Today's Chip Industry, Energy Efficiency, and the Benefit to Our Environment

DOING MORE USING LESS
From the cell phone in your pocket to the data centers that support the Internet; from the hybrid vehicles plying our highways to the solar panels increasingly dotting our neighborhoods; from the refrigerator in your kitchen to the motor controls running our nation’s largest manufacturing facilities — today, chips are allowing us to do more with less. **WHAT WILL THEY DO FOR OUR PLANET TOMORROW?**
The technological innovations of the past half-century have created whole new industries with millions of high paying jobs. Technology has boosted American productivity, wages, and the quality of our lives. Sometimes overlooked, however, are the enormous strides that have been made in delivering these capabilities in ever-more energy efficient and environmentally friendly ways.

A study by the American Council for an Energy-Efficient Economy found that for every extra kilowatt-hour of electricity that is demanded by information and communications technology, the U.S. economy increased its overall energy savings by a factor of about 10 on average. These savings are a result of the phenomenal increases in economic productivity that are created as faster, better, and cheaper semiconductors, computers, and telecommunications equipment are widely adopted, creating efficiencies throughout the economy.

Whether it is in reducing the energy demand of the world’s largest data centers or enabling mechanisms that make everything from cars to supermarket refrigeration systems more efficient—chips play a key role in today’s energy conservation and climate protection efforts.

Chips are also an integral component in many of the alternative energy technologies that are being developed to allow us to operate today and grow tomorrow in ways that our planet can sustain.
SAVING ENERGY IN THE APPLIANCES WE USE IN OUR HOMES EACH DAY

Thirty years ago, a mid-sized television set, coffee pot, refrigerator, washer/dryer, lamps, and a toaster were among the staple items plugged into the wall in most homes. Today, large panel digital TVs, game consoles and more than 30 other items demand electricity in many homes. Adding to the situation, a significant share of the consumption of electricity in America is required to operate household appliances, such as refrigerators or washing machines, that use energy to turn a motor that may rely on decades-old and inefficient control technology.

In the rec-room, chip advances like digital signal processors and high-performance analog power supply controllers allow HDTVs and other electronic goods to achieve energy conversion efficiencies approaching 90%. Meanwhile, in the utility room and kitchen, chip-enabled motor control technologies increasingly allow consumers to use smaller, more efficient motors with greater and greater levels of performance in their many motor driven household appliances, including refrigerators, dishwashers, and washing machines.
Chip advances like digital signal processors and high-performance analog power supply controllers allow HDTVs and other electronic goods to **ACHIEVE ENERGY CONVERSION EFFICIENCIES APPROACHING 90%**.
The basic design principles of the four-stroke internal combustion engine that propels a car has remained largely the same since it was patented in 1884. The dramatic improvements in fuel efficiency and emissions control that we have witnessed over the past decades have largely been delivered by changes in engine control electronics.

Today’s vehicles have countless chip-enabled features such as gasoline direct injection, knock detection, oxygen sensors, exhaust gas recirculation, evaporative emission control systems, misfire detection, and secondary air systems. Even electronic steering systems leverage chip technology to eliminate the hydraulic system and associated engine drag to improve efficiency. These chip-based features both reduce energy consumption and improve vehicle performance and safety. And, thanks to further chip advances, tomorrow’s vehicles will feature even more fuel saving electronic features such as electronic throttle control, variable valve timing, cylinder deactivation, camless engines, and in-cylinder combustion control.

SAVING ENERGY IN THE CARS WE DRIVE
Chips additionally play an integral role in the increasingly popular hybrid cars available to energy-conscious consumers across the nation. And chip advances will be critical to expanding the consumer utility of plug-in electric vehicles by substantially extending their range and performance.

**These chip-based features both reduce energy consumption and improve vehicle performance and safety.**

And, by allowing a new level of interconnectivity – and thus enabling telecommuting, teleconferencing, and remote education – chips are an integral part of the effort to reduce the amount we drive in any vehicle. In fact, according to a 2007 study by the Consumer Electronics Association, using electronics for telecommuting saves the same amount of energy used by roughly one million U.S. households each year.
LCD screen power savings delivered by a single chip company have resulted in 20 million kilowatt-hours of energy savings per year, **ENOUGH TO PREVENT 16 MILLION POUNDS OF CARBON DIOXIDE FROM ENTERING THE ATMOSPHERE.**
Twenty years ago, a mobile phone made only calls, required its own carrying case, and weighed as much as most hardback bestsellers. Today, mobile phones slip in your pocket, can run for days on a charge, and offer functions like Web access, music and video downloads, and the ability to take and send pictures. Yet, these same devices use less power, allowing extended battery life and longer lapses between recharges. Similar developments have improved the functionality and efficiency of laptop computers.

Chip technologies are currently in development that would allow a mobile phone to run off a single battery for extended periods of time, perhaps even years. Advances in chip technologies are also being applied to solar power systems. This will enable tomorrow’s laptops and other more power intensive portable devices to recharge using solar power and to operate in dim ambient indoor light.

Chip advances have additionally allowed us to significantly decrease the electricity consumption of desktop computers in our homes, in some cases by as much as 40%. For the LCD screen, power savings delivered by a single chip company have resulted in 20 million kilowatt-hours of energy savings per year (enough to prevent 16 million pounds of carbon dioxide from entering the atmosphere).
In 2006, the United States spent nearly $4.5 billion in energy costs to power the servers, cooling, and auxiliary infrastructure equipment in data centers. However, recent chip advances bring new means for saving energy in all arenas of data center operation. Chip advances have the potential to significantly lower the energy used and heat generated by servers. During computations, which

Data centers provide the massive computing power necessary to drive the Internet and the ever-expanding global communications network of satellites, fiber optics, and cell phones. ENERGY, HOWEVER, IS PROVING TO BE THE BIGGEST CHALLENGE FACING DATA CENTER ADVANCEMENT.
account for about 35% of a server’s energy draw, new chip technologies allow those parts of the processor not fully engaged in an application to draw reduced amounts of energy. Meanwhile, new chips can also reduce the energy use by up to 40%, even in the less energy-intensive memory arena. Chip technologies also improve the efficiency of the data center cooling systems and enable intelligent sensing, control, and communication capabilities that further reduce energy usage.

The more energy efficient data centers will in turn become increasingly important as the Internet contributes to energy efficiencies in homes and businesses. Intelligent metering will allow market-based pricing to reflect demand on the electric grid, thereby encouraging consumers to shift to off-peak hours; and networks of sensors will automatically lower lighting and adjust heating and air conditioning when people are not present.
It is estimated that industrial applications of new energy-saving chip technologies could **improve energy efficiency by up to 88% due to more efficient motor control and power management.**
SAVING ENERGY IN THE MACHINES THAT RUN OUR FACTORIES AND OTHER WORKPLACES

Two-thirds of the world’s industrial electricity runs electric motors and only 5% of these use variable speed drives, which consume $\frac{1}{8}$ of the energy as a constant speed drive. The 5% of electric motors that do use variable speed drives are estimated to save the energy produced by 10 power plants and annually prevent the emission of 68 million tons of greenhouse gases.

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Chip-enabled motion and video sensors are increasingly being used in commercial and industrial settings to control lights and heating, ventilation, and air conditioning systems based on movement within a room or building. Such smart facilities take on the task of making sure the environment is suitable for the worker while saving energy.
It is predicted that there will be 5,500 megawatts (MW) of installed solar power systems worldwide by 2010 – up from about 1,400 MW in 2005. **CHIPS PLAY A KEY ROLE IN THE ELECTRONICS USED IN BOTH SOLAR AND WIND-GENERATED POWER SYSTEMS.**
ENABLING THE ALTERNATIVE POWER TECHNOLOGIES THAT WILL FUEL OUR FUTURES

New technologies are helping make alternative energy more efficient and cost-effective. The availability of these new technologies combined with rising fossil fuel costs and a growing understanding of the impact that the wide-scale use of traditional energy sources is having on our environment is making renewable energy an increasingly viable option for industrial and consumer applications.

Central among these alternative renewable energy sources are solar and wind-generated power. It is predicted that there will be 5,500 megawatts (MW) of installed solar power systems worldwide by 2010 — up from about 1,400 MW in 2005.

Chips play a key role in the electronics used in both solar and wind-generated power systems, including solar inverters and wind turbines, which convert direct current from solar panels or turbines into usable household alternating current. With the latest chip technologies, system efficiency is maximized so it can be productive even on cloudy and low wind days.

Chip technologies are also being researched to better use solar power — both natural sunlight and indoor ambient — in recharging the batteries of portable devices.
Increased energy efficiency and the resulting decrease in energy consumption deliver tremendous benefits that range from cost savings for consumers, to improving public health, to reducing America’s dependence on foreign energy resources, to the long-term improvement of the Earth’s atmosphere by reducing the greenhouse gas emissions that contribute to global warming.

Semiconductors play a key role in addressing America’s energy challenges today and protecting our global environment tomorrow. That’s why the Semiconductor Industry Association and America’s semiconductor companies are reaching out to policymakers to work on policy solutions now that will help all of us do more with less.
SIA POLICY RECOMMENDATIONS

- **Invest in Energy Efficient Research and Development.** Government and industry need to increase research and development investments in energy efficient technologies to reduce the rapid growth in energy demand and the impact it is having on the environment. By increasing funding for targeted energy efficiency research, expanding public-private partnerships, and enhancing economic incentives, such as the federal Research and Development Tax Credit, we can help increase the pace of technology innovation and deliver solutions to our energy and environmental problems more rapidly.

- **Build Awareness of Energy Efficient Technologies and Practices.** Consumer awareness and demand for energy efficient products is the key to developing a scalable and sustainable market for energy efficient products. Government and industry...
can help expand consumer awareness by advancing policies that help educate consumers about the environmental, health, social, and economic benefits that energy efficient technologies deliver.

Create Incentives for Innovative Energy Efficient Solutions and Technologies. Government can help expedite the development and adoption of energy efficient technologies and solutions by providing incentives for manufacturers that develop products that meet high standards for energy efficiency and incentives to motivate consumers and businesses to invest in energy efficient products and technologies. For example, federal tax incentives currently provided for manufacturers and consumers of certain appliances that meet high standards for energy efficiency could be expanded to include electronics, computers, and related equipment. Other proven policy treatments include providing tax credits for capital investments and expenditures related to producing energy efficient technologies, promoting energy utility rebate programs for manufacturers, consumers, and businesses that invest in energy efficient technologies, and other targeted incentives to help businesses, consumers, and manufacturers establish a sustainable market for highly energy efficient technologies and products.

Establish Public-Private Partnerships to Drive Energy Efficient Technology Standards and Share Best Practices. By joining forces and sharing resources, government and industry can more readily respond to the need to create effective standards and share best practices that will increase energy efficiency and reduce energy use. Government-industry collaborations can include sharing current research on advanced materials, surveying public and private Information Technology managers on ways to reduce their IT energy costs, and identifying promising areas for future research.

For more information, visit www.sia-online.org.
ABOUT THE SIA
The SIA is the leading voice for the semiconductor industry and has represented U.S. semiconductor companies since 1977. Collectively, the chip industry employs a domestic workforce of 216,000 people. More information about the SIA can be found at www.sia-online.org.