



Environmental Sustainability and Innovation in the Consumer Electronics Industry





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Letter from the Consumer Electronics Association

We are pleased to present to you the first-ever consumer electronics (CE) industry environmental sustainability report. As the preeminent trade association representing the consumer electronics industry, the Consumer Electronics Association (CEA)[®] is benchmarking our industry's progress toward environmental sustainability while highlighting our industry's environmental accomplishments. These strategies not only benefit our industry and our customers, but they also contribute to the health of people and the planet.

The CE industry attracts the best and brightest minds—visionaries, who can see the world in 30 years as if it were today, and who develop technologies and products to meet the needs of our children and grandchildren. Indeed, our industry is shaping the world and the way we communicate and connect to one another. Our products take cars off the roads and reduce emissions from office buildings by enabling telecommuting. And we must do more, for we cannot look to the future without recognizing a great ethical responsibility to our environment. We exist not only as part of a global economy, but also as part of a global ecosystem. Our future success will be

determined as much by our stewardship to the environment as to our customers, employees and business partners.

We have the highest confidence that the people who have changed our world with ubiquitous devices such as mobile phones and computers as well as technologies such as digital photography and high-definition television can have an even greater impact through innovations in environmental sustainability. Our progress will include at times small steps as well as great leaps. This report not only shows the great progress we have made, but it also helps light the way for the future by identifying opportunities for continued improvement. CEA is committed to leading this effort by providing support to our members with environmental initiatives currently underway, as well as educating the broader CE industry about best practices in sustainability. The CE industry has an important role in environmental sustainability. We look forward

to the continued strides by our industry to not only provide great products and services, but also to protect and preserve our environment.



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Introduction and Methodology

The consumer electronics industry is a globe-spanning network of tens of thousands of companies, including companies that make materials and components, design, manufacture and distribute products, and sell them in retail stores and online. More and more, the environment is taken into account as companies perform these activities.



For purposes of this report, CEA defines environmentally sustainable business as *business that operates in a way that meets the needs of the present without compromising the ability of future generations to meet their own needs.*

The CEA's definition is a variation on the classic Brundtland Commission definition of sustainable development: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

This report explores environmental sustainability and innovation in five ways:

- First, we examine how companies have changed their design process to create products that are more streamlined, need less packaging, contain fewer harmful chemicals, and allow for increased reusability and recycling.
- Second, we look at the way products contribute to conservation of energy and electricity.
- Third, we study companies' internal processes to uncover best practices in lean manufacturing and greening of facilities.
- Next we focus on clean delivery strategies—those that keep the supply chain efficient, conserve resources, and encourage minimal waste.
- Finally, we highlight companies' successful strategies for giving back to their communities.

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To more carefully measure the extent to which consumer electronics companies have improved business practices and implemented process changes to become more sustainable, we examine quantitative research on companies that make popular products found in stores, such as cell phones, computers, televisions and digital cameras. In examining existing practices, we noticed immediately that some systems bring environmental benefit as a natural component of doing business. In these instances, no tradeoff exists between profit and planet, and each day, companies are discovering more and more ways to align these two goals. Next, we interviewed dozens of people in the industry who are working on their companies' environmental products and programs to determine what changes we have to look forward to in the future, and what challenges still exist. We identified 31 companies with the largest market share, representing 16 categories of products; 20 of these companies track and report their environmental data. **These top 20 companies make about half of the consumer electronics units in the global marketplace.**

They employ about 2 million people globally and had combined revenue of around \$700 billion in 2007, according to public financial information.

We looked at these companies' use of electricity, natural gas and water; the waste they generate and chemicals they use; greenhouse gas emissions (especially carbon dioxide); and practices for taking back products for recycling after consumers have finished using them. All companies have programs underway to minimize resource and chemical use—this is simply good business, for such practices save money.



From these interviews, we documented many stories of exemplary practices occurring right now, as well as technical and business innovations that could bring greater benefits in the future. These industry-wide practices and specific inspiring cases we gathered form the bulk of the report.

Finally, to gain some sense of this huge CE industry's quantitative environmental impact, we gathered data on companies' use of resources and their recent conservation efforts; the results are summarized throughout the report. To dig deeper, we connected directly with the people working toward environmental sustainability among major consumer electronics companies—and many others in the industry—and found some truly exemplary practices.

It is important to note that environmental and economic benefits sustain all key industry stakeholders, including customers, investors and business owners.

These exceptional stories are highlighted throughout the report. Our hope is to drive adoption of these practices more widely across the industry.

It is important to note that environmental and economic benefits sustain all key industry stakeholders, including customers, investors and business owners. The CE industry has already begun committing significant time and resources toward environmental leadership.

The results of this study indicate that the industry likely will invest even more resources, and it pledges to redesign products and components, conduct extensive due diligence, design efficient supply chain processes, and make internal commitments to fortify green policies. Maintaining a green attitude to business will certainly be a crucial part of the CE industry's innovative future.



Key Findings

In examining environmental data from 20 of the largest consumer electronics companies by market share, we found that most were looking for ways to reduce waste, conserve resources and shrink product size. Nonetheless, a diversity of results has been achieved, and this study is one of the first to highlight the range of behaviors, so that more companies can move into the realm of the highest performers.

- For example, electricity use per one million revenue dollars decreased by 5–25% during the past three to four years among those companies that achieved reduction, according to their own reports. The exemplary companies are using dramatically fewer resources and are making genuine efforts to “close loops” by taking back products and selling their unusable materials to other companies.
- From 2003 to 2007, one company reduced its electricity use per employee by an impressive 58% (despite increasing the number of employees by 60%). Another decreased its electricity use per million dollars of revenue by 46% while increasing revenue by 43%. **Two truly exemplary companies reduced their absolute electricity use, even while growing their businesses. Together, they saved 223,000 tons of CO₂ from entering the atmosphere. That is the equivalent of taking 51,000 cars off the road for a year.**

- Efforts to reduce greenhouse gas emissions demonstrate the diversity of company behavior as well as the promise of emulating the top performers. Looking at the emissions of 10 major companies that have tracked this data during the past three years, we found that seven of the 10 lowered their emissions per million dollars, and four companies actually lowered their absolute greenhouse gas emissions—meaning that they emitted less carbon even while the company grew. Clearly there is an opportunity for all companies to learn from the exemplary players. If several large companies can achieve reductions, it’s likely many others can also.



- At least half the companies we interviewed were diverting 80% or more of their unusable materials from landfills and some diverted as much as 98%. They found more creative uses such as recycling the materials or selling them to partners who used them as feedstock in their own businesses. **If all 20 of these companies sent no more than 2% of their waste to landfills, nearly two million tons of material would be beneficially repurposed.** And we estimate that nearly 600 million tons of used electronics products have been recycled by these top 20 companies alone.

Also included in this report are the results from a joint survey performed by TFI Environment and Sims Recycling Solutions of 64 companies—a few large and well-known, and many mid-sized and small players—regarding their recycling, reuse and conservation efforts. The results demonstrate that among this diverse and representative set, there is quite high engagement with environmental practices. For example, 69% of respondents are already recycling, and 38% are reusing some form of the electronics products they make or use.





Eco-Design of Products

Eco-Design of Products

Eco-design means starting off right: Creating products out of environmentally friendly materials, using efficient designs that require fewer materials, and maximizing reusability and recyclability.

Some practices in the consumer electronics industry already bring about the result of lower environmental impact. Miniaturization is a clear example: As cell phones, computers, cameras, and nearly every other product become smaller and lighter for easier portability, so too do their environmental footprints shrink. Smaller products require fewer raw materials to extract, less energy to transport the raw materials and fabricate components, smaller floor space in manufacturing, fewer trucks and ships for transporting finished products, often less energy during product use and



BRINGING IT ALL TOGETHER

EPSON[®] EXCEED YOUR VISION Seiko Epson takes into account the entire life cycle of its printers and other products while they are still in the design phase, earning the company 13 eco-design awards in two years. For instance, it has created its own database of the environmental impacts of chemicals, established quantitative metrics of businesses' impact on society, and designed its own labeling system called EcoLeaf.

Epson makes its packaging out of trees specifically grown for that purpose, and plants 20% more trees than are consumed. Each product comes with a full Ecology Profile that includes recycling information about every component. Printer product components are also 85% recoverable.

reuse, and less to recycle at end of life. When the product's package is designed to be as small and light as possible, materials are further reduced and shipping and shelf-space optimized even more. These days, even the product manuals are reduced in size or distributed electronically. All of these steps save resources (and money) and result in less carbon emission.

The signature practice in eco-design is called Design for Environment (DfE). In the United States, the Environmental Protection Agency publishes an evolving set of guidelines that many companies have found helpful for DfE. Implementation of these guidelines assures that products use the minimal amount of the most benign and

STAYING AHEAD OF THE CURVE



The European Union's Restriction of Hazardous Substances (RoHS) directive went into effect in July 2006, limiting the usage of five classes of materials. Even prior to this directive, Nokia had decided to voluntarily omit certain compounds from its products because their safety to human health and the environment was in question. Nokia's design-for-environment engineers worked with the environmental department to remove about 225 additional substances from the company's products.

recyclable materials and that they are constructed to be easy to disassemble, for instance by using simple screws or snap fits rather than glue between parts. Most top companies now have explicit DfE programs, and others include some of these principles as part of cost reduction efforts. For example, both Hewlett-Packard and Philips began incorporating DfE principles into their product design more than 15 years ago. Additionally, the CE industry is minimizing or eliminating the use of hazardous chemicals or materials where feasible.

Many companies are creating additional internal guidelines on the weight, noise, energy use, and number of recyclable parts for their products. And more and more components are designed to be recoverable (the company can reuse them), meaning

that companies have strong incentive to retrieve products when their customers are finished with them.

How can consumers choose products with good eco-design? The Green Electronics Council (GEC) has created a rating system called EPEAT (Electronic Product Environmental Assessment Tool) that evaluates products on 51 environmental criteria in eight categories, including materials use, design for end of life, and packaging. GEC estimates that 2007 purchases of EPEAT-certified products have reduced the use of primary materials by 75.5 million metric tons (equivalent to the weight of more than 585 million refrigerators) and reduced the use of toxic

LINKING BACK TO DESIGN



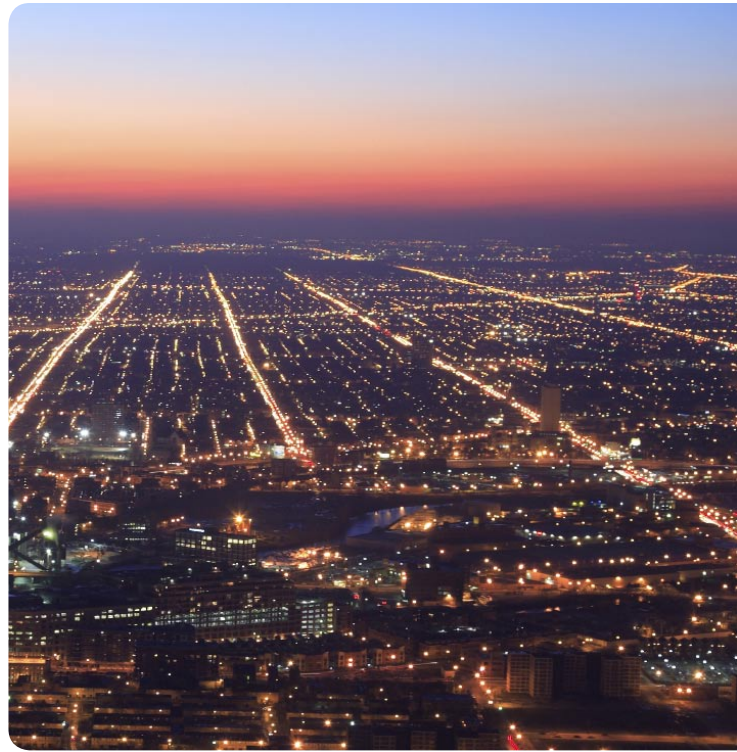
In a brilliant example of the cycle of value, Lenovo is driving the use of post-consumer recycled material in its products. This recycled material is designed in—meaning that the company moves from this fifth sustainability practice back the first! And the cycle repeats.

Lenovo's EPEAT Gold monitors have over 25% recycled material in them, and this is increasing with the design of each new product. All of Lenovo's product lines use recycled plastic and metals; the gold, silver and other precious metals are recovered from end-of-life products. Using specifically post-consumer material has become a keen focus this year for Lenovo and is an effective differentiator in the market for the company.

materials, including mercury, by 3,220 metric tons (equivalent to the weight of 1.6 million bricks). In addition, the electricity savings are 42.2 billion kilowatt-hours—enough to power 3.7 million U.S. homes for a year.

And the power of the purchasers' dollars matters. Philips claims that 20% of its sales come from 'green products', which offer significant improvement in the company's green focal areas (including packaging, hazardous substances, and recycling and disposing). Epson's customer surveys show that 46% of its consumers pay attention to green criteria when buying. Easy access to green criteria is growing. For example, CEA created www.myGreenElectronics.org to help consumers choose products that qualify for various eco-efficiency certifications.

The Green Electronics Council notes that 90% of a product's environmental attributes come from design, so starting off right is a critical step. A specific aspect of design—the reduction of energy consumption during use—is explored in the next section. For consumer electronics products, the energy used while the product is in people's hands typically exceeds the energy used to make the product, so paying attention to this phase of a product's life cycle is very important.



DID YOU KNOW?

Savings from 2007 purchases of EPEAT-certified products are equal to 75.5 million metric tons of primary materials, 3,220 metric tons of toxic materials and 42.2 billion kilowatt-hours—enough to power 3.7 million U.S. homes for a year.



Energy Efficiency of Products

Energy Efficiency of Products

Products designed to be energy-efficient use less electricity from outlets or run longer before needing recharging or new batteries.

This efficiency reduces greenhouse gas emissions and hazardous waste and saves money.



As with the cost reduction mentioned in the last section, energy efficiency is a goal of all consumer electronics companies whether for physical design, cost, or competitive considerations.

Accordingly, continuous improvement is seen across the industry in nearly every product. Voluntary, market-oriented energy efficiency programs in the CE sector strive to reduce power consumption without sacrificing product performance, features or functionality for the consumer. In portable devices, long battery life and alternatives to batteries are differentiators, which bring the additional environmental benefit of producing, using and properly disposing of fewer batteries.

Several consumer electronics companies have created Lifecycle Analysis (LCA) tools that measure the energy consumption of every aspect of a product's life. Using this

tool, the companies can select the raw materials, components, manufacturing processes, delivery methods, energy draw during use, and reuse-recycling strategies that minimize energy consumption. All of these energy-saving factors are decided before the product's design is completed.

To name just a few specific examples of energy efficiency gains in consumer electronics products, Panasonic has reduced the power consumption in its plasma televisions by 96% since 2000. As a result, customers have saved around 3.6 billion kilowatt-hours of electricity,

RACKING UP THE ENERGY SAVINGS



Intel's new microprocessors use nearly 10 times less power than models from just 18 months ago. The Core™ 2 Duo processor uses 40% less energy to do 40% more work than the previous Pentium processor. The total energy savings from all the Core 2 Duo products in the marketplace is equivalent to taking millions of cars off the road. And the newer Xeon processor gives another 35–60% efficiency gain over previous products.

Intel also works to improve the energy efficiency of business data centers, which combine many processors. Its Eco-Rack design reduces power consumption by 16–18%, which, if it were used by all servers and data centers in the United States, would save the equivalent of the energy used by 986,000 homes. Each Eco-Rack saves about \$44,000 in electricity costs.

Intel provides employee incentives for innovations in energy efficiency: Bonuses are tied to efficiency milestones, and the Intel Environmental Excellence Award recognizes highly innovative projects.

FLAT PANELS WITH SLIM ENERGY USE

lenovo Lenovo understands its customers' interest in energy savings and has stepped ahead of the curve. A few years ago, people were satisfied to replace their bulky CRTs with flat panel monitors, which use half to two-thirds as much energy. But Lenovo goes on to ask how efficient the flat panel can be. Its monitors are up to 33% more efficient than other flat panels on the market. And the company is leading innovations in light-emitting-diode (LED) backlights, which use up to 75% less energy than standard fluorescent backlights (while also improving the color and brightness uniformity).

enough to power more than 300,000 households for a year. Seiko Epson's printers used about four times less power in 2006 than they did in 2000, despite continual increases in product performance. And the widespread shift from CRT to LCD monitors that occurred earlier this decade reduced average energy use per monitor by about 30%.

Certifications have been developed to support energy efficiency. The EPEAT rating includes energy efficiency as a consideration and is focused on government procurement channels. The ENERGY STAR® certification, however, is focused solely on energy



efficiency. The ENERGY STAR® program is a partnership between the Department of Energy, the Environmental Protection Agency, and manufacturers. Overall, close to 35 million ENERGY STAR® televisions, monitors, audio, and video products were sold in the United States in 2006 alone.

In 2007, Best Buy sold seven million units of ENERGY STAR® products. According to EPA calculations, consumers saved \$100 million on their utility bills with these products, and the atmosphere avoided 1.4 billion pounds of carbon emissions—the equivalent of removing 128,000 cars from the road.

Reducing power consumption and increasing energy efficiency at the product level is only part of the story. Companies are also achieving major savings and environmental benefit by improving the efficiency of their own internal practices, from manufacturing to distribution to communications. The next sections delve into these behind-the-scenes aspects of companies that produce the consumer electronics that people enjoy.

CHARGED UP ABOUT ENERGY EFFICIENCY

NOKIA®
Connecting People

Electricity is consumed by mobile phone chargers that are left plugged in after the phone is charged ("no-load" energy use). Over the last nine years, Nokia has reduced the amount of no-load energy in its best-in-class chargers by 90%. Nokia's newest chargers go even farther, using up to 94% less energy than the ENERGY STAR® requirements in the United States, and also meet the highest European Union standards.

In May 2007, Nokia became the first mobile manufacturer to put alerts into phones, encouraging people to unplug their chargers. The energy that could be saved globally if all Nokia phone users unplugged their chargers when not in use would power 100,000 average-size European homes.



“Green” Facilities and Manufacturing

“Green” Facilities and Manufacturing



Companies help the environment and save money by adopting “green” practices in their own facilities. For example, companies participate in the same practices as people do at home like recycling and turning off unnecessary lights. From 2004 to 2007, 11 major consumer electronics companies reduced their electricity use per one million dollars revenue by an aggregate average of 12.3% (Figure 1).

And in factories, nearly all kinds of waste reduction are helpful to the Earth. Lean manufacturing—a growing business movement among consumer electronics companies and their suppliers—is helping to reduce waste and create efficiencies all around the world. Examples include:

- Increasing material efficiency of production processes so they use less energy, water,

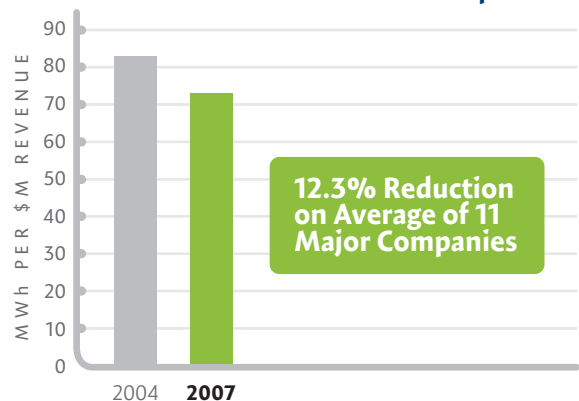
fewer chemicals and other inputs, and generate less waste.

- Recycling and reusing the water, metals and other materials in a plant.
- Testing products more intelligently so that errors are caught earlier, creating less scrap.

These practices are beneficial for the consumer, the company and the environment. Using less electricity, gas, water and paper means spending less money. Using fewer chemicals means safer products, a cleaner work space, and easier compliance with environmental laws.

Although much of this makes good business sense, some companies are going the extra mile to consciously become “greener,” setting aggressive reduction goals and finding creative new ways to improve their environmental impact. For example, several companies are considering composting their food waste, which can then be used in landscaping or sold for agricultural uses.

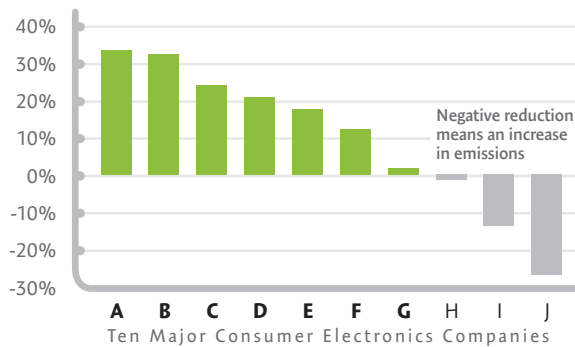
1 Electricity Reduction at Major Consumer Electronics Companies



2a

Greenhouse Gas Reduction at Major Consumer Electronics Companies

Percentage GHG Emission Reduction per \$M Revenue 2004–2007

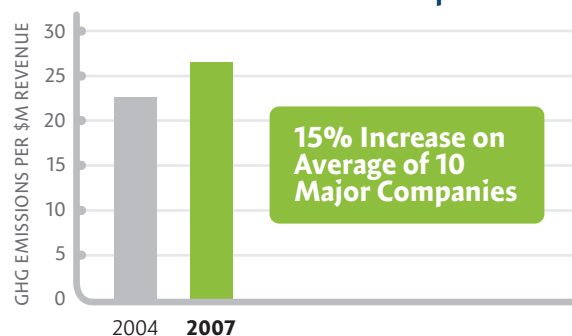


Effort is certainly required to achieve reduction in resources, and many companies are meeting the challenge. Others can learn from the top performers. **Figure 2a** shows that of 10 major companies that have reported greenhouse gas emissions from 2004 to 2007, seven have achieved a reduction per one million dollars revenue.

Figure 2b shows that as an aggregate, however, these companies' emissions per one million dollars revenue have increased. We found very often that a wide range of behavior was seen among companies and would encourage all players to move toward the highest performance.

2b

GHG Emissions at Major Consumer Electronics Companies



Some consumer electronics companies are racing to creatively up the ante with resource conservation. Compact fluorescent bulbs are replaced with the even more efficient LED lights (containing no mercury). Motion sensors in offices are supplemented by sensors that shut off lights when the daylight is sufficient even when the room is occupied. One-use, bio-based cafeteria supplies are replaced with plates and flatware that last significantly longer than disposable materials. Telecommuting and e-commerce are helping companies cut down on their environmental footprint and overhead, and at the same time cars are kept off the road and electricity costs are trimmed.

It will pay for these companies to be ahead of the curve. According to the EPA, 30% of energy in buildings is wasted or used inefficiently. Costs for energy and carbon

MAKING MONEY FROM WASTE

NEC At its Roseville, CA site, NEC Electronics America has been watching its waste since 1996. Eighty-seven percent of what could have been trashed is being reused or recycled—and the latest project is making compost from cafeteria food waste by combining it with grass clippings from the company grounds. During the past two years, 1.3 million pounds of waste has been kept out of the landfill—at a savings of \$500,000.

In addition, NEC has reduced its hazardous waste by 95% during the past 12 years. No wonder they have garnered six consecutive WasteWise awards from the U.S. Environmental Protection Agency.

emissions are on the rise: One carbon analyst firm¹ predicts that the price of a ton of carbon emissions may hit \$40 as soon as 2015, sparking a 20% rise in electricity bills. The next step for many of these players is to perform careful measurements of their greenhouse gas emissions and to better integrate their knowledge of resource use into their operations to realize even greater



environmental gains. Looking to the future, many companies, including Best Buy, Cisco, Intel, and Nokia, are building or retrofitting Leadership in Energy and Environmental Design (LEED) facilities. **LEED buildings save an average of 25–30% in energy use per square foot.** And given that buildings account for nearly half of the greenhouse gas (GHG)

BALANCED CARBON

DELL™ As of August 2008, Dell became a “carbon-neutral” company. In this case, this means that Dell’s operations are entirely powered by renewable energy (wind, solar, biomass and geothermal) directly or offset using renewable energy credits (RECs). At this time, “green power” is available for 20% of its operations, while the remaining 80% comes from RECs that subsidize purchases of renewable energy by other organizations where green power is more readily available. As renewable power sources increase, a greater percentage of direct renewables will be used.

emissions that contribute to global warming, this saving is a big win for the environment.

To budget for internal improvements, Intel has developed a dedicated capital funding program that allocates funds solely for the purpose of conservation and efficiency projects—including efficient lighting, “smart” system controls, boiler efficiency, chilled water improvements, and heating, ventilation, and air-conditioning improvements. As a result of this program, Intel has approved more than 200 projects and saved over 400 million kilowatt-hours of electricity since 2001.

Making positive changes “inside the four walls” can easily keep a company busy for many years. In addition, extending the efforts “outside the four walls” can bring even greater savings. After all, once the product is built, it still needs to get into the consumer’s hands.

SAVING WATER WHERE IT IS NEEDED MOST



Intel’s Ocotillo plant in Chandler, AZ, has achieved excellent results in water conservation, a critical factor in its desert Southwest location, through internal water recycling and reuse of wastewater:

- The plant produces 0.85 gallons of ultra-pure water for every gallon of fresh city water.
- Its water-reduction efforts save over 800 million gallons of Chandler’s fresh water per year.
- Going even farther, Intel has helped replenish Chandler’s aquifer—more than 3 billion gallons of water have been returned for eventual reuse.

Due to Intel’s conservation efforts, it now takes less than 10 gallons of water to produce a Core 2 Duo processor as compared to 1,800 gallons of water to make a pair of jeans, 120 gallons of water for a single egg, or 65 gallons of water to produce a gallon of milk.

¹ New Energy Finance: http://www.eurekalert.org/pub_releases/2008-02/nef-tu021208.php.



Clean Delivery

Clean Delivery

Getting products from the raw materials stage, to factories, and then to stores requires teamwork by companies throughout the supply chain. Efficient shipping and coordination of suppliers lower costs while ensuring that people receive products quickly. Effective supply chain management is also crucial to environmental stewardship. The complexity of a sophisticated supply chain is made simpler when the overall goal is saving time, energy and materials.

company reduced its fuel use by 90% by restructuring its assembly process to eliminate a trans-Pacific flight. Many companies are going even further by working with their suppliers and customers to consolidate orders, choose environmentally efficient means of transport, and exchange information more effectively.

Most companies now require suppliers to meet standards for clean, non-hazardous materials in their components or

subassemblies. Philips even performs “sustainability audits” of its suppliers and trains them in sustainability principles.

Epson helps its suppliers and customers by creating for each of its products an “Ecology Profile” that shows all the materials and energy used to create that product. The profile can be used to coordinate environmental efforts along the supply chain.



Consumer electronics companies ship billions of products across the globe every year as they are assembled, distributed and sold. Simply planning the routes efficiently makes a big difference. For example, one

Would you think that shipping one product instead of eight separate products would reduce environmental impact? Well, of course! Today’s consumer electronics products combine into one product

functionality previously delivered by multiple products. Shipping today's mobile phones, for example, can eliminate the additional shipping of a camera, personal digital assistant (PDA), global positioning system (GPS) device, clock or watch, land-based phone, music player/recorder, or even TV or computer. With further consolidation of functions we need into less hardware, everyone wins: Consumers can do more with less, companies benefit through innovation, and the carbon footprint from the several stages of product delivery is smaller. The next generation of products is likely to combine even more functionality.

Another aspect of clean delivery is employee commuting and travel: How are people getting to work and moving around to do business? Nearly all of the companies we

OFFSETTING WITH CARE



Carbon offsets are a means of reducing the harm of carbon emissions by performing an "equivalent" action that reduces CO₂, such as planting trees or buying power from solar or wind sources. Nokia understands that it is preferable to reduce emissions directly, but in the case of necessary travel, the company has an offsetting program: In late 2007, Nokia partnered with Climate Care.

When employees come back from travel, they enter their trip information on the Nokia internal website, and the company purchases equivalent offsets, which go to investment in clean-energy technologies. It is currently a volunteer program that goes on the employee's expense report but could become more fully endorsed as it gains popularity.

RESPONSIBLE TAKE BACK



Best Buy makes recycling consumer electronics products easy. Its new take-back program, launched at 117 stores in summer 2008, allows consumers to bring in monitors, TVs, and similar devices for free recycling, no matter where the items were purchased. This is the first ongoing program of such broad scope at a retail store in the United States and is an extension of Best Buy's previous special recycling events that brought in 1,700 tons of electronics during 2007. In addition:

- Every store has a kiosk that takes items such as rechargeable batteries, cell phones, ink cartridges, and DVDs. Last year, 41.5 tons were collected.
- When customers buy a new TV or appliance, they can return the old one for recycling, which has brought in more than 9,000 tons of electronics and 32,000 tons of appliances.
- Non-profits and community organizations can apply for grants to host recycling events. Best Buy has spent \$96,000 to support 77 events that brought in 1,300 tons of electronics.

And Best Buy recycles other materials from its own distribution centers—this year alone, 79,000 tons of cardboard, 10,000 tons of wood, 4,400 tons of plastic, and 3,600 tons of metal—pushing Best Buy to the number one spot among retailers.

spoke with are taking steps to reduce business travel—to the tune of reducing trips by 20% to 50%—a huge savings in carbon emissions. In lieu of automatically packing a bag and flying across the continent or globe for one meeting, they are bundling trips and using trade shows or technological innovations such as videoconferencing, web-conferencing, and software installed to remotely monitor

DID YOU KNOW?

The top 20 respondents in a survey conducted by Sims Recycling Solutions have recycled nearly 600 million tons of used electronics products.

suppliers. Few companies have taken steps to measure employee commutes, but many companies offer subsidies for using public transportation, give preferential parking to carpools and hybrid electric or electric vehicles, start bike-to-work clubs, and/or have telecommuting policies in place.

All of these efforts are made in recognition that unnecessary movement generates waste and consumes resources.

Once the product reaches the store, is the manufacturer finished with it forever? No. Companies are an integral part of society, and retain an interest in their products during the time people use them and also at the product's end of life. In the case of consumer electronics, creating the cycle of value often involves "product stewardship"—making sure that electronics products are properly recycled and that components in working order are reused after first use. This activity can be undertaken by companies of all sizes and is easy to begin on a small scale.



PARTNERSHIPS FOR SUCCESS



Cisco Systems is a leader in creating partnerships for clean delivery, which comes down to realizing: "We cannot do this alone."

Cisco worked with a packaging supplier and its customers to design a multi-pack (packaging several products together) that is 77% lighter and takes up 84% less space than the original, in addition to using more environmentally benign materials. It improves customer convenience, helps the environment, and saves money—and each partner could not have done it alone.

Another innovation is Cisco's Telepresence product, which eases the communication needed for top-notch teamwork. Featuring a full-video screen that simulates sitting together at a conference table, Telepresence allows people to interact far more richly than by phone or e-mail. Cisco uses it to collaborate with overseas suppliers, enabling strong partnerships and clear communication—without the need for long-distance travel.

Some examples of successful recycling programs include:

- **Hewlett-Packard** has recycled more than 400 million pounds of computer hardware since it began its recycling program in 1987. Dell and Sony are also major electronics recyclers.
- **Crutchfield**, an electronics distributor and retailer based in Virginia, has kept 600,000 pounds of waste out of the local landfill through its new recycling program. For example, Crutchfield replaced polystyrene peanuts with biodegradable starch pellets in its 950,000 outbound shipments this year—a tremendous gain for the environment.
- **Hometech**, a 15-employee installer of audio/video equipment, has created a partnership with a nearby recycler to handle the end-of-life equipment they receive.
- **Kodak's** single-use camera might at first seem to be an environmental burden. But in 2007 alone, Kodak collected 120 million single-use cameras of all manufacturers' types for recycling. That brings the total number of cameras recycled under Kodak's program since its inception in 1990 to 1.2 billion. Furthermore, nearly all its single-use cameras now use recycled parts.

As shown in **Figure 3** in a survey of 64 electronics companies conducted with Sims Recycling Solutions, 69% of respondents are

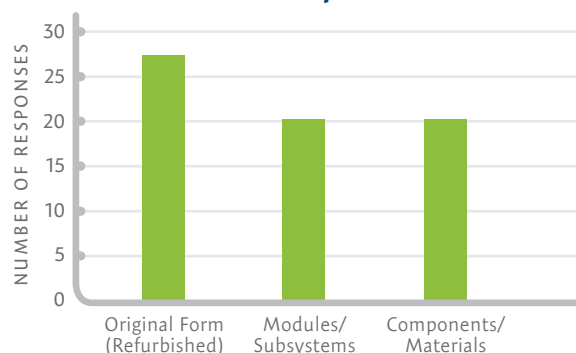
MAKING THE MOST OF EACH PRODUCT

BlueCoat When a customer replaces an older Blue Coat networking product with a newer one, Blue Coat collects the replaced product—for free—and “harvests” working parts to use in refurbished products. With this take-back program, customer convenience and business sense win over landfill:

- Customers have a free and easy way to pass along replaced units—and gain the peace of mind that these will not become electronic waste.
- Customers still using legacy products never have to worry about the company running out of replacement parts.
- Blue Coat gains products to refurbish at nominal cost—saving about one-half million dollars a year.

This take-back system was the idea of two employees participating in Blue Coat's Environmental Heroes program, created to generate top-notch environmental ideas.

3 Reuse Processes at Consumer Electronics Companies



Q: Which parts of your products do you reuse?

A: Companies use whole product, its modules/subsystems, and its component parts.

Multiple Selections Allowed



already recycling, and another 14% are setting up programs, while 38% are reusing some form of the electronics products they make or use—the product as a whole, its modules and sub-systems, or its components and materials. The majority stated that they reap financial gains, such as avoiding the purchase of some new materials through reuse and generating revenue from no-longer-needed materials through recycling.

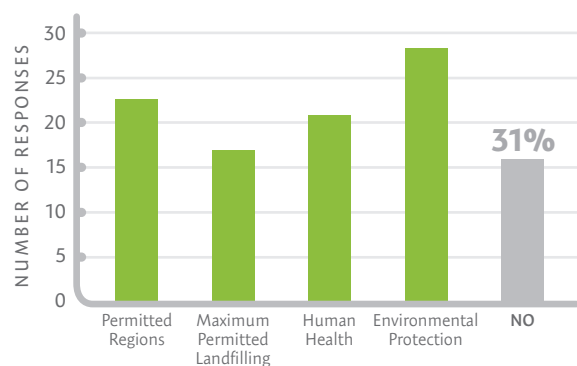
These 64 companies alone—which span a representative range from small (<\$10M) to large (>\$10B) players—have averted the accumulation of more than 765,000 tons of electronic waste. And when we consider the top 20 players, nearly 600 million tons of used electronics products have been recycled.

Sixty-nine percent of the Sims survey respondents have written or enforced standards about how their products are recycled, and “environmental protection” is cited as the top reason for doing so (Figure 4). Sixty-five percent engage in tracking and auditing their recycling activities. Also of interest are the reasons companies cite for their environmental success.

The top responses were:

- Clear metrics and goals
- Company-wide education and communication of goals
- Support from top leadership
- Linking the changes to the promotion /review process

4 Attention Paid to Quality of Recycling Done for Consumer Electronics Products



Q: Have you written and enforced standards for the way your products are recycled?

A: 69% have written and enforced standards.

Multiple Selections Allowed



Giving Back

Giving Back

Companies also give back to society, creating a cycle of value that contributes to global sustainability. A corporation's giving-back program can help to protect and restore the environment we all share. Some of the main avenues for social responsibility are direct giving, social programs, or other responsible business practices.

At Intel, for instance, 38–40% of employees worldwide do volunteer work at non-profit organizations, to the tune of nearly 1 million hours per year. In many cases, Intel pays the non-profit \$10 per hour through a company matching program. Panasonic's employees participate in WalkAmerica, benefiting the

March of Dimes, and have raised

approximately \$450,000 for this cause. And in Mexico, 61 HP employees planted 600 trees as part of a reforestation project.

Formal corporate social responsibility (CSR) programs have existed for many years; recently a number of new developments have occurred. CSR now often includes explicit environmental goals, far beyond compliance with regulations. In addition, philanthropic efforts have taken on a more strategic flavor. For example, several companies offer health care assistance in rural villages where their factory workers live, which helps people and also creates a healthy workforce. It is also worth noting that nearly all major consumer electronics companies have a dedicated section on their website with information on environmental and social benefit programs. In these ways, CSR is seen not purely as an "extra," but as a more integral part of operations and communications.

Consumer electronics companies also give back by closing the information loop with stakeholders such as customers and investors. By reporting their energy, water, and chemical use, as well as clearly communicating their environmental goals and innovations, companies let all of us know what is being done to protect the air, water, land, and natural systems. This informs our choices as consumers and citizens.





DID YOU KNOW?

At Intel, 38–40% of employees worldwide volunteer at non-profit organizations, to the tune of nearly 1 million hours per year, often matched by \$10 per hour contributions to the non-profit by Intel.

Some companies have written environmental reports for many years, beginning as early as 1987. Companies often find that in addition to providing the outside world with information, these reports can actually improve operations by bringing greater awareness of their own resource usage. In gathering data for this report, we found that most large consumer electronics companies provide environmental data, but very few small companies do. It is expected that more and more companies will participate in the future as reporting standards are raised and interest in environment sustainability accelerates.

“Giving back” also describes the way companies move toward environmental sustainability. Once a company has actually gone through the process of designing and

building its products to be ecologically sound, shipping them in a resource-conscious way, and handling their recycling/reuse, it has a much clearer idea of how to make the next round of design changes. The cycle goes back to design for environment. Just as consumer electronics products have higher technical performance with each generation, they can have higher environmental performance too. Imagine if companies competed for the ecological superiority of their products in addition to lower prices and more technical features.

In many ways, they already are. Reducing resource consumption during production brings competitive advantage in the form of cost savings. And as more consumers demand ecological features such as lower power use and recyclability, companies will respond.

SETTING THE STANDARD



Hewlett-Packard sets the standard for keeping ahead of the curve in sustainability. It began environmental work in 1992, and now includes 100 full-time employees dedicated to its sustainability programs, in addition to many other volunteer programs throughout the company. Its efforts span all five categories outlined in this report, from design for environment to a sophisticated recycling program.

HP’s broad-based efforts also position the company to serve as a leader in creating environmental standards. The following are just a few areas where HP has helped create the structures that serve the environment:

- Focused Improvement Supplier Initiative (FISI) in China
- Electronic Industry Code of Conduct (EICC)
- Carbon Disclosure Project (CDP)



Looking to the Future

Looking to the Future



This report highlights the consumer electronics industry's best efforts and successes to date to be sustainable leaders. Of course, many other consumer electronics companies—more than we could mention—have set sustainability goals and are making good progress. And on the path to sustainability the industry will need, where possible, to reduce and eliminate waste, use renewable and benign materials, minimize product movement around the world, and run carbon-neutral (or even carbon-positive) facilities. CEA, as an advocate for its members, fully supports the industry's progress toward environmental sustainability. All stakeholders, including consumers, companies, and government groups, can expect even more progress in the coming years.

How do we know? A quick glimpse at some of the more innovative products already on the market indicates what might be headed for the mainstream. For instance, Sony's flat-screen TV using OLED (organic light-emitting diode) technology offers the potential for greater energy savings in televisions. OLEDs do not require a backlight. And OLED production could be less material-intensive, especially if they can be made using continuous processing techniques rather than standard batch production. Already used in mobile phones and car stereos, OLEDs are just entering the TV market with Sony's pilot 11-inch model.

Many companies are exploring solar power for consumer electronics products, from standalone portable chargers to flexible panels integrated onto the product itself. For example, Xantrex sells the XPower Powerpack Solar battery system, which runs a laptop for three hours or a television for 45 minutes. Voltaic Systems and Innovus Designs sell laptop bags with integrated solar panels to charge your computer on the way to the next meeting.

Furthermore, cutting-edge research and development work suggests that some interesting innovations are in store farther in the future. Sony has developed a bio-battery that generates electricity by breaking down sugar, analogous to the process that occurs

in living organisms. The battery achieves an output of 50 milliwatts at 0.3 volts, the highest for batteries of its type; using several together easily powers a portable music player. A variation on using an external bio-battery is using human muscle power directly: The Eco-Media Player runs for 40 minutes after you wind it up mechanically. Imagine the freedom of needing neither batteries nor a sunny day!

Microsoft, Philips, Honeywell, and others have publicized their concepts for the “home of the future,” which invariably include a fully integrated electronic system linking the entertainment, security, and information systems of the house. In these models, intelligent devices have become “ubiquitous” and nearly invisible, automatically adjusting to the human inhabitants’ locations, the time of day, and the function being performed—all with high energy efficiency and pleasing design. As these electronics are designed to fit in with human life, they also have the potential to be more ecologically sound if designed that way from conception. These examples and others show that the trend in electronics is toward reducing environmental impact.

While technological advancement exists for the design of new products, similar innovations are already occurring, and will accelerate, for production processes. For example, IBM has developed a novel

semiconductor reclamation process in its Burlington, VT, manufacturing facility. The facility makes silicon wafers that in turn become the chips used in consumer electronics products. IBM now converts the scrap wafers into material that is used to make solar panels.

And new materials such as carbon nanotubes could be used to reduce the electricity demand of electronics. Academic and industry researchers have already succeeded in producing functional transistors out of nanotubes, some of which use 13 times less energy for the same amount of work (or operate 13 times faster than conventional electronics at the same energy consumption).

An industry’s steps toward environmental sustainability can occur in sudden leaps or steady movement forward. The consumer electronics industry’s environmental leaders and their significant progress highlighted in this report can inspire all companies—inside and outside the industry—to take bold steps for the benefit of all: companies, consumers, and the environment.

Toward environmental conservation, CEA opted to present this report in electronic version only. In kind, please consider the environment and refrain from printing this report.

About the Authors

We were delighted when the Consumer Electronics Association chose TFI Environment to write the consumer electronics industry's first sustainability report. We see it as an opportunity to (1) showcase the industry's best new practices for reducing its environmental impact, and (2) encourage the rest of the industry to meet and beat these vital achievements.

Given increasing concern over climate change, diminishing natural resources, and participation by more and more people in creating a healthy environment, we welcome the opportunity to highlight ways the consumer electronics industry is using fewer resources and mitigating its impact on the natural environment.

This industry—whose role for decades has been to simplify tasks and provide entertainment—also has a powerful and important role to play in protecting the environment.

This report highlights leadership examples from the consumer electronics industry's environmental responsibility, and it shines a light on upcoming technologies and business practices for a brighter future.

We have structured this report according to consumer electronics companies' progress in


five environmental sustainability practices: eco-design, energy efficiency, green facilities and manufacturing, clean delivery, and giving back. These five practices are meant to capture the progress being made from cradle to cradle all along the supply chain of the consumer electronics industry. Our hope is that the diversity of examples and breadth of coverage convey both the complexity of moving toward sustainability and the creative engagement of the industry with this challenge.

Special thanks go to our team: Co-Author Dr. Kim Allen, Interviewer Anne Feith, and Design Coordinator Cathy Dalton. Together with CEA we recognize that it will take all of us, with expediency, to sustain our planet.



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