household

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Research Report

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Executive summary

Key findings

We model eight broad opportunities to reduce energy waste by deploying energy efficiency and demand flexibility throughout the economy. Using Energy Innovation's Energy Policy Simulator (EPS), we find that between now and 2050 these could significantly lower energy bills, help manage rising peak electricity demand, and strengthen the economy and the environment:

- Families and businesses avoid about $4.8 trillion in wasted energy and related costs cumulatively—almost **$31,000 per household**.
- Energy costs savings average **$215 billion** a year.
- Electric efficiency measures reduce growing peak demand by **20%** on average; the 208-GW average reduction is equivalent to the output of more than 400 large power plants.
- The U.S. economy nets an additional **1 million jobs** per year on average.
- The U.S. avoids **22 billion metric tons** of climate pollution cumulatively.
- Thousands of tons of small particulates and other air pollution are eliminated, resulting in approximately **278,000 fewer premature deaths** cumulatively.

Energy efficiency is the fastest, cheapest, and cleanest way to meet our energy needs while addressing the three major, interlocking energy challenges of rising home energy bills and gasoline prices, new demand for electricity from data centers and other loads, and high greenhouse gas emissions from burning fossil fuels. Cutting energy waste reduces bills, frees up electric system capacity, and slashes pollution. Efficiency can also improve health, comfort, and resilience, especially for limited-income and rural communities that are struggling economically. Demand flexibility—shifting electricity demand to times when the electric system has more capacity to meet it—provides similar benefits.

Achieving these energy savings requires a number of strategies, including reducing energy waste (e.g., through more insulation in buildings); newer efficient technologies (e.g., industrial heat pumps); using sensors, controls, and communications to make systems work better (e.g., digital freight networks); and shifting electricity demand to reduce strain on the grid (e.g., preheating water). Among the most important public policies to drive these changes are

- Efficiency standards: vehicle standards, appliance efficiency standards, energy codes for new buildings, and performance standards for existing buildings
- Consumer information: ENERGY STAR, home energy ratings, and vehicle labels
- Financial incentives: programs to help limited-income and other utility customers purchase more efficient products

- Research, development, and demonstration funds to invent and commercialize new technologies

In this report, we combine many technologies, programs, and policies into eight broad energy efficiency and demand flexibility opportunities for residential and commercial buildings, industry, and transportation: (1) buildings equipment efficiency, (2) zero-emissions new buildings, (3) existing building improvements, (4) industrial energy efficiency and electric heat, (5) reduced industrial materials, (6) efficient and electric vehicles, (7) transportation system efficiency and access, and (8) electricity demand flexibility. We then use the EPS to model the impacts on energy bills, electricity demand, climate pollution, and other metrics through 2050. We assume widespread implementation of the measures, which would require concerted, long-term public and private action and yield large benefits. We include measures that shift from fuels to electricity in all three economic sectors when they are the best way to achieve large energy savings.

The analysis shows that the package of efficiency measures would reduce energy bills and associated operating costs in homes, commercial buildings, industry, and transportation; they require only modest net capital investments. Total net savings rise to about $550 billion a year by 2050 (figure ES1). Cumulative net savings are $4.8 trillion (discounted present value), which is almost $31,000 for each American household. For comparison, that is more than the $3.6 trillion that Americans spent on housing in 2024.

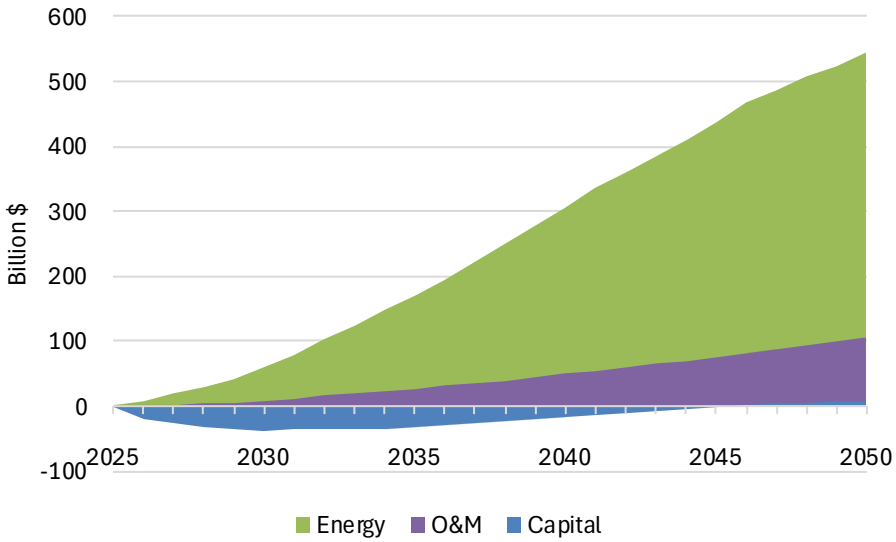

Figure ES1. Total costs and savings (energy, capital, and operations) by year in real 2025 dollars from the set of energy efficiency and demand flexibility measures modeled. Negative numbers are added investment.

Energy cost savings alone are $215 billion a year on average and steadily rise to $439 billion in 2050. Almost half of these savings go directly to families—$636 annually per household on average—in the form of lower home energy bills and vehicle fuel costs.

Efficiency yields major savings in gas and oil costs.[1] While electricity costs would at first rise modestly, due to a shift to electric equipment and vehicles, by 2043 the full set of measures also lowers overall

[1] Throughout this report "gas" is used to refer to natural gas, which is mostly methane, and liquefied petroleum gas (LPG) or propane.

electricity costs. Remarkably, the efficiency measures modeled in EPS save more than their initial upfront investment *even apart from the energy savings*. This is because industrial material and transportation system efficiency reduce operations and maintenance costs, such as fewer vehicle repairs, as well as the need for capital investment.

The more efficient use of electricity also relieves pressure on the electric system. Electric efficiency measures (i.e., other than measures that shift use from fuels to electricity) reduce peak demand by 20% on average through 2050 or 208 GW. The reduction would leave capacity for new loads from data centers, heat pumps, and electric vehicles. By 2050 those efficiency measures reduce electricity use and peak demand by even more: 1,788 TWh (32%) and 440 GW (37%), respectively. In the EPS model, demand flexibility reduces the peak use of the most expensive power plants, like those fueled by gas and oil, rather than total peak demand; it reduces peak fossil generation by 14%, and the 67-GW reduction in 2050 is equivalent to the output of more than 130 large power plants.

When families and businesses save money on energy bills, they also create new jobs throughout the economy as they spend the money saved. This is in addition to the jobs directly created by efficiency investments. The EPS model estimates an average of 1 million net additional jobs per year, rising to 1.8 million jobs in 2050, from the suite of measures.

The reduced energy waste delivers significant environmental and health benefits. It reduces climate pollution by 1.6 billion metric tons of carbon dioxide equivalent (CO_2e) in 2050, a 34% reduction from baseline emissions in that year. Cumulative emissions reductions through 2050 are 22 billion tons of CO_2e. The reduced burning of fossil fuels also results in 24% less energy-related small particulates, 22% less sulfur dioxide, and 33% less nitrogen oxides. The environmental benefits bring health benefits, including an estimated 278,000 fewer premature deaths due to particulates between now and 2050.

Unfortunately, the current attacks on federal, state, and local energy efficiency policies threaten more waste, higher energy bills, less ability to power new data centers, and more pollution and health problems. We urgently need to reverse course and use the power of energy efficiency to reduce energy costs, free up electric grid capacity, cut pollution, and meet our energy needs.