Products and solutions

HP products, services, and solutions represent our greatest opportunity to advance Positive Impact—HP's drive to help conserve more than we as a company consume. Our broad portfolio helps customers use energy and other resources more efficiently, replace outmoded and inefficient processes, and live and work more sustainably. To learn more about environmental and social innovation across the infrastructure, software, services, and solutions HP offers, visit our Tech gallery.

HP's holistic approach

Through our Design for Environment program, HP takes a holistic approach to reducing the environmental impact of our products and solutions across their entire life cycle—from their earliest stages of development through use and end of life. We increasingly use the insights from life cycle assessment and stakeholder consultation to increase our understanding of the environmental impact of our products, inform design, and foster innovations in materials use, manufacturing, and transport processes.

A sustainable approach to services at HP

HP provides services that help enterprise customers measure and manage their resource consumption and carbon emissions across an enterprise's data centers, business processes, and operations. HP Energy and Sustainability Management (ESM) addresses the use of energy, water, and other resources across a customer's entire organization. HP Critical Facilities Services focus on improving energy consumption and efficiency, and water usage in data centers (see graphic below). And HP Carbon Emissions Management Service helps customers calculate, record, and analyze energy use and carbon emissions in every aspect of their IT infrastructure—from the desktop to the mainframe.

Highlights

50%

HP achieved a 50% reduction in energy consumption of our products by the end of 2011 compared with 2005 levels—exceeding our original goal of a 40% reduction.*

95%

The HP EcoPOD modular data center uses 95% less facilities energy than a traditional data center.**

74%

Replacing 2,000 PC desktops and monitors made in 2005 with the same number of HP thin client solutions—including the required servers—would cut energy consumption by 74% and save an estimated 795,000 kilowatt hours (kWh) per year.***

* The average energy consumption of HP products is estimated using high-volume product lines representative of the overall shipped product volume. Energy consumption has been estimated in 2005 and annually since. The high-volume product lines include notebook and desktop computers, inkjet and LaserJet printers, and industry-standard servers.

** New POD technology from HP offers 95% greater energy efficiency compared with a traditional brick-and-mortar data center, based on internal HP testing.

*** The technology refresh takes 2005 desktops and monitors in an enterprise setting and replaces them 1:1 with HP t5570 Thin Clients and new HP Compaq LE19 WLED monitors. In the background, a set of HP BL460cG7 blade servers and a rack of storage disks support the new thin clients (about 70 thin clients to one blade server).

Sustainability initiatives across the life cycle

Learn more about how HP approaches sustainability at each stage of the life cycle, illustrated by innovations in our PC and printer products, as well as our data center services.

Research, development, and design

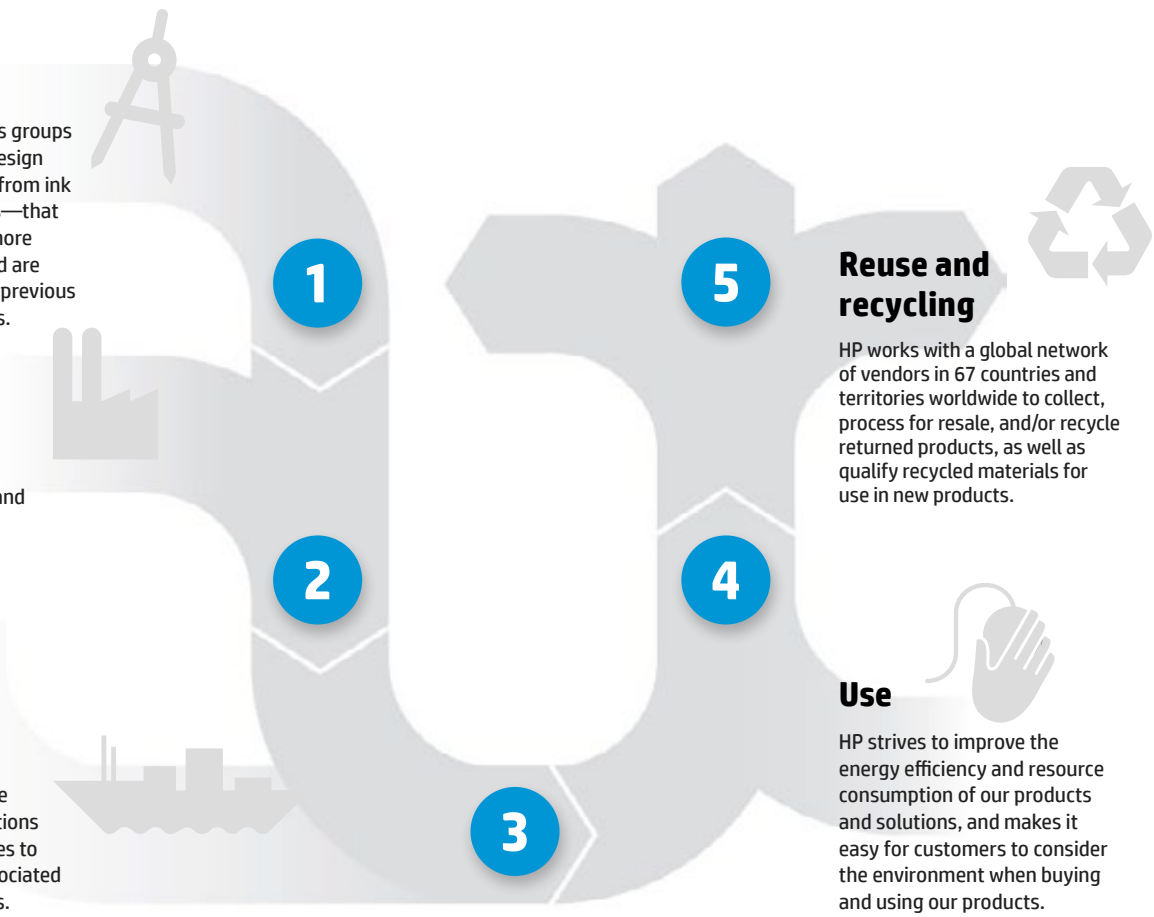
HP Labs and HP's business groups attempt to develop and design products and solutions—from ink cartridges to data centers—that require less energy, use more sustainable materials, and are easier to recycle than the previous generation of HP products.

Manufacturing

HP collaborates with our manufacturing partners and suppliers to understand, reduce, and report the environmental impact of product manufacturing.

Packaging and transport

HP strives to develop more sustainable packaging options and make transport choices to decrease fuel use and associated greenhouse gas emissions.



Reuse and recycling

HP works with a global network of vendors in 67 countries and territories worldwide to collect, process for resale, and/or recycle returned products, as well as qualify recycled materials for use in new products.

Use

HP strives to improve the energy efficiency and resource consumption of our products and solutions, and makes it easy for customers to consider the environment when buying and using our products.

Life cycle stage	**HP Z1 Workstation** Learn more in the Tech gallery.	**HP ENVY[110] printer** Learn more in the Tech gallery.	**HP Critical Facilities Services** Learn more in the Tech gallery.
Research, development, and design	Registered EPEAT® Gold and ENERGY STAR® qualified. The all-in-one form factor contains less plastic than a separate PC and monitor of similar size, and features a mercury-free 27-inch diagonal white LED display.	ENERGY STAR qualified e-All-in-One.	HP Energy Efficiency Analysis assesses a data center's energy efficiency and provides design and site recommendations to reduce environmental impact.
Manufacturing	Manufactured using brominated flame retardant BFR- and polyvinyl chloride PVC-free materials.*	Manufactured using PVC-free materials.**	HP helps customers achieve certifications for the U.S. Green Building Council (USGBC) LEED® Standard for Data Centers.
Packaging and transport	Surface transport within the United States and Canada uses a 100% SmartWay-compliant carrier network.	Surface transport within the United States and Canada uses a 100% SmartWay-compliant carrier network.	HP develops plans and procedures to help customers better maintain and test facilities, which reduce the need to transport and store spare parts and equipment.
Use	Features up to 90% efficient power supply and helps customers conserve energy by providing real-time power consumption data with HP Power Assistant.***	Allows for optimum paper use through automatic two-sided printing.	HP provides ongoing consulting to help customers increase data center energy efficiency.
Reuse and recycling	Designed to be more than 90% recyclable by weight.	Designed to be 90% recyclable. Uses Original HP 60 cartridges that contain up to 70% recycled plastic.	HP Asset Recovery services rebuild, reuse, and recycle outdated data center components.

* The HP Z1 workstation meets the industry definition of "BFR/PVC-free" per the iNEMI Position Statement on "Low Halogen" Electronics. Plastic parts incorporated into the chassis generally contain < 1,000 ppm (0.1%) of bromine or chlorine. Printed circuit board and substrate laminates generally contain < 1,500 ppm (0.15%) of total bromine and chlorine. Service parts after purchase may not be BFR/PVC-free. External accessories, including power supplies, power cords, and peripherals are not BFR/PVC-free.

** HP ENVY[110] e-All-in-One is polyvinyl chloride-free (PVC-free); meeting the evolving definition of PVC free as set forth in the "iNEMI Position Statement on the Definition of 'Low-Halogen' Electronics (BFR-/CFR-/PVC-free)." Plastic parts contain < 1,000 ppm (0.1%) of chlorine [if the Cl source is from CFRs or PVC or PVC copolymers]. USB cable and power cord are not PVC free.

*** HP Power Assistant enhances management of the system energy requirements and enables users to take control of their power consumption for a reduced impact on the environment. Power calculations and cost calculations are estimates. Results will vary based on variables, which include information provided by the user, time PC is in different power states (on, standby, hibernate, off), hardware configuration, variable electricity rates, and utilities provider. HP advises customers to use information reported by HP Power Assistant for reference only and to validate impact in their environment. Environmental calculations were based on U.S. EPA eGrid 2007 data found at www.epa.gov/egrid/. Regional results will vary. Microsoft® Windows® required.

Life cycle assessment

HP increasingly uses life cycle assessment (LCA) to better understand and reduce the environmental impacts of the products we offer. LCA covers every stage of a product's life cycle, from materials extraction to end of life.

Specifically, LCA techniques allow us to:

- Assess our current materials, packaging, and products; model alternatives; and target areas for improvement.
- Develop tools to estimate the carbon footprint of our products of our products
- Determine which processes, components, and materials have the greatest environmental impact and prioritize these for analysis, with the goal of reducing these impacts.
- Develop metrics to help product designers compare design options.
- Support Design for Recycling initiatives.

LCAs for HP products

In 2011, we carried out or commissioned LCAs on several products. Examples include:

- **HP LaserJet black toner cartridges vs. remanufactured cartridges** A 2011 study commissioned by HP found that paper use during printing—not cartridge manufacturing or production—is the greatest contributor to the environmental impact of toner cartridges.[1] Inconsistent print quality often leads to reprinting and increased paper consumption, which increases the environmental impact associated with cartridges. As reported in a separate 2010 study, Original HP LaserJet toner cartridges are more reliable and deliver higher print quality than the remanufactured cartridges examined,[2] which often means fewer reprints and less paper use. The 2011 study also reported that recycling at the end-of-life phase reduces the environmental impact of toner cartridges. HP offers recycling programs for HP cartridges.
- **HP HDPE banners vs. PVC scrim banners** HP banners made of High-Density Polyethylene (HDPE)—for outdoor use on billboards and other media—can help reduce the carbon footprint of banner printing materials by up to 80% compared with traditional polyvinyl chloride (PVC) scrim banner material.[3] Key factors include a lighter weight that enables reduced raw material consumption as well as lower transportation[4] and disposal costs.[5]
- **Albums of printed photos vs. digital photo frames** An HP study revealed that printing 200 photos—including materials for the printer and album, energy use, and end-of-life impacts—produced just 15% of the GHG emissions of displaying 200 photos on a digital photo frame in a typical home for 2 years.[6]

LCA challenges

The LCA process has its limitations in assessing information technology (IT) products, due to the use of different methodologies, inconsistent assumptions, the complexity of IT products (including the large number of suppliers providing inputs), and the rapid rate of technological innovation. These factors affect the results, reliability, and consistency of LCAs, making it challenging to accurately compare the environmental impacts of products within our industry.

Standardizing LCA approaches and methodologies

HP is collaborating with other industry leaders, academia, nongovernmental organizations, and governments to promote and share best practices, and create universally accepted methods for performing LCAs. Our objective is to enhance product comparability across the industry and improve the use and disclosure of LCA data within our own product designs. Working with others in the IT industry also helps us reduce the environmental impacts of our shared supply chains.

Through our membership in The Sustainability Consortium (TSC) and our support for the Electronic Industry Citizenship Coalition product carbon footprint (PCF) project, we're working to develop a common approach to LCA and PCF data capture. In addition, we're collaborating with the Massachusetts Institute of Technology (MIT), as well as other original equipment manufacturers (OEMs) and suppliers, to create a Product Attribute to Impact Algorithm (PAIA) tool in order to estimate the PCF of our notebook and desktop computers, and monitors in a way that is transparent, objective, credible, and relevant to customers. The goal of the PAIA tool is to provide information to the purchaser or end consumer to facilitate discussion and understanding of a product's environmental impacts. We anticipate releasing the PAIA tool and PCF notebook data in 2012, once pertinent supplier data has been vetted.

We're also working with international groups to strengthen the PCF and LCA data capture process for imaging and printing products. In 2011, HP helped draft a commercial printing carbon footprint standard as a member of the International Organization for Standardization (ISO) technical committee working group. Similar to the goals for the PAIA project, the ISO standard will provide a transparent, universally accepted methodology to guide HP and other manufacturers when performing PCF and LCA analyses on printers and related products. The proposed standard will be up for a committee vote during 2012.

[1] 2011 Four Elements Consulting study, commissioned by HP, compared Original HP LaserJet CB436A and CC364A black toner cartridges with a sample of remanufactured alternatives across eight impact categories. For more information, visit www.hp.com/go/lj-lca-na or www.hp.com/go/lj-lca-emea.

[2] QualityLogic 2010 study, commissioned by HP, compared Original HP LaserJet monochrome toner cartridges with remanufactured cartridges sold in North America, Europe, the Middle East, and Africa for the HP LaserJet P1505 and P4015 printers, HP 36A, and 64A. For details, see www.qualitylogic.com/NAremanreport.pdf or www.qualitylogic.com/EMEAremanreport.pdf.

[3] For example, the carbon footprint of banner printing material can be reduced by up to 80% using 170 g/m^2 (5-ounce) HP HDPE Reinforced Banner. Calculation by the HP IPG Environmental Technology Platform Team (and confirmed by an independent environmental life cycle assessment firm), based on the activities associated with the manufacturing of the product, and comparing 200 g/m^2 (6-ounce) HP Double-sided HDPE Reinforced Banner to 440 g/m^2 (13-ounce) HP Outdoor Frontlit Scrim Banner using the Swiss Center for Life Cycle Inventories Ecoinvent 2.2 database and model IPCC 2007 version 1.02; primarily for the category of PVC/PET/HDPE, and measuring materials extraction, transportation to the manufacturing site, and GHG emissions generated during manufacturing. The reduction in carbon footprint for HP HDPE Reinforced Banner is slightly less.

[4] For example, HP Double-sided HDPE Reinforced Banner based on the transportation cost per square foot of material comparing a 30-roll pallet of HP Double-sided HDPE Reinforced Banner (1,067 mm x 45,7 m/42 in x 150 ft rolls, 870 lbs, 15,750 sq ft of material) and a 20-roll pallet of HP Outdoor Frontlit Scrim Banner (1,067 mm x 35 m/42 in x 115 ft, 844 lbs, 8,050 sq ft of material); using FedEx National shipping rates (Standard Service) from San Diego, California, United States, to New York, New York, United States, of $4.77 USD/lb for 870 lbs and $4.87 USD/lb for 844 lbs. Ground transportation costs vary by region and ship-to location. Transportation cost comparison for HP HDPE Reinforced Banner is similar.

[5] In many European countries such as the United Kingdom, there is a Landfill Tax payable on waste disposed of at landfills. The tax is regulated by HM Revenue and Customs. Tax on active waste amounts to £40/tonne (+VAT) in 2009–2010 and is set to increase £8/per year to 2013. According to www.defra.gov.uk/environment/economy/waste/, this is becoming a standard practice for other EU countries www.cewep.com/data/landfill/index.html.

[6] "Carbon Footprint Analysis Comparing a Digital Frame to Printed Photos," Tom Etheridge and Tim Strecker.

Research and development

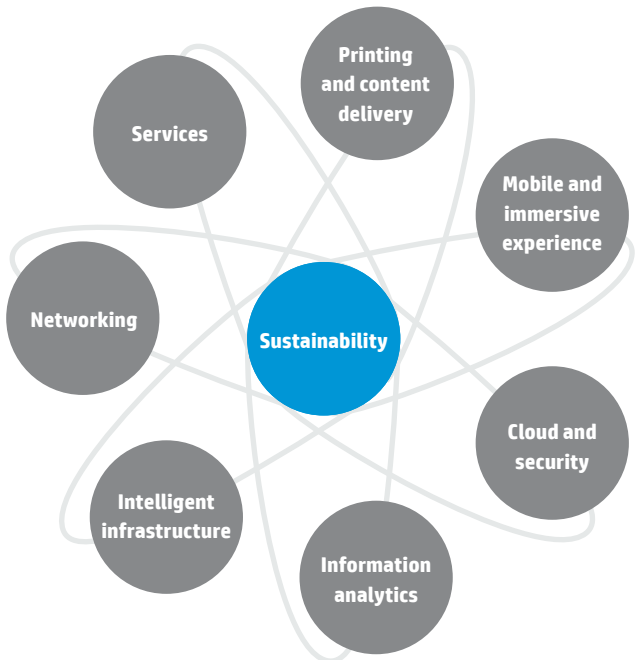
Research and development (R&D) at HP focuses on developing breakthrough technologies, spearheading the next generation of HP products and services, and creating new opportunities for HP's businesses and customers. We are committed to innovation both internally and in collaboration with leading universities and technology companies worldwide.

Innovation and R&D occurs throughout our business groups, and is essential to HP's ongoing ability to deliver leading products and services. Complementing these efforts, HP Labs is our central research organization. It aims to:

- **Deliver business value** through a variety of paths to commercialization, including technology transfer to HP businesses, demonstrations, coinnovations with customers, and licensing.
- **Drive the conversation and demonstrate thought leadership** in the industry through intellectual property (IP) generation and publications at premier academic and industry conferences.
- **Coinnovate with customers and research partners**, creating transformational solutions for real-world problems through an open innovation approach.

Sustainability is one of eight primary research categories within HP Labs (see graphic). With assistance from the Sustainable Ecosystems Research group (SERg), HP Labs integrates sustainability within every research category, helping HP create new technologies, products, services, and business models for the emerging low-carbon economy.

HP Labs research areas



HP employees making an impact: Chandrakant Patel

Chandrakant Patel is an HP senior fellow and interim director of HP Labs. His vision for building a more sustainable world has helped make HP a leader in energy-efficient computing. Learn more about Chandrakant Patel on page 144.

2011 R&D highlights

HP Labs made progress in several key areas in 2011:

Energy-efficient data centers

HP Labs continues to research new ways of developing energy-efficient, reduced-emissions data centers, including the use of renewable technologies and alternative energy sources. The research is part of HP Labs' sustainable data center project, a large-scale rethinking of how data centers are designed, built, and operated. With each low-energy innovation, HP moves closer to its goal of creating a data center that consumes net-zero energy from nonrenewable sources over its entire life cycle. HP also incorporates many of the technologies developed for the sustainable data center project into other HP products and solutions.

Multiscale Energy Modeling tool HP Labs collaborated with the HP Enterprise Servers, Storage, and Networking (ESSN) business group on the development of several technologies used in the HP POD 240a modular data center, also known as the HP EcoPOD. For example, the EcoPOD team used the Multiscale Energy Modeling tool—conceptualized by HP Labs and the University of Limerick in Ireland—to accurately project the EcoPOD's total energy consumption and costs. The team has also used the tool to evaluate potential EcoPOD customer sites in support of the account and technical teams. HP Labs is currently investigating how to enlist the Multi-Scale Energy Modeling (M-SEM) tool to run offline or run-time optimizations of the EcoPOD infrastructure to further improve energy efficiency.

Fort Collins data center In March 2011, HP opened a data center in Fort Collins, Colorado, United States, that doubles as a working test bed for HP Labs technologies, including sustainable data center innovations. The facility expands on HP's Converged Infrastructure solutions with research focused on working to eliminate information technology (IT) sprawl, increasing energy efficiency, and reducing power consumption. Recent advancements include motorized Adaptive Vent Tile technology, which makes local cooling adjustments for individual IT racks, and a cooling microgrid that employs multiple cooling resources, including a chiller plant, a water-side economizer, outside air, on-site energy storage through ice, and an integrated management system. Learn more about our Fort Collins data center.

Cloud Sustainability Dashboard HP has developed a Cloud Sustainability Dashboard (CSD) to help IT professionals better understand and quantify the sustainability impact of cloud computing. The dashboard provides a high-level view of the economic, environmental, and social impacts of related IT and facility resources and services, including servers, storage, networking, power and cooling, and IT support. For example, users can assess the impact of changing electricity costs by region, determine which cloud service offers the smallest environmental footprint, or examine the potential effect of cloud computing on economic development.

Resource Management as a Service

HP Labs continues to explore how IT can help cities cope with the growing strain on nonrenewable resources. In 2011, we initiated the Resource Management as a Service (RMaaS) project—an integrated hardware, software, and services platform that can be tailored to manage energy, water, and waste at a city-wide scale. Still in its early stages, the model conceives of cities as a series of "campuses" connected by transportation and information networks. Each campus will have its own customizable hardware and software infrastructure, along with an ecosystem of sustainability "apps" that support real-time resource management based on availability and demand. HP is working on an RMaaS prototype at our HP Labs site in Palo Alto, California, United States.

HP open innovation

HP Labs collaborates with top researchers, scientists, and entrepreneurs worldwide on high-impact joint research projects through an open innovation research model. This allows us to bring together global expertise to foster discovery, develop breakthrough technologies, and tackle the next generation of global challenges.

SERg, for example, extends its research capabilities through university collaborations, and then transfers working solutions to HP business units for product and service development. The model provides students the opportunity to work on real-world sustainability problems while gaining invaluable experience and knowledge for their future careers at HP Labs or elsewhere. Among our most notable successes is the Environmental Sustainability Assessment Tool (ESAT), which originated from a multiyear project with the University of California-Berkeley (UC Berkeley) in Berkeley, California, United States, addressing energy efficiency in the data center.

SERg is currently collaborating with such top research institutions as UC Berkeley in Berkeley, California, United States; Carnegie Mellon University in Pittsburgh, Pennsylvania, United States; Virginia Tech in Blacksburg, Virginia, United States; and the University of Limerick in Limerick, Ireland.

Visit HP Labs for more information about HP's innovation for the environment and other research areas.

HP Labs and social innovation

HP Labs and our business groups' R&D teams also further social innovation by providing solutions to improve healthcare access and delivery, enhancing the quality of life for individuals and communities worldwide. Learn more about Social innovation on page 147.

Design

HP considers the environment in designing its products and solutions, from the smallest ink cartridge to entire data centers. We emphasize sustainability principles when selecting the materials for our products and packaging, assessing the resources required for transporting products, determining how they will function during use, and facilitating their reuse and recycling.

This holistic design approach extends to how we deliver information technology (IT) infrastructure and data center services for enterprises. We design complex IT systems in ways that can help large organizations consume less energy and water, reduce greenhouse gas emissions, and operate more efficiently.

Sustainability in product design

Environmental considerations are integral to HP research and development. We continually challenge ourselves to reduce the environmental impact of our products and meet increasing customer demand for more sustainable alternatives.

Through our company-wide Design for Environment (DfE) program, launched in 1992, more than 50 environmental product stewards work with design teams to identify and evaluate potential improvements in energy efficiency, materials choices, and recyclability. The principles of DfE help set requirements and fuel innovations in all new HP-designed hardware products and printing supplies. Environmental product stewards help teams to improve product performance, measure progress, and communicate results to customers, HP management, and other stakeholders.

In November 2011, we launched HP Project Moonshot—a multiyear, multiphase program dedicated to designing extreme-low-energy server technologies. By incorporating more efficient chip designs that deliver increased computing power, we expect Project Moonshot to reduce energy use by up to 89% and costs by up to 63%.[1] These designs will also improve server efficiency, scalability, and utilization, while requiring up to 94% less rack space at a data center.[1] We plan to combine our Project Moonshot work with HP Converged Infrastructure innovations to enable customers to share storage, networking, and management resources across thousands of servers while reducing energy usage and cooling.

Through the HP Pathfinder Program, part of Project Moonshot, we are assembling a network of industry leaders—including independent software vendors and computing, storage, and networking partners—to collaborate on developing and deploying extreme-low-energy server solutions. We expect HP Pathfinder to spur hardware and software innovations that support the evolution of cloud-based computing services, on-demand computing, and other technology environments that require massive data center infrastructures.

Design for recyclability

We design HP products to help facilitate recycling. For example, we use common fasteners and snap-in features and avoid applying glues, adhesives, or welds where feasible. This helps recyclers to more easily dismantle our products and to separate and identify different plastics. Most HP PCs are more than 90% recyclable, by weight.[2] In addition, HP workstations and the Elite and Pro series desktop PCs have a chassis that can be easily disassembled for upgrade to extend product life and for recycling at end of life.

As part of HP's efforts to enhance recycling, we are also working to improve the ability to remove inks from printed paper through research in innovative inks, additives, paper design, and deinking processes.

Design for accessibility

HP strives to create products, solutions, and online materials that are accessible to everyone, including people with disabilities and seniors with age-related limitations. Our product design teams regularly explore ways to enhance accessibility, productivity, and user comfort. Examples of accessibility features on HP products include buttons identifiable by touch, ports and switches positioned within easy reach, and large adjustable displays. Our customer support programs incorporate assistive technologies such as Telecommunications Relay Service, Video Relay Service, and Web Captioned Telephone to better serve users who are deaf or hard of hearing.

See the HP Accessibility website for more information and examples.

Sustainability in IT and data center design services

Through our IT and data center design services, we offer expertise in creating facilities and operations that help customers conserve energy and other resources while reducing costs and improving business efficiency. We apply many of the same technical innovations and best practices from HP's own operations to our designs for customers.

HP Critical Facilities Services (CFS) provides strategic consulting, design-build, and operational assurance resources to help customers upgrade existing data centers or build highly efficient new facilities. For example, our Energy Efficiency Analysis compares customers' power usage effectiveness and other measures to industry best practices and recommends improvements. Further, HP CFS helps customers achieve key energy-efficiency certifications such as the U.S. Green Building Council (USGBC) LEED® Standard for Data Centers, U.S. Environmental Protection Agency (EPA) ENERGY STAR® for Data Centers, and U.S. Department of Energy (DOE) "Save Energy Now." As of April 2012, HP CFS had designed more than 60% of all LEED-certified data centers.

HP CFS has been integral to Citigroup's leadership in the design and construction of highly reliable data centers that are also more sustainable. The LEED-certified centers that Citi worked on with HP CFS, as well as other LEED-certified projects, keep Citi on track with its $50 billion USD, 10-year program to reduce its environmental footprint. Learn more.

Details of the HP CFS life cycle approach can be found in the Products and solutions section life cycle graphic.

[1] Based on weighted average performance projections for workloads such as web serving, memcached, and data analytics. Cost estimates include infrastructure, space, and power and cooling costs over 3 years.

[2] Calculated using HP's Recyclability Assessment Tool.

Materials

HP evaluates environmental impact across the product life cycle when selecting materials for use in our products. We design products to use less material, and we seek alternatives to materials of concern. We strive to use recycled materials when possible, and we comply with all relevant government regulations wherever we do business. Our objective is to minimize the environmental impact of HP products while continuing to deliver exceptional value to customers.

Using less material

HP works to use materials more efficiently through innovations in technology and product design. For example, HP thin client computing devices can require up to 50% less material to produce than a traditional HP desktop PC. We also provide software and services that help customers optimize paper and supplies consumption.

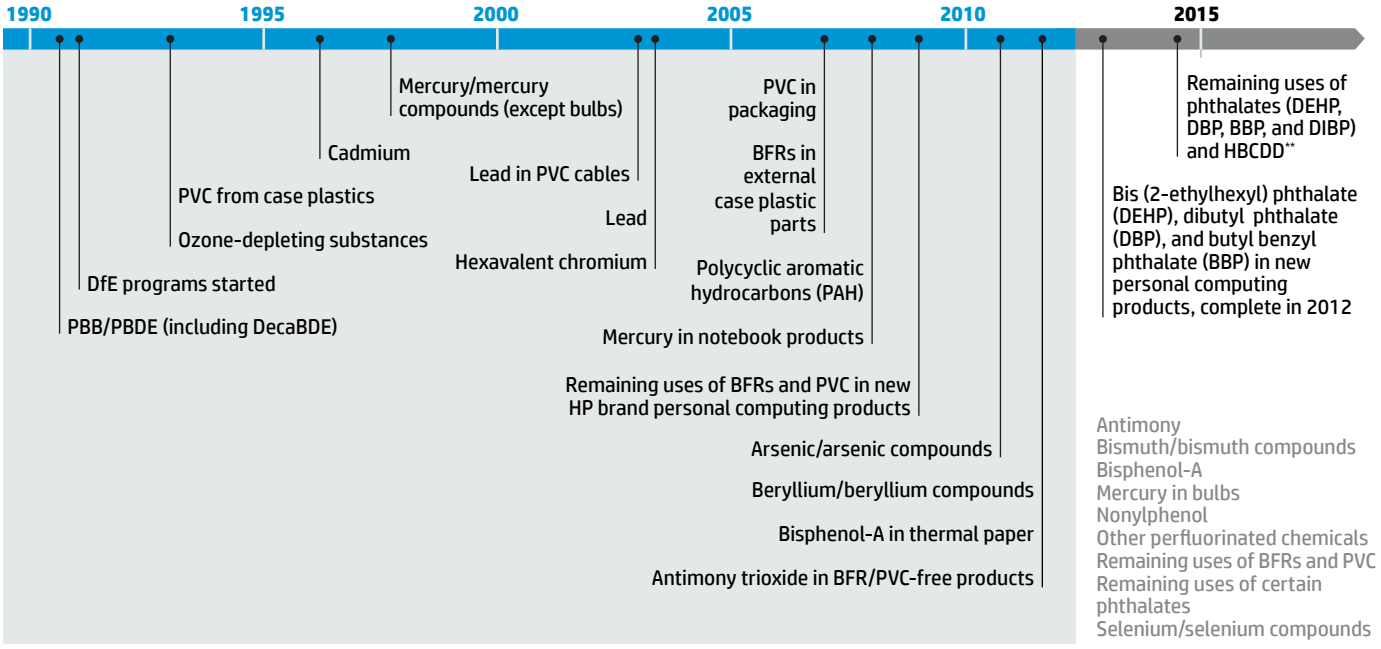
Evaluating substances of concern

HP proactively evaluates materials of concern. We may restrict substances because of customer preferences, legal requirements, or because we believe it is appropriate based on a precautionary approach. When scientific analysis reveals a potential health or environmental concern, we seek to replace substances with commercially viable alternatives. HP carefully assesses the environmental, health, and/or safety risks of these alternatives.

Nanotechnology

Nanotechnology holds long-term promise for creating electronics applications that require fewer materials and consume less energy. Since 1995, HP Labs has led research in the areas of nanoarchitecture, nanoelectronics, nanomechanics, and nanophotonics. Outcomes of this research include advances in memristor-based computer memory, which has the potential to run 10 times faster and use 10 times less power than an equivalent flash memory chip.

HP product proactive materials restriction/substitution timeline*



* Dates refer to when proactively adopted materials restrictions were first introduced on an HP product, ahead of regulatory requirements. Materials in gray text beyond April 2012 have been identified by stakeholders as potential materials of concern. Future possible restriction of those materials depends, in part, on the qualification of acceptable alternative materials. For a comprehensive list of HP's materials restrictions, including numerous materials restricted by HP on a worldwide basis in response to regional regulations, refer to HP's General specification for the environment.

** Limited to products within the scope of the EU RoHS Directive.

HP recognizes that since the properties of matter can depend on size and shape at the nanoscale, consideration of potential health and safety issues of nanostructured materials must be an integral part of any research program that seeks to bring such materials to market. Our Intelligent Infrastructure Research group at HP Labs has been a leader in research in this area.

HP employees making an impact: Dr. Paul Mazurkiewicz

As a senior scientist, Dr. Paul Mazurkiewicz helps identify materials that have a reduced risk of health and environmental impact for use in HP products. Learn more about Paul Mazurkiewicz on page 142.

HP compliance process

To help ensure HP meets legal requirements as well as our own materials standards, we follow a compliance process that has three key pillars:

- **The HP General Specification for the Environment (GSE)** includes substance and materials requirements for parts and components that are used in HP products, packaging, and manufacturing processes.
- **The HP Supplier Safe and Legal Standard** provides a consistent management system standard for the design, manufacture, and delivery of products that meet regulations concerning electromagnetic compatibility, safety, telecommunication authorization, energy efficiency, and other product content specifications.
- **The HP Active Verification Material Testing Specification** defines our requirements for testing materials used in HP products for the presence of specific substances that are restricted under the GSE.

In 2011, we added restrictions to the HP GSE on the use of certain phthalates in plastic parts in HP products. We are considering additional future restrictions on phthalates.

Phasing out BFRs and PVC

HP is working to phase out brominated flame retardants (BFRs) and polyvinyl chloride (PVC) where technically feasible in new products. For example, 96% of HP Compaq business PCs and HP notebooks launched in 2011 or after are BFR and PVC free.[1]

The timeline above shows substances that HP has proactively restricted or is considering for restriction.

Examples of BFR- and PVC-free products* in 2011

- The HP Compaq 8200 Elite Ultra-Slim Desktop PC
- The HP EliteBook 2760p Notebook PC, which also features a mercury-free LED-backlit display and is made with at least 12% postconsumer recycled plastic
- The HP ENVY[110] e-All-in-One, the world's only PVC-free printer as of August 2011**

* Meeting the evolving definition of "BFR/PVC-free" as set forth in the "iNEMI Position Statement on the Definition of 'Low-Halogen' Electronics (BFR/CFR/PVC-Free)." Plastic parts contain < 1,000 ppm (0.1%) of bromine [if the Br source is from BFRs] and < 1,000 ppm (0.1%) of chlorine [if the Cl source is from CFRs or PVC or PVC copolymers]. All printed circuit board (PCB) and substrate laminates contain bromine/chlorine total < 1,500 ppm (0.15%) with a maximum chlorine of 900 ppm (0.09%) and maximum bromine being 900 ppm (0.09%). Service parts after purchase may not be BFR/PVC free. Power supply and power cords are not BFR/PVC free.

** The HP ENVY[110] e-All-in-One is polyvinyl chloride-free (PVC-free), meeting the evolving definition of "PVC-free" as set forth in the "iNEMI Position Statement on the Definition of 'Low-Halogen' Electronics (BFR/CFR/PVC-Free)." Plastic parts contain < 1,000 ppm (0.1%) of chlorine (if the Cl source is from CFRs or PVC or PVC copolymers). Printers sold in China, India, and Korea have power cords that are not PVC-free. USB cable, required in limited geographic areas, is not PVC-free.

Assessing alternative materials

When replacing substances of concern, we seek to identify alternatives with a reduced risk of potential human health and environmental impacts that also meet our performance and cost criteria.

To support these objectives, we have developed an integrated assessment approach to analyzing potential replacements for substances of concern. Established in 2007, our approach begins with a hazard-based screening step to help rule out alternative options that are of equal or greater concern than the substances that they would replace. This comparative chemical hazard screening is based on the GreenScreen™ for Safer Chemicals framework developed by the nongovernmental organization (NGO) Clean Production Action.

Integrating the GreenScreen framework into our overall alternatives assessment protocol has enabled HP to more easily select replacement materials with a reduced risk of human health and environmental impacts. We have completed more than 130 assessments since the program began. Projects in 2011 included evaluating PVC-free power cords, process cleaners, and general plastic resins. We also participated in the Green Chemistry and Commerce Council (GC3) plasticizer alternatives assessment project, which employs GreenScreen.

[1] Meeting the evolving definition of "BFR/PVC-free" as set forth in the "iNEMI Position Statement on the Definition of 'Low-Halogen' Electronics (BFR/CFR/PVC-Free)." Plastic parts contain < 1,000 ppm (0.1%) of bromine [if the Br source is from BFRs] and < 1,000 ppm (0.1%) of chlorine [if the Cl source is from CFRs or PVC or PVC copolymers]. All printed circuit board (PCB) and substrate laminates contain bromine/chlorine total < 1,500 ppm (0.15%) with a maximum chlorine of 900 ppm (0.09%) and maximum bromine being 900 ppm (0.09%). Service parts after purchase may not be BFR/PVC free. Power supply and power cords are not BFR/PVC free.

Building on HP's success with this approach, we joined with the Business-NGO Working Group for Safer Chemicals and Sustainable Materials in 2011 to help draft a version of the chemical alternatives assessment protocol for use by other industries and groups to improve their materials selection processes.

Using recycled materials

HP continues to expand the use of recycled materials in its products. For example:

- The HP EliteBook 2560p, launched in 2011, is our first notebook computer made with more than 20% postconsumer recycled plastic.
- The HP Deskjet 3070A e-All-in-One printer contains 25% recycled plastic, and the HP Deskjet 3050A e-All-in-One contains 25% postconsumer recycled plastic. As of July 2011, no other manufacturer had claimed to produce a printer made with more recycled content.[2]

Through our "closed loop" recycling process, Original HP ink and LaserJet toner cartridges are reduced to raw materials that can then be used to make new cartridges as well as other metal and plastic products. We are also developing "closed loop" recycling processes for some of our hardware products. This effort involves recovering plastic from electronics products at HP's North American recycling facilities, and recompounding the plastic to return it to virgin resin properties and colors for use in creating new electronics products.

Supporting relevant government regulations

HP complies fully with materials regulations, and we were among the first companies to extend the restrictions in the European Union (EU) Restriction of Hazardous Substances (RoHS) Directive to our products worldwide through the HP GSE. HP has contributed to the development of related legislation in Europe, as well as China, India, and Vietnam.

We believe the RoHS directive and similar laws play an important role in promoting industry-wide elimination of substances of concern. We have supported the inclusion of additional substances—including PVC, BFRs, and certain phthalates—in future RoHS legislation that pertains to electrical and electronics products. (See our compliance statement.)

HP complies with the EU's Registration, Evaluation, Authorisation, and Restriction of Chemical substances (REACH) legislation, which includes requirements for assessing and managing the risks posed by chemicals. We accomplish this by working closely with suppliers to gather information on listed substances that may be in HP product materials and providing related safety information to customers.

Our approach to regulatory compliance also covers material sourcing. HP is working with a range of stakeholders to help ensure that conflict minerals—minerals originating from the Democratic Republic of Congo (DRC) and adjoining countries that are used to produce tin, tantalum, tungsten, and gold—do not directly or indirectly fund groups responsible for human-rights abuses.

Manufacturing

Product manufacturing, managed primarily by HP suppliers, represents a sizable amount of our overall greenhouse gas (GHG) emissions footprint. HP collaborates with our manufacturing partners and suppliers to reduce this environmental impact.

As part of our Supply Chain Social and Environmental Responsibility (SER) program, HP focuses on a broad range of environmental performance factors across our business. We capture data on energy use, GHG emissions, and water use to assess our suppliers' carbon footprint, communicate the findings, and engage suppliers to improve their performance.

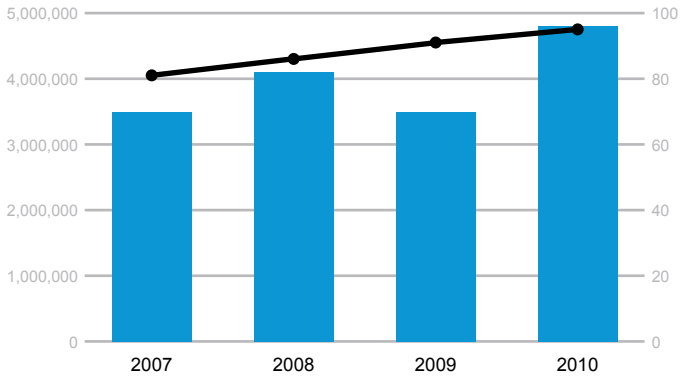
In 2008, HP became the first major information technology (IT) company to publish aggregated supply chain GHG emissions, beginning with data from 2007. We have continued working with suppliers and industry organizations to improve energy management within our supplier base.

[2] HP IPG Research Alliance, July 2011. Based on a survey of publicly available information.

Supplier GHG emissions data

To provide context for the data we report on first-tier supplier GHG emissions, we also report the percentage of our overall spending on first-tier suppliers that the data represents. Each year since 2007, that percentage has increased. The proportion of that spend with suppliers that have reduction goals has also continued to rise, from 67% in 2008 to 88% in 2010 (the most recent year data is available). Additionally, the percentage of that spend represented by suppliers that estimate their own Scope 3 GHG emissions[1] have increased from 29% in 2008 to 54% in 2010. During that same time period, the data we captured has shown a steady decrease in GHG emissions intensity (see graph below).

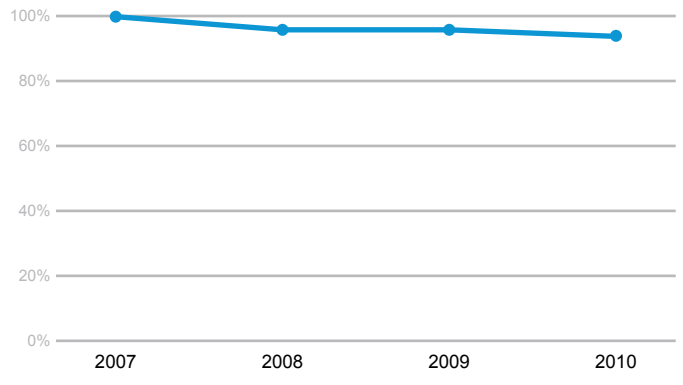
Supplier GHG emissions performance* [tonnes CO_2e]



	2007	2008	2009	2010
Aggregate first-tier suppliers' Scope 1 and 2 emissions	3,500,000	4,100,000	3,500,000	4,800,000
Coverage [percentage of first-tier supplier spend captured]	81%	86%	91%	95%

* Refers to first-tier suppliers for manufacturing, materials, and components. Emissions are estimated based on suppliers' dollar volume of HP business compared with their total revenue. The majority of these companies report on a calendar year basis. 2010 is the most recent year data is available.

Supplier GHG emissions intensity [tonnes CO_2e/first-tier supplier spend, 2007 = 100%]



	2007	2008	2009	2010
Supplier GHG emissions intensity	100%	96%	96%	94%

[1] The World Resources Institute (WRI) defines Scope 1, 2, and 3 GHG emissions in its Greenhouse Gas Protocol; see www.ghgprotocol.org/calculation-tools/faq.

The growth in aggregate first-tier emissions in 2010 may be attributable to several factors, including strong business growth and a 4% increase in data collection scope. As more companies disclose emissions numbers, and require their partners to do the same, the data is becoming more comprehensive, inclusive, and accurate. HP remains at the forefront of encouraging transparency in data collection, leading to greater insight into emissions across the IT industry.

Environmental hot spot analysis

We enlisted the services of HP Energy and Sustainability Management (ESM) to conduct an assessment that would complement data received from suppliers. Leveraging analytic modeling tools from HP Labs, ESM developed a supply chain "hot spot" analysis and service that rapidly analyzes energy and natural resource use in any company's supply chain.

The analysis examined HP's supply chain, from raw materials extraction to product manufacturing, considering specific environmental aspects including electricity and natural gas use, water consumption, waste generation, and GHG emissions. The results of this analysis will help shape HP's future capability building programs, and may be used to identify specific areas of focus in our supply chain to improve efficiency and performance.

Expanding the Energy Efficiency Partnership program in China

In 2010, HP became a charter member of the BSR Energy Efficiency Partnership (EEP) program in China. The working group helps suppliers reduce energy use and associated GHG emissions, and lower costs. Throughout 2011, all 12 participating supplier sites developed and submitted action plans for energy management, including a total of 24 new energy-saving projects (see sidebar at right).

The programs target improved energy efficiency across operations: heating, ventilation, and air conditioning (HVAC); boilers and steam heating; lighting; heat recovery ventilation (for fresh air and climate control); compressed air; and electrical motor and drive systems used to operate machinery. During the first 10 months of the 2011 program cycle (through June 2011), participating HP suppliers reported that they saved a total of 6 million kilowatt hours (kWh), equal to the carbon dioxide equivalent (CO_2e) emissions of removing 811 passenger vehicles from the road for a year.[2]

In 2012, HP is expanding its role in the initiative by partnering with the World Wildlife Fund (WWF), extending the reach of the initiative to additional companies. Program participation will total 34 suppliers and 50 sites across China, up from eight suppliers and 12 sites in 2011.

A partner in efficiency

Jabil, a worldwide electronics solution provider, joined the EEP program in 2010. The company provides design, production, and product management services to electronics and technology companies.

One component of their EEP participation was a 2011 comprehensive energy audit by an external firm at Jabil's manufacturing site in Huangpu. As a result, the company instituted a number of energy-management practices. One involved a smart metering system to track and measure energy consumption throughout the facility. While the initial phase is focused on electricity use, future monitoring will include water, steam, natural gas, and other resources used in Jabil's manufacturing, heating, lighting, and operations.

During the first 6 months, Jabil saved almost 2.7 million kWh at the site, helping to reduce GHG emissions and deliver substantial cost savings. Due to these energy savings, the system is expected to pay for itself within 2 years.

[2] U.S. EPA Greenhouse Gas Equivalencies Calculator. For details, see www.epa.gov/cleanenergy/energy-resources/calculator.html.

Packaging

Packaging can contribute significantly to the environmental footprint of HP products. It also provides an opportunity for us to demonstrate to customers our commitment to conserving resources. While we aim to reduce environmental impacts associated with the materials, transport, and recycling or disposal of packaging, we must balance those efforts with other considerations such as adequate product protection, regulatory requirements, total costs, and the overall impact of alternative packaging options. HP pursues a holistic approach to packaging that considers all phases of the process—from raw materials acquisition to end of life—to guide our decisions.

We integrate these considerations into our guidelines for third-party packaging vendors, enabling them to create more innovative and environmentally responsible packaging designs. Also, our General Specification for the Environment (GSE) restricts substances of concern and requires that all materials used in HP packaging be recyclable.

Our environmental strategy for packaging consists of the following six dimensions. (Examples of our work across each of these dimensions can be found in the table below.)

Remove

We strive to eliminate the use of substances of concern when lower-impact alternatives are readily available. For example, our GSE bans the use of PVC as a packaging material with minor exceptions.[1] (See related information regarding our products in Materials on page 36.)

Reduce

To be effective, packaging designs must take into account a product's size, weight, and durability. In turn, the size and weight of packaging materials affect the carbon footprint of product transport. With these considerations in mind, we continue to reduce the amount of packaging used per product while maintaining adequate protection. We meet or exceed local legal standards for packaging minimization where they exist; where local standards do not exist, we stipulate that packaging cannot be more than twice the volume of the product it contains. We have also continued to reduce the amount of paper delivered with products, such as warranties and manuals, by making the information available online for our customers rather than including it in the packaging. (See Paper on page 27 for more information.)

Reuse

We design packaging to enable reuse where feasible, while providing sufficient protection for our products. This includes making it easier for our retailers, distributors, and enterprise customers to return packaging materials to HP or reuse the materials for future shipments. For example, we incorporate reusable packaging when shipping certain components from suppliers to factories, and when sending certain replacement parts to customers.

Recycle

We are committed to increasing the proportion of recycled content in HP packaging materials. The amount of recycled content varies widely by region, packaging material, and product type. Where feasible, HP is shifting from plastic packaging to paper and molded pulp alternatives that contain recycled content and/or have been certified in accordance with a sustainable forest management standard. In some instances, however, plastic packaging may actually decrease carbon footprint because it is significantly smaller and lighter than the molded pulp packaging that would be needed to provide a similar level of protection. In those cases, we increasingly use expanded polystyrene (EPS) or polyethylene (PE) foam cushions that contain recycled plastic.

Replace

Whenever possible, we use packaging materials that reduce environmental impact while still meeting our product protection requirements. We evaluate the total life cycle of materials to assess the overall impact of a change; for example, weighing factors such as recyclability and the potential to reduce greenhouse gas (GHG) emissions.

[1] The restriction on PVC in HP packaging does not apply to protective tape covers with a surface area equal to or less than 15 square centimeters (2.35 square inches) and/or weighing less than 1g (0.035 ounce).

Influence

As a major purchaser of packaging materials, HP uses its influence to encourage packaging vendors to increase the use of recycled fiber content and sustainably harvested fiber in our paper-based packaging. We are also working with providers of 100% recycled EPS and PE foam cushions to broaden industry adoption of these materials and build the infrastructure required to make them easier to recycle. Our support helped Sealed Air, a major supplier of recycled PE foam used in cushions for HP packaging, to expand its "closed loop" recycling process globally and create Ethafoam® MRC, which is made with 100% recycled resin content (see quote at right).

"HP has enhanced its sustainability efforts by working with its packaging suppliers, production factories, and end users to send back their PE foam material scrap through our 'closed loop' recycling system instead of to a landfill. Together, we are improving the design of PE foam packaging for HP to facilitate the safe arrival of its products, while also further reducing environmental impact."

—Ron Cotterman, Sustainability Director, Sealed Air

HP packaging: environmental highlights

HP packaging innovations often touch on multiple dimensions of our environmental strategy, as shown in the following examples.

Remove

HP notebook PCs
Eliminated a cardboard insert from packaging to use fewer materials.

Reduce

HP notebook PCs
Reduced packaging material weight by an average of 180 grams per unit—reducing GHG emissions from product transport by an estimated 15,000 tonnes of carbon dioxide equivalent (CO_2e) annually.

HP Officejet Pro 8600 e-All-in-One printer
Influenced product design to enable smaller and lighter packaging, reducing GHG emissions from product transport by an estimated 2,100 tonnes of CO_2e annually.

Reuse

Bulk shipping of products
Return corrugated fiberboard trays to manufacturers after they have been used for bulk shipping of products to retailers.

HP BladeSystem blade server bulk packs
Supply chain partners reuse packaging materials when shipping server components from one factory to the next.

Recycle

HP high-capacity XL ink cartridge combo packs
Use paperboard containing 15% recycled content for the external shell.

HP commercial desktop PCs
Units shipped in North America are packaged with foam cushions made from 100% recycled plastic content.

Replace

HP high-capacity XL ink cartridge combo packs
Replaced thermoformed plastic with paperboard in external packaging.

HP commercial desktop PCs
Replaced molded pulp with recycled PE foam cushions that are smaller and lighter.

Influence

Desktop PCs
Working with providers of recycled foam cushions to broaden industry adoption and build recycling infrastructure.

Transport

HP conducts business in more than 170 countries globally, and ships more than a million products around the world on a typical day. We are committed to reducing the greenhouse gas (GHG) emissions and other environmental impacts related to these activities.

In 2011, GHG emissions related to transporting our products equaled an estimated 1.9 million tonnes of carbon dioxide equivalent (CO_2e), approximately the same as in 2010. This is roughly comparable to GHG emissions from our own operations.

Our strategy for decreasing fuel use and transport-related emissions concentrates on three areas.

Optimizing product transport networks

HP is decreasing the distance products need to travel, and therefore reducing fuel use and GHG emissions. We accomplish this by locating manufacturing facilities closer to customers, using distribution centers that allow us to operate the most direct routes, and consolidating shipments when feasible.

In 2011, HP began manufacturing some desktop PCs and monitors bound for the Middle East, Mediterranean, and Africa in the northwestern Turkish city of Corlu, instead of in the Czech Republic. This shift converted shipments from air to ocean, reducing costs and decreasing fuel-related GHG emissions that year by more than 30%.[1]

We also recognize the environmental benefits of warehouse consolidation. In the United States, HP consolidated three West Coast warehouses into one—reducing the total square footage, improving operational and energy efficiencies, and increasing the consolidation of outbound freight. With all inbound freight now shipped to a single port and consolidated for distribution, we were able to decrease average transport distance per shipment by approximately 200 road miles.

To further reduce overall environmental impacts, HP takes a holistic approach to the relationship between product packaging and transport. Learn more in Packaging on page 41.

Shifting modes of transport

We typically ship HP products by ocean or air from the manufacturing location to regional distribution centers, and then by truck or rail to their final destinations. Because emissions vary greatly by transport mode, shifting modes can reduce impacts substantially (see chart below).[2] In 2011, HP air-to-ocean conversions included selected shipments of HP notebook PCs from Asia Pacific to Europe, Latin America, and the United States, resulting in an estimated savings of 15,000 tonnes of CO_2e.

Estimated GHG emissions from product transport, 2011*

Mode	2010			2011		
	GHG emissions [million metric tonnes CO_2e]	**GHG emissions** [percentage of total from transport for year]	**Shipment mix by weight-distance** [approximate, kg-km]**	**GHG emissions** [million metric tonnes CO_2e]	**GHG emissions** [percentage of total from transport for year]	**Shipment mix by weight-distance** [approximate, kg-km]**
Air	1.2	65%	10%	1.3	70%	10%
Ocean	0.2	10%	70%	0.2	10%	70%
Road (includes rail)	0.5	25%	20%	0.4	20%	20%

* Table does not include data from all recent HP acquisitions.

** All figures rounded; improvements in mode transport efficiency may not be fully reflected.

1 Calculation based on GHG Protocol weight/distance method.

2 According to the World Resources Institute GHG Protocol. Calculation methodology based on GHG Protocol distance-based method.

Influencing logistics service providers

HP works with logistics service providers (LSPs) who maintain high standards for reducing their environmental footprint and that of their customers. We require our LSPs to track GHG emissions associated with the transport of HP products.

In the United States and Canada, all HP consumer products are shipped using a network composed entirely of surface transportation carriers certified by SmartWay—a collaboration between the U.S. Environmental Protection Agency (EPA) and the freight transportation industry. Now considered a baseline requirement in shipping and logistics, SmartWay aims to reduce fuel consumption and GHG and other air emissions.

Use

Addressing impacts during customer use of our products and solutions is an integral part of HP's life cycle approach to environmental sustainability.

For example, HP works to improve energy efficiency across our entire portfolio, from the smallest devices to the largest data centers. In 2011, we exceeded our goal of reducing the energy consumption of HP products[1] and associated greenhouse gas (GHG) emissions to 40% below 2005 levels by the end of 2011, achieving a 50% reduction 9 months ahead of schedule.

HP recognizes the importance of addressing energy and paper consumption during product use. For many of our products, the use phase represents the largest portion of their respective carbon footprints.

At the same time, relative impacts vary across a hardware portfolio as diverse as HP's, which ranges from single user personal computing devices and printers to enterprise-wide servers, storage equipment, and complete data centers. Conscious of the complexity that portfolio usage and global power mix entail, HP is undertaking an effort to measure the carbon footprint during use of sold products according to the Greenhouse Gas Protocol (GHG Protocol) Corporate Value Chain (Scope 3) Accounting and Reporting Standard.[2]

To reduce resource and energy consumption during product use, HP continually strives to improve product performance and provide customers with the knowledge and tools that help to inform their purchase decisions and usage.

HP Energy and Sustainability Management (ESM)

In early 2012, ESM began working with a major northeastern American city to assess its energy consumption and develop a strategic approach to reducing energy costs. ESM advised the city on technology and software solutions best suited to reduce its energy use, decrease GHG emissions, and meet goals established by city government. The project included a rapid assessment of the city's ongoing energy use to identify opportunities to reduce a growing energy budget.

Using the web-based HP Carbon Footprint Calculator for computing and printing products, customers can compare estimated paper and energy use and costs, along with carbon emissions for HP and Compaq products, side by side, based on location-specific data.[3] In 2011, we expanded the calculator to cover more than 9,000 HP and non-HP devices.[4] The calculator receives more than 10,000 visits per month.

Personal computers and devices

At the end of 2011, HP had more than 400 PC and display products with configurations that are ENERGY STAR® qualified with 85% efficient power supplies. One example is the HP TouchSmart610 PC series. If just 10% of all desktop PCs and monitors sold in 2005 were recycled and replaced with the energy-efficient HP TouchSmart PCs,

[1] The average energy consumption of HP products is estimated using high-volume product lines representative of the overall shipped product volume. Energy consumption has been estimated in 2005 and annually since. The high-volume product lines include notebook and desktop computers, inkjet and LaserJet printers, and industry-standard servers.

[2] The GHG Protocol, a decade-long partnership between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD), is the most widely used international accounting tool for government and business leaders to understand, quantify, and manage greenhouse gas emissions. More information at www.ghgprotocol.org.

[3] Power, cost, and carbon calculations are estimates. Results will vary based on variables, which include information provided by the user, time PC is in different power states (on, standby, off), time PC is on AC, hardware configuration, variable electricity rates, and utilities provider. HP advises customers to use information reported by this Carbon Footprint Calculator for reference only and to validate impact in their environment. For more information about calculation assumptions, see www.hp.com/large/psg/toolassumptions.pdf.

[4] The Carbon Footprint Calculator also estimates the user's costs for the electricity and paper a printer consumes. It is based on certain key assumptions and makes use of data and models generated by third parties.

more than 3.1 million tonnes of carbon dioxide equivalent (CO_2e) emissions would be avoided during the first year, equivalent to removing 596,000 cars from the road for a year.[5]

As of January 2012, HP has 89 EPEAT® Gold registered personal computing products, meeting the highest global standards for "greener" electronics as measured by the Electronic Product Environmental Assessment Tool. And as of the end of 2011, the entire family of HP ENVY Notebook PCs is EPEAT Gold registered as well.

The HP Compaq 8200 Elite ultraslim desktop PC delivers 40% faster performance and up to 50% greater energy efficiency than the previous-generation product.[6]

Helping end users more easily manage their energy use, HP Power Assistant offers real-time visibility and control of a PC's energy use, and helps customers meet their goals for more energy-efficient computing. The Usage Details feature estimates the costs of running a PC—in dollars, kilowatt hours, and CO_2e emissions.[7]

Imaging and printing

As of December 2011, we offered the greatest number of ENERGY STAR qualified printers and multifunction printers (MFPs) in the industry. Further, HP increased the overall energy efficiency of our ink and laser printing products by 46% from 2005 to 2011.[8]

HP continues to pioneer ways to help customers reduce the carbon footprint of their printing. Worldwide in 2012, HP LaserJet and inkjet printers will use 13% less electricity per year than 2011 HP LaserJet and inkjet printers.[9] That's equivalent to 71,000 tonnes of GHG emissions—or like taking 14,000 passenger cars off the road for a year.[10]

The HP LaserJet Pro P1102 is the world's most energy-efficient laser printer.[11] It also features HP Auto-On/Auto-Off Technology, which turns your printer on when you need it and off when you don't.[12] By the end of 2012, most new HP LaserJet printers and multifunction printers will include Auto-On/Auto-Off energy-saving features.

HP Managed Print Services (MPS) helps cut costs and conserve resources. Pre- and post-analysis of HP MPS customers' imaging and printing operations reveals energy savings of up to 80%, and reductions in paper consumption in the millions of pages.[13] Disney seeks the best solutions to help deliver on its environmental promise and worked with HP to develop its Document Output Management Program using HP MPS. Disney reduced the number of printing devices by 59%. As a result, Disney reported that its energy consumption for printing dropped by 18% and avoided an estimated 185 tonnes of CO_2e emissions over 3 years. To learn more, read the Disney case study.

HP Web Jetadmin provides organizations a comprehensive view of activity across their printing fleet and lets IT managers centrally configure and manage devices across the enterprise to take advantage of energy-saving features such as automatic sleep and wake modes. And with the HP EcoSMART Fleet—introduced in 2011—users can collect data and control settings, then create reports to establish and monitor progress toward environmental goals.

HP Retail Publishing Solutions offers HP MiniLab and HP MicroLab inkjet solutions, self-contained systems that provide a less resource-intensive alternative to traditional photo processing by eliminating the need for water. If all silver halide systems worldwide were switched to HP Minilab printers, the estimated reduction in carbon dioxide (CO_2) emissions would be equivalent to removing 65,000 passenger vehicles from the road for a year.[14] And HP Retail Publishing Solutions is nearly three times more energy efficient than traditional silver halide minilabs—amounting to an estimated cost savings of up to $1,000 USD per machine per year.[15]

[5] HP compared the energy consumption of comparable HP products in 2005 with our latest models for each category of products, including the HP TouchSmart 610 series PCs. Estimations of the energy consumption of 2005 products were done by using worldwide IDC shipped volumes, HP products, U.S. Environmental Protection Agency's ENERGY STAR program product averages, and the typical energy consumption (TEC) method. The energy costs are based on U.S. Department of Energy data, and actual results may vary. We used the following products for this analysis: HP Deskjet 3050, HP LaserJet CP1215, HP LaserJet CP1025, HP Compaq 8200 Elite, HP Compaq 2310, HP Compaq 8000f Elite, HP Compaq LE19 monitor, HP StorageWorks EVA, HP ProBook 6550b, HP G60t Series Notebook, HP TouchSmart610 PC, HP ProLiant DL380 G4 and G6 servers, and the HP ProLiant DL360 G7 server.

[6] PCMark05 performance benchmark and comparison testing performed on a similarly configured HP Compaq 8000 Elite SFF and HP Compaq 8200 Elite SFF. Performance profiles: PCMark05 done with the "as shipped" defaults. Power benchmark and comparison testing performed on a similarly configured HP Compaq dc7900 SFF and HP Compaq 8200 Elite SFF. Power profiles: power measurements were done with the "as shipped" defaults. Power measurements for idle, off, and sleep/standby were conducted per ENERGY STAR guidelines. Actual results may vary based on system configuration, and performance will vary over time depending on software installed.

[7] HP Power Assistant enhances management of the system energy requirements and enables users to take control of their power consumption for a reduced impact on the environment. Power calculations and cost calculations are estimates. Results will vary based on variables, which include information provided by the user, time PC is in different power states (on, standby, hibernate, off), time PC is on battery or AC, hardware configuration, variable electricity rates, and utilities provider. HP advises customers to use information reported by HP Power Assistant for reference only and to validate impact in their environment. Environmental calculations were based on U.S. Environmental Protection Agency (EPA) eGrid 2007 data found at www.epa.gov/egrid. Regional results will vary. Microsoft® Windows® required.

[8] Efficiency is defined in terms of kilowatt hours (using the typical electricity consumption method) divided by pages per minute. These families represent more than 32% of inkjet printers and more than 45% of LaserJet printers shipped in 2005. HP updated this goal from the goal included in the FY07 Global Citizenship Report, which targeted a 30% improvement in energy efficiency by 2010, relative to 2005.

[9] Baseline figure is 2011 HP LaserJet and inkjet printers sold worldwide.

[10] U.S. EPA Greenhouse Gas Equivalencies Calculator. For details, see www.epa.gov/cleanenergy/energy-resources/calculator.html.

[11] Energy consumed based on competitive TEC measurement results found at www.energystar.gov, and manufacturers' published data sheets for single-function mono and color laser printers as of January 2012. Individual product configuration and usage will affect power consumption.

[12] HP Auto-On and Auto-Off capabilities subject to printer and settings.

[13] Estimated energy and paper savings based on analysis of select HP Managed Print Services customers' imaging and printing operations using data gathered on devices and paper consumption, and comparing with post-MPS actuals or projections.

[14] Claim based on PFN data on worldwide total installed base of approximately 106,416 silver halide minilabs (September 2009). Calculated with the EPA Greenhouse Gas Equivalencies Calculator. For details, see www.epa.gov/cleanenergy/energy-resources/calculator.html. Based on a 2010 life cycle assessment (LCA) performed by Four Elements Consulting and commissioned by HP. The study compared the impact of using HP ML1000D, HP ML2000D and HP Microlab pm2000e printers with the impact of using Fuji Frontier 370 and Noritsu QSS-3502 printers to produce 450,000 4 x 6-inch photos a year in North America. For details, see www.hp.com/go/rps.

[15] h20338.www2.hp.com/enterprise/downloads/HP%20Retail%20Publishing%20Solutions%20-%20Saving%20Energy.pdf.

Data center services and solutions

HP takes a holistic approach to the data center. Our services include comprehensive networking, storage, and server assessment; energy-efficiency evaluation; and data center design and management. We're improving the energy efficiency of our servers as well. The latest HP ProLiant G7 and Gen8 servers are ENERGY STAR qualified, helping customers reduce energy consumption, reclaim capacity, and extend the life of the data center.

In 2011, with the help of HP Converged Infrastructure, global logistics provider UPS replaced a disparate, disconnected collection of traditional servers that were difficult and costly to manage with an HP Converged Infrastructure solution that moves the company's mission-critical systems to a virtualized environment with industry-standard HP ProLiant servers and HP storage arrays, supported by HP networking solutions. Virtualization has reduced server count by more than 1,000 physical servers over 2 years, and reduced energy use by 4.8 million kilowatt hours (kWh). To learn more, read the full case study.

HP Critical Facilities Services (CFS) provides consulting and design engineering and architecture services, working with clients to evaluate their needs and help with the planning and implementation of all aspects of data center infrastructure. One solution is the HP Flexible Data Center, which uses prefabricated, standardized components to shorten the time it takes to build and deploy a data center. In addition to lower capital costs and faster time to market, HP Flexible Data Center configurations improve the use of power and cooling resources to reduce energy and water consumption, and decrease GHG emissions. The Flexible Data Center can cut energy costs by nearly 14% and reduce annualized power usage effectiveness (PUE) rating by 13.2%, compared with a traditional data center.[16]

HP POD 240a Data Center

In 2011 we announced the HP POD 240a—also known as the HP EcoPOD—a self-contained, modular, ultraefficient data center. The HP EcoPOD achieves ten times the information technology (IT) capacity per square foot, compared with conventional brick-and-mortar data centers. It can be quickly deployed at one-quarter of the cost of a traditional data center and uses 95% less facilities energy.*

* New POD technology from HP offers 95% greater energy efficiency compared with a traditional brick-and-mortar data center, based on internal HP testing.

Software

HP software products can help customers save energy, costs, and other resources by reducing unnecessary computing and storage capacity.

With HP Software as a Service (SaaS), HP hosts and operates software for our customers, sharing the systems on which the software runs among multiple users and multiple applications. Because customers are not running software through their data centers, they save power, cooling, energy, and floor space.

SaaS is a component of cloud computing which provides on-demand access to configurable shared resources, including software. The predicted adoption of cloud computing by U.S. businesses with annual revenues of more than $1 billion USD could save an estimated 85.7 million tonnes of CO_2 emissions by 2020, as a result of spending 69% of infrastructure, platform, and software budgets on cloud services.[17]

HP SaaS can reduce environmental impacts related to software disk and packaging manufacture, distribution, and shipping, also resulting in greater operational efficiency and better resource management. And by offering remote access to software via the Internet, SaaS expands opportunities for telecommuting and remote IT support, which can reduce the need for travel.

HP Business Service Automation (BSA) is software that customers use to manage IT services and capacity to improve efficiency across domains and virtual environments. For example, BSA can be used in conjunction with data center hardware to dynamically adjust capacity, switching off equipment when it is not needed. Companies that have used BSA for storage provisioning report that they have regained up to 40% of space from existing storage.[18]

HP Service Health Optimizer is capacity-planning software that makes recommendations on how to reduce the number of systems in an IT environment. It proposes configurations for the ideal size, placement, and allocation of virtual machines relative to physical space. This increased density can decrease the system footprint space and energy consumption.

[16] h20195.www2.hp.com/V2/GetPDF.aspx/4AA2-1533ENW.pdf.

[17] 2011 Carbon Disclosure Project Study.

[18] Dimensional Research "HP Customers Reveal Real-Life Benefits of IT Automation" 2010.