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Energy Efficiency Fact Sheet

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Industrial Energy Efficiency

Using new technologies to reduce energy use in industry and manufacturing

Key Facts

- Industry uses over one-third of the energy consumed in the United States.
- Oil and natural gas provide nearly four-fifths of industrial energy; the rest comes mostly from electricity and coal.
- Between 1990 and 2003, US industrial output has grown 25 percent but industrial energy use has increased only by 2 percent.

Efficient Industrial Technologies

- *Combined heat and power:* When electricity is generated, the heat produced as a by-product can be captured and used for process steam, heating or other industrial purposes. Conventional electricity generation converts about a third of the fuel's potential energy into usable energy, while combined heat and power, also called cogeneration, converts as much as 90 percent of the fuel into usable energy. This technology allows companies to generate power on-site, so they do not need to purchase as much electricity from the utilities.
- *Motors:* Engines typically run on a constant flow of energy, which is often higher than needed for normal operations. An adjustable speed drive can vary the motor's energy output to match the load, achieving energy savings ranging from 3 to 5 percent up to 60 percent, depending on how the motor is used. Using superconducting materials in motor coils can also greatly reduce energy losses.
- *Steam systems:* Over 45 percent of the fuel used by US manufacturers is combusted to make steam. According to the US Department of Energy (DOE), the typical industrial facility can reduce this energy usage 20 percent by insulating steam and condensate return lines, stopping steam leakage, and maintaining steam traps.
- *Compressed air systems:* Many industries use compressed air for sand blasting, painting, or other tools. Optimizing compressed air systems by installing new equipment with variable speed drives, along with preventive maintenance to detect and fix air leaks, can improve energy efficiency 20 to 50 percent, according to the US Department of Energy.
- *Continuous fiber ceramic composites:* These new composites are light, strong, and corrosion resistant. They heat up quickly and can be used in heat exchangers where they are able to operate efficiently at higher temperatures than metal components. They can be used as liners around turbines to seal in heat and gases, preventing leaks and withstanding high temperatures for long periods of time, thereby reducing the turbines' maintenance downtime and increasing its efficiency.
- *Combustion:* Advanced boilers and furnaces can operate at higher temperatures while burning less fuel. These technologies produce fewer pollutants in addition to being more efficient.

Advances in the Five Most Energy-Intensive Industries

- *Aluminum:* Smelting aluminum is highly energy-intensive, as it involves passing electrical current through molten aluminum. Demonstration projects conducted by the Department of Energy using new technologies and materials apply the current more efficiently and allow the smelting process to occur at lower temperatures, achieving energy savings of 20 to 30 percent over technologies in use today.

- *Chemicals:* The chemical industry is developing new catalysts to lower the energy requirements for various chemical reactions. Many chemicals, including petroleum, need to be separated into their components. Scientists are developing membranes separate chemicals using less energy than distillation or centrifuges.
- *Forest products:* The forest products industry is the third largest industrial consumer of energy. In combined heat and power plants, it uses its wood waste to generate more than half the energy it uses. Drying paper is the most energy-intensive step in paper production, and a new process called impulse drying can reduce the energy required to dry paper by up to 50 percent. The paper industry is also developing new bleaching agents to use less energy while creating less toxic by-products.
- *Glass:* New and recycled glass must be melted so that it can be shaped into the desired products. DOE demonstration projects with new, heat-resistant materials and furnaces that use pure oxygen rather than air use 5 to 7.5 percent less energy than older furnaces.
- *Steel and other metals:* Producing a ton of steel in 2005 requires 25 to 50 percent less energy than in 1970, according to a study by the International Iron and Steel Institute (IISI). Research into energy efficiency is continuing, and improved metal casting technologies reduce the need to rework parts, lower the number of defects in the metal, and can allow metals to be cast in a continuous process, which is more energy efficient than traditional multi-step casting processes.

Costs and Benefits

- Over the past 25 years, the DOE's Industrial Technologies Program (ITP) has supported more than 600 research, development, and demonstration projects that have produced over 160 new technologies. In 2003, technologies developed with this program's assistance saved industry more than 121 trillion Btus, about $740 million (based on 2004 industrial energy prices), according to ITP.
- The Dallas-Fort Worth International Airport reduced energy usage at its central plant by 28 percent from 2001 to 2005, resulting in a total avoided energy use of 25 million MMBtus, or $150 million at today's energy prices. The airport estimates its nitrogen oxide (NOx) emissions have been reduced by 86 percent.
- At its 300,000-square-foot bakery in Sacramento, California, Sara Lee replaced a 150-horsepower air compressor with a 100-horsepower unit fitted with a variable-speed drive, fixed leaks, and made other repairs. It now uses about 470,000 kilowatt-hours less electricity annually and saves $40,000 per year in operating costs (at 2005 energy prices). The new equipment requires less maintenance—an additional $10,000 per year savings. After an $11,000 rebate from the Sacramento Municipal Utility District, the total project cost Sara Lee Corporation only $27,000, yielding a simple payback time of only 6.5 months.

Issues

- *Financing:* Companies installing energy-efficient equipment can incur significant capital costs. Companies can avoid these upfront costs by contracting with an energy service firm that purchases and installs the new equipment, and then is paid from the energy savings, under an agreement known as an energy service performance contract (ESPC).

For More Information

American Council for an Energy Efficient Economy http://aceee.org/industry/index.htm
Consortium for Energy Efficiency, Inc. http://www.cee1.org/ind/ind-main.php3
Industrial Efficiency Alliance http://www.industrialefficiencyalliance.org
US Combined Heat and Power Association http://uschpa.admgt.com
DOE Office of Energy Efficiency and Renewable Energy http://www.eere.energy.gov/EE/industry.html

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