



# 2011 Environment Report



From algae-based aviation fuel to ground-based applications of solar technologies that power spacecraft, innovative Boeing designs are creating a cleaner future.



## Creating a Better Future

Message from Jim McNerney, Boeing chairman, president and CEO, and Mary Armstrong, vice president of Environment, Health and Safety.



## Environmental Technologies

The new 747-8 and 787 are designed to be 16 to 20 percent more fuel efficient than the airplanes they replace. Boeing is introducing enhancements that boost fuel efficiency and reduce emissions of the 737, 767 and 777, while also investing in innovative clean technologies for the future as well.



## Reducing Our Footprint

Our newest factory is using 100 percent renewable energy to assemble the fuel-efficient 787 in a clean new way. Boeing's ongoing commitment to energy efficiency is one of the reasons we were named a U.S. EPA ENERGY STAR partner of the year in 2011.



## Measuring Our Progress

Since 2002, Boeing has reduced CO<sub>2</sub> emissions and energy consumption by nearly one-third and cut water intake and hazardous-waste generation by more than 40 percent.

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Creating a Better Future

## Message From Jim McNerney and Mary Armstrong



PHOTO: BOEING PHOTO

Jim McNerney, chairman, president and chief executive officer of The Boeing Company, and Mary Armstrong, Boeing vice president of Environment, Health and Safety.

Environmental considerations drive our people and our business.

we have always done in the past, are stepping up to this challenge.

Our customers want more airplanes that can be operated and maintained using less fuel and fewer hazardous chemicals.

For the past 95 years, Boeing has focused some of the best and brightest talent from around the world to develop

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“Through our skilled and innovative workforce, we are making tremendous strides to improve the environmental performance of Boeing, of our products and of the global aerospace industry.”

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Our investors want the increased productivity that comes from saving energy, conserving water and eliminating waste. Our neighbors want to ensure that we are protecting the environment. And the innovative people of Boeing, as

that which rested only in the imagination of previous generations. As we look forward to our 100th anniversary as a company, we realize that pollution and climate change are serious challenges that require aggressive action. We also



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believe that, through our skilled and innovative workforce, we are making tremendous strides to improve the environmental performance of our company, our products and the global aerospace industry.

We are building the next generation of efficient aerospace products. We are pioneering the research into cleaner

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fuels. We are improving the efficiency of the global air traffic management system to reduce the global carbon footprint of air travel. And we are investing in bold, new technologies to create a brighter future.

At the same time, inside our own facilities, we are conserving energy, water and natural resources; this both improves our productivity and decreases Boeing's environmental footprint. Since 2002, on a revenue-adjusted basis, Boeing has reduced carbon dioxide emissions by 28 percent, energy

consumption by 30 percent, hazardous-waste generation by 44 percent and water intake by 41 percent.

Our newest facility in South Carolina demonstrates Boeing's commitment to continuous environmental improvement. This site will send zero waste to landfills and be powered entirely with energy from renewable sources — including solar panels on the roof of the 787 Dreamliner final assembly building there.

At Boeing, we have challenged ourselves to make our products, services and

operations ever more environmentally progressive. Boeing employees around the globe are embracing this challenge and making incredible strides to benefit our customers, our investors, our communities and our world. As we accelerate these environmental improvements, we continue to pursue new game-changing possibilities.



Jim McNerney  
Chairman, President and Chief Executive Officer  
The Boeing Company



Mary Armstrong  
Vice President  
Boeing Environment, Health and Safety



## Pioneering Environmental Technologies



PHOTO: BOEING PHOTO

The new 747-8 and 787 Dreamliner, both scheduled to enter commercial service in the second half of 2011, are more fuel efficient — with a smaller noise and emissions profile — than the airplanes they replace.

From algae-based aviation fuel to ground-based applications of solar technologies that power spacecraft, innovative designs by Boeing are creating a cleaner future. The Boeing approach to achieving higher performance involves the development of new products, while improving our current product lines at the same time.

Improved fuel consumption is at the core of our research-and-development efforts. Our biggest contribution as a

company is designing airplanes that burn less fuel and produce a smaller carbon footprint.

We are researching cleaner energy sources, such as biofuels made from algae, salt water grasses, oilseeds and other feedstock, that do not compete with food crops for land or water. And we are developing advanced concepts for the future, including hydrogen- and solar-powered aircraft for our government customers. ■

## Pioneering Environmental Technologies

# Improving Product Performance



BOEING ILLUSTRATION

The ecoDemonstrator will accelerate emerging technologies in the areas of fuel efficiency, emissions and noise reduction. Boeing will begin flight testing an ecoDemonstrator 737 in 2012 and an ecoDemonstrator twin-aisle airplane in 2013.

Boeing's approach to achieving higher performance involves developing fuel-efficient new products and improving our current product line at the same time. The fuel efficiency of airplanes has improved significantly since the first commercial jetliners were introduced, and the next generation promises to be even more efficient.

The new 747-8 and 787 Dreamliner, both scheduled to enter commercial service in the second half of 2011, are more fuel efficient — with a smaller noise and emissions profile — than the airplanes they replace. In addition, Boeing is introducing enhancements to boost fuel efficiency and reduce CO<sub>2</sub>

than today's airplanes of comparable size. The Dreamliner recently completed its 1,000th flight, marking another milestone in the flight-test program. As of May 2011, the seven airplanes participating in flight testing accumulated more than 3,500 hours of flying and more than one million miles (1.6 million kilometers).

The 747-8, with its advanced engines and systems, will have the lowest seat-mile cost of any large commercial jetliner. The airplane provides 16 percent better fuel economy and 16 percent lower carbon emissions, and generates a 30 percent smaller noise footprint than the 747-400.

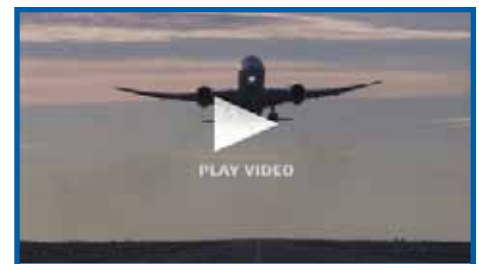
**“The 777F is a game changer. Its operational efficiencies and environmental benefits alone are impressive.”**

— Michael L. Ducker, president, International, FedEx Express

emissions of our entire product line of commercial airplanes.

The 787, with its composite fuselage and wings, is designed to be 20 percent more fuel-efficient

We also are making improvements to our existing airplanes to improve fuel efficiency, while reducing CO<sub>2</sub> and nitrogen oxides emissions. For example, the 777 is delivering greater



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fuel efficiency along with reduced emissions as a result of a new Performance Improvement Package that reduces emissions of the 777-200, -200ER and -300 models through improved aerodynamics and wing vortex generators. Nineteen operators with fleets totaling more than 350 airplanes have ordered the upgrades, and these improvements also will be installed on new 777 models during factory production.

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Improved fuel consumption is at the core of our research-and-development efforts. Each gallon of fuel conserved prevents 21 pounds of CO<sub>2</sub> from being emitted (or, each kilogram of fuel conserved prevents approximately 3.16 kilograms of CO<sub>2</sub> from being emitted).

Starting in 2012, Boeing will begin flying an ecoDemonstrator 737 to test low-emission and low-noise technologies. The following year, an ecoDemonstrator twin-aisle airplane will join the program. These first ecoDemonstrators will be conducted in partnership with the Federal Aviation Administration's CLEEN (Continuous Lower Energy, Emissions, Noise) program.

The ecoDemonstrator program will accelerate the development of technologies in the areas of fuel efficiency, emissions and noise reduction. The program will explore concepts such as ceramic matrix composite acoustic engine nozzles, advanced inlets, and adaptive wing trailing-edge flaps that can help reduce fuel consumption and noise during the takeoff, climb and landing phases of flight.

These innovations continue a long trend in commercial aviation. Compared to the Boeing 707, Douglas



PHOTO: BOEING PHOTO

A U.S. Navy's biofuel-powered F/A-18 takes off from Naval Air Station Patuxent River, Md. Operating platforms like the Super Hornet with renewable energy sources is part of the Navy's strategy to reduce reliance on fossil fuels by half over the next decade.

DC-8 and other early jetliners, today's commercial airplanes generate 70 percent fewer emissions and have a 90 percent smaller noise footprint. We continue embedding environmental design considerations in our products, and are committed to deliver at least a 15 percent improvement in fuel and CO<sub>2</sub> efficiency with each new generation of commercial airplane.

Throughout Boeing Defense, Space & Security, teams are identifying and implementing effective solutions that improve the performance of our military products and reduce their environmental footprint. The F/A-18E/F Super Hornet — recipient of numerous U.S. Navy awards for environmental excellence — and AH-64 Apache

helicopter programs are testing new chrome-free coatings and related processes that will reduce exposure to hazardous materials in the factory and in the field. Super Hornet engine noise reduction efforts also are under way to help improve the communities where the jet flies. Our Joint Direct Attack Munition program is using advanced Lean manufacturing techniques to optimize its workflow and reduce waste. Environmental advances also are helping us win new business, with aggressive efforts to write proposals that address our customers' needs. ■

## Pioneering Environmental Technologies

# Sustainable Biofuels



PHOTO: BOEING PHOTO

Kathryn Gehrett, chemical engineer in the Fluids and Lubricants laboratory at Boeing, performs a variety of standardized tests on sustainable biofuels and other aviation fluids. Sustainable biofuels can be manufactured from numerous sources of biomass; algae, plant seeds and waste materials are among the possibilities. Boeing focuses on sustainable aviation biofuels produced from renewable resources that do not compete with food crops for land or water.

Boeing is taking a leadership role in creating a global infrastructure and encouraging the adoption of sustainability standards for aviation biofuels.

In March 2011, Boeing joined with the École Polytechnique Fédérale de Lausanne in Switzerland to create the Sustainable Biomass Consortium, a research initiative focused on increasing alignment between voluntary standards and regulatory requirements for biomass used to create jet fuel and bio-energy for other sectors. This consortium aims to harmonize sustainability standards for biomass-based fuels.

Biofuels, when produced in sustainable ways, contribute far less to global climate change than traditional fuels because carbon dioxide (CO<sub>2</sub>) is recycled, being pulled out of the atmosphere by a growing plant-based feedstock. In contrast, petroleum-based fuels introduce new CO<sub>2</sub> to the atmosphere for a net increase.

As a company, Boeing focuses on sustainable aviation biofuels produced from renewable resources that do not compete with food crops for land or water. Our experts have intensively investigated a number of biofuels candidates, including algae, camelina, jatropha and salt-tolerant plants known



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as halophytes. These efforts confirmed the feasibility of creating jet fuel from biomass feedstock.

Boeing is bringing together agricultural interests, academic researchers, refiners and aerospace companies around the globe to establish local infrastructure needed to develop a sustainable and economically viable



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PHOTO: BOEING PHOTO

Boeing researchers are investigating pongamia as a potential biomass source. Once mature, it can grow in areas that are not suitable for food crops, and it will not compete with food or water sources.

biofuels industry. Through Boeing's leadership, regional projects have been launched in Europe, the Middle East, India, [Australia](#), China, Mexico, South America and the [Northwest United States](#). Initial reports from these efforts will be issued starting in spring 2011 and continuing into the following year.

In March 2011, Boeing released the results of [research](#) conducted by Yale University's School of Environmental Science on jatropha, an inedible oil-producing plant. This study shows that jatropha can deliver strong environmental and socioeconomic benefits in Latin America. Based on interviews with farmers and scientific field analyses, this comprehensive study provides vital real-world guidance for site selection and cultivation.

Working in partnership with Air China and PetroChina, we also helped pioneer the testing and availability of jatropha-based biofuels for China's aviation market. Trade publication *Biofuels Digest* honored this industry collaboration in 2011 with a corporate partnership award.

Flight tests show that biofuels perform as well as or better than kerosene-

based jet fuel. Since 2008, biofuels flight tests have been conducted by airlines and military operators with a variety of Boeing aircraft. These include flights in the past year involving an AH-64 Apache operated by the Royal Netherlands Air Force, and U.S. Air Force flights involving Boeing C-17s and F-15s.

ASTM International, a recognized standards body, currently is in the process of approving the use of sustainable biofuels based on hydroprocessed lipid feedstocks for regularly scheduled commercial flights. Final approval is anticipated in either late 2011 or early 2012.

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“I didn't notice a difference on instrumentation or handling, but our crew chief did comment that the exhaust fumes of the engine running on bio-kerosene smelled less of sulfur than the engine running on traditional fuel.”

— *Raymond Laporte, test pilot for Royal Netherlands Air Force's biofuels flight using a Boeing AH-64 Apache helicopter*

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The U.S. Air Force has approved its entire Boeing C-17 Globemaster III fleet for unrestricted flight operations with a biofuels blend. The Air Force is in the process of amending the military aviation fuels specification to include bio-derived fuels for aviation for use on all major airframes.



PHOTO: BOEING PHOTO

A Boeing AH-64D Apache is powered by a blend of sustainable bio-kerosene and standard aviation jet fuel. Extensive laboratory testing by fuel processors, feedstock providers and engine manufacturers has shown that aviation biofuels meet or exceed the high performance and quality standards specified for military and commercial jet fuels.

Boeing is a founding member of the [Sustainable Aviation Fuel Users Group](#), which works to reduce commercial aviation's greenhouse gas emissions. We are a founding member of [Sustainable Aviation Fuels Northwest](#) and belong to, and convened the initial meeting that led to the formation of, the [Commercial Aviation Alternative Fuels Initiative](#), a broad-based industry coalition including commercial, noncommercial and military aviation. In addition, we sponsor and serve on the board of the [Algal Biomass Organization](#), which focuses on creating commercial markets for algae-based fuels and greenhouse gas abatement, and we are a member of the [Roundtable on Sustainable Biofuels](#), an international initiative bringing together industry, investors, environmental organizations and producers of biofuels feedstock. ■

## Pioneering Environmental Technologies

# Efficient Air Transportation Systems



PHOTO: FAA PHOTO

Boeing is working to reduce aviation's environmental footprint by modernizing global air traffic management systems and making them more efficient.

Modernizing the global air traffic control system presents the world with its greatest short-term opportunity to improve aviation's environmental performance. The International Air Transport Association estimates that air traffic management solutions can improve fuel efficiency by up to 12 percent with a corresponding reduction in carbon dioxide (CO<sub>2</sub>) emissions. Other authorities estimate even greater improvements could result from modernizing the global air traffic system.

Boeing is a leading architect of this transformation. We are collaborating with the U.S. Federal Aviation Administration, international aviation authorities, airlines, air navigation service providers, aerospace and equipment manufacturers, and nongovernmental organizations to modernize the system. Although still relatively early in the transition, the

new technologies and concepts on which a modern air traffic management system will rely have been defined and validated.

A modern system will rely on satellite-based navigation that takes advantage of the sophistication of airplane flight management systems and other advanced technologies. These improvements allow planes to fly more direct, use airspace more efficiently, minimize delays and employ more precise navigation capabilities.

One example of the type of improvements that could be made is the Boeing Tailored Arrivals concept, in which jetliners descend continuously to the runway instead of repeatedly stepping down to lower altitudes and then maneuvering in the airport vicinity at higher thrust settings before landing. Operational flight trials have shown this advanced arrival technique shortens



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flight durations and saves up to 500 gallons (1,893 liters) of fuel per flight. Each gallon of fuel saved reduces CO<sub>2</sub> emissions by 21 pounds (or each liter of fuel saved reduces CO<sub>2</sub> emissions by approximately 2.5 kilograms).

In May 2010, the FAA awarded a Boeing-led team a major research-and-development support contract for the Next-Generation Air Transportation System (NextGen). Working with a comprehensive industry team, this work will move concepts to solutions that can be implemented in the near

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term. Boeing also is closely involved in the Single European Sky ATM Research (SESAR) Joint Undertaking as an association member, supporting a number of work packages.

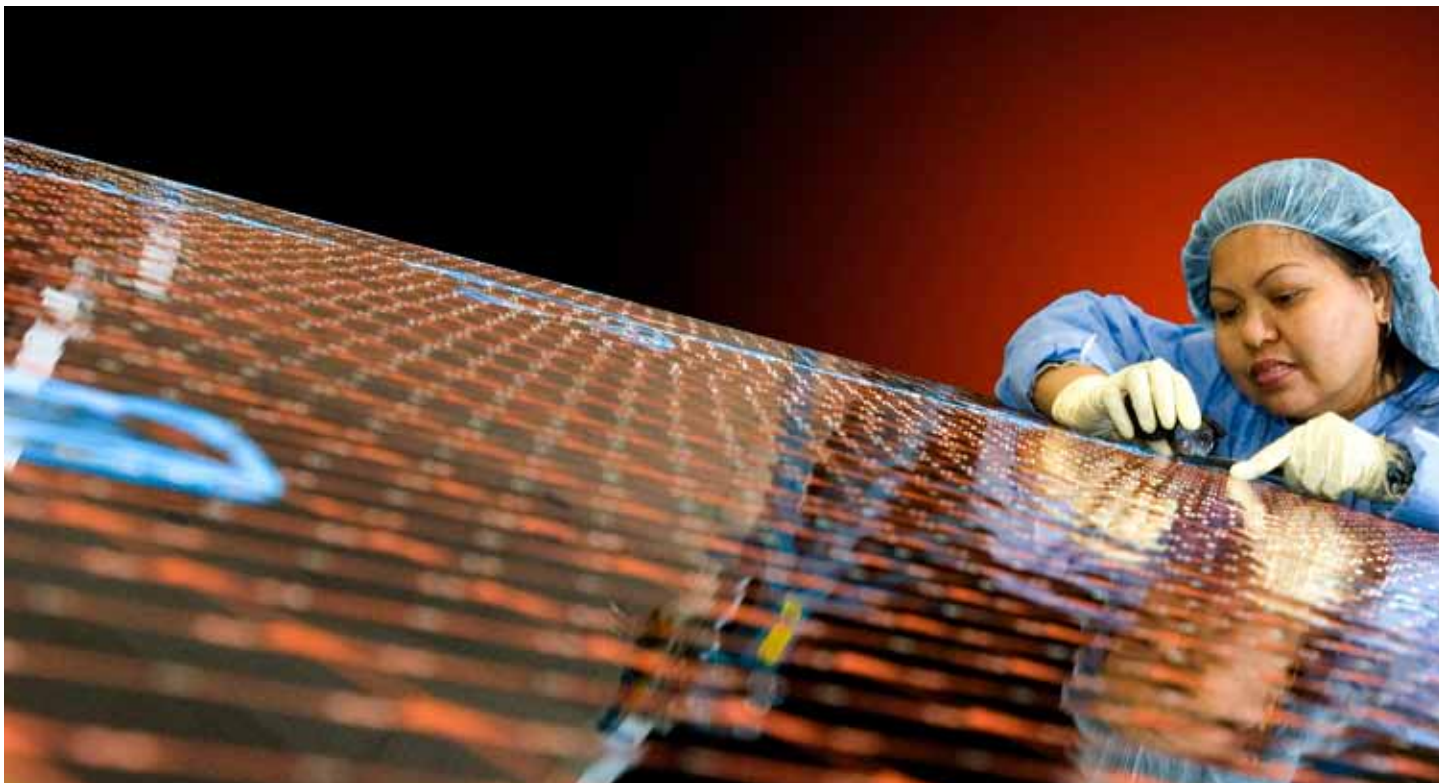
The transition to modernizing the global air traffic management system is scheduled to be completed around the year 2025, with the FAA's NextGen and SESAR programs leading the way. In the meantime, phased implementations of component technologies and flight procedures are already resulting in significant CO<sub>2</sub> reductions around the world.

Optimizing flight operations is another way Boeing is helping airlines conserve fuel and reduce carbon emissions. This includes updating the onboard flight management computer with an intelligent selection of the most current and accurate wind information, and continuously monitoring each flight for optimal flight paths. Boeing InFlight Optimization Services is a suite of applications that automate these processes, offering flight crews opportunities to make adjustments after departure to save fuel and improve operational performance. ■



## Pioneering Environmental Technologies

# Alternative Energy Solutions



Spectrolab associate Connie Siv inspects a section of a solar panel that will eventually power a satellite.

PHOTO: BOEING PHOTO

Solutions for reducing the Earth's dependence on fossil fuels are already in use in space.

Using the technology that powers satellites, Boeing subsidiary Spectrolab produces solar cells that can convert more than 40 percent of sunlight into electricity for use on Earth. Boeing also is demonstrating advanced aerospace and computing technology to help government customers and public utilities make electrical grids more secure and efficient, bring down energy costs and reduce waste.

In addition, we are researching innovative uses of fuel cells — which convert hydrogen into energy and water with zero emissions — for applications in aerospace and beyond. For example, Boeing fuel cells lit up the red carpet at the 2010 Academy Awards in Hollywood, Calif.

### **Spectrolab**

[Spectrolab](#), the world's leading manufacturer of solar cells and panels, powers everything from satellites to renewable solar energy projects in the desert regions of Arizona, Nevada, California and Australia. Spectrolab, which has manufactured space products for more than 50 years, recently produced its three millionth space-based solar cell.

Spectrolab's terrestrial "multijunction" cells are the result of over 50 years of leadership in space power, and have been optimized for maximum performance under desert sunlight. Spectrolab production solar cells convert sunlight into electricity more efficiently than any silicon solar cell. In March 2011, Spectrolab began manufacturing its fourth generation multijunction solar cell (the C4MJ cell), which converts 40 percent of sunlight into electricity.

### **Energy**

Boeing Energy — part of Boeing Defense, Space & Security — is increasing the efficiency and security of local, regional and national energy systems.

Applying advanced technologies to improve the environmental footprint and energy needs of government facilities, Boeing Energy provides solutions for military installations implementing "net zero" and other U.S. Department of Defense energy-security programs.

Boeing Energy offers a comprehensive set of services that enable military commanders to meet their requirements and improve efficiency, self-sufficiency and security of their base energy systems.

Employing advanced cyber security technology for the smart grid of the future, Boeing Energy also develops



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solutions for commercial utility customers concerned about nontraditional threats to the integrity of their electrical grids. Boeing Energy's technologies are designed to defend the electrical grid from hostile attacks, hackers or other potential operational shocks.

Boeing Energy has been awarded several U.S. Department of Energy grants to help develop U.S.-based smart grid technologies and systems, including

- A 2010 grant by the department's National Energy Technology Laboratory to develop core technologies for the U.S. power grid of the future.
- Grants to work with public utilities to demonstrate Boeing's smart grid technologies.

Boeing has teamed with KEMA, a global authority in strategic and technical energy consulting, to collaborate on the development of smart grid technologies and other opportunities related to secure, reliable and sustainable energy infrastructure. We are a member of the [Renewable and Sustainable Energy Institute](#), an



PHOTO: BOEING PHOTO

Boeing Energy is redefining power grid performance and management through energy applications that integrate network, data management and cyber technologies to improve environmental performance and lower operating costs, while protecting infrastructures against cyber attacks.

interdisciplinary joint research effort between the University of Colorado at Boulder and the U.S. Department of Energy's National Renewable Energy Laboratory. Boeing is leading the institute's efforts to develop solutions for creating a national smart grid that modernizes energy distribution and use.

Boeing technological advancements in solar cells, fuel cells, energy storage and environmentally progressive energy systems promise to reduce greenhouse gas emissions and conserve resources. ■

## Pioneering Environmental Technologies

# Chemical Reduction



PHOTO: BOEING PHOTO

Construction is well under way at Boeing's new metal-treatment facility in Portland, Ore. Using new technologies at the site will reduce the amount of cadmium, historically used to protect metal against corrosion, in the manufacturing process.

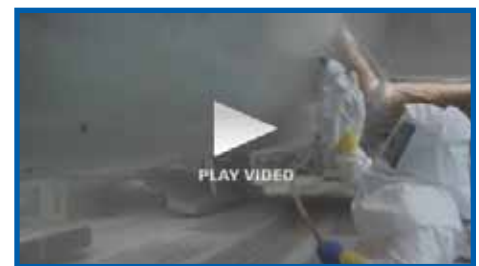
Reducing the use of chemicals protects our employees and customers, minimizes hazardous waste and reduces both environmental impact and the risk of future cleanup requirements. That is why Boeing is looking for ways to reduce, replace and — where possible — eliminate the use of hazardous chemicals.

Construction is well under way at our new metal processing facility in Portland, Ore. The facility will incorporate technology that replaces the use of cadmium plating with zinc nickel, which is now approved by the U.S. Federal Aviation Administration to meet airplane corrosion safety standards. Cadmium, a carcinogen, long has been the industry standard for protecting metal parts. The new facility is expected to be fully operational in 2014 and will provide

corrosion protection for many parts used on Boeing's family of commercial airplanes.

Boeing also is making major strides in reducing the use of hexavalent chromium, or chrome. Chrome is used in the aerospace industry to help paint adhere to the fuselage and prevent corrosion when aircraft are exposed to the elements at various altitudes. Boeing has been working for years to develop alternatives to chrome, which is a toxic metal that can be harmful to the environment and pose health hazards during the application and removal process if not handled correctly.

Boeing pioneered the use of chrome-free primers and paints on our military aircraft, including the AH-64 Apache helicopter, C-17 airlifter, and the F-15 and F/A-18 tactical aircraft. The



▶ [Click to launch video on the website](#)

program has expanded to Boeing Commercial Airplanes with airlines currently testing chrome-free finishes on 20 Boeing 737s and six 777s in commercial service.

So far, test results are positive, leading Boeing to use chrome-free paints and primers for the distinctive red and orange "sunrise" livery on the new 747-8 Intercontinental currently in flight test. If tests continue to yield successful results, later this year we expect to

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PHOTO: BOEING PHOTO

A Boeing employee in Mesa, Ariz., adds a chrome-free coating to an AH-64 Apache helicopter fuselage. The coating eliminates potentially hazardous chemicals and maintains the necessary level of corrosion protection.

switch to using chrome-free paints and primers for all new 737s. Switching to chrome-free paints and primers is expected to reduce the amount of hazardous materials generated and eliminate the need for special handling of paint waste.

In addition to reducing chrome in exterior applications, the 777 program launched a pilot program last year to remove chrome primer from aluminum tubing used throughout the aircraft. As part of this process, design engineers switched from vapor to aqueous

degreasing techniques for tubing, resulting both in the elimination of hazardous materials and the reduction of energy use.

Boeing is partnering with universities across the United States to research advanced technologies, including multifunctional coatings and sealing systems, to replace chrome entirely. We continue looking for opportunities to reduce the use of hazardous chemicals in our products and operations to benefit our employees, our customers and the environment. ■



## Pioneering Environmental Technologies

# Life Cycle Approach



PHOTO: BOEING PHOTO

Boeing is developing both hydrogen-powered and solar-powered aircraft for military and reconnaissance missions. One of those is the unmanned, high-altitude Phantom Eye, which can stay aloft for up to four days carrying a 450-pound (204-kilogram) payload. Phantom Eye has a 150-foot (46-meter) wingspan and is powered by a pair of four-cylinder hydrogen engines.

At Boeing, we have long focused on supporting our products throughout their operational life cycle. This commitment begins with research and development, extends through supporting customers while our products are in use, and continues through end-of-service when aircraft are recycled in a safe and environmentally responsible way.

### Research and Development

More than 75 percent of Boeing Commercial Airplanes' research-and-development budget effectively contributes to improved environmental performance. Major focuses include reducing fuel consumption, emissions, noise and hazardous materials, while increasing the use of recycled and sustainable materials.

We are investing in innovative new design concepts that are environmentally

efficient and provide greater capabilities to our customers. The X-48 is a remotely piloted, blended, wing-body aircraft Boeing is using to research and test aerodynamics and technology concepts that could reduce the carbon footprint of future aircraft by an additional 20 percent. We're also developing environmentally efficient unmanned aircraft for military and reconnaissance missions. These include the solar-powered SolarEagle and hydrogen-powered Phantom Eye, which are designed to fly missions above 60,000 feet and stay aloft for up to four days carrying a 450-pound payload, respectively.

### Supply Chain

In 2010, we made major changes in contracting language and expanded the use of environmental criteria in evaluating and selecting suppliers. Besides being



PHOTO: BOEING PHOTO

With the X-48, Boeing is researching and testing aerodynamics and system concepts that could reduce the carbon footprint of aircraft by an additional 20 percent.

able to provide high-quality aerospace parts on time and within budget, we also look to our suppliers to maximize the use of recycled materials, minimize hazardous waste, conserve energy and prevent pollution. In addition, we



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launched a pilot program to include environmental reviews as a standard part of Boeing's ongoing quality inspections at suppliers.

### **End-of-Service Recycling**

With some 7,200 jetliners expected to be retired from active service during the next 20 years, aircraft recycling is a significant environmental opportunity. Boeing has taken a leadership role in aircraft end-of-service recycling strategies. We are a founding member of the [Aircraft Fleet Recycling Association \(AFRA\)](#), a global consortium of more

than 50 companies that provides environmentally responsible options for addressing older aircraft. Association members recycle an average of 150 airplanes per year and have recycled approximately 6,000 commercial airplanes and 1,000 military aircraft to date.

The association has established specifications for environmentally appropriate ways to dismantle and recycle airplanes and aerospace components. Member companies annually recycle 35,000 tons of aircraft

aluminum, 2,000 tons of special alloys used in aerospace manufacturing and 600 tons of reusable aircraft parts.

In 2008, Boeing led an AFRA initiative to develop and publish "Best Management Practices" for aircraft disassembly. AFRA adopted these practices and developed a related accreditation program. During the past year, Boeing has provided significant support to developing a follow-up Best Management Practice, which is on target for public release in summer 2011. ■

## Reducing Our Environmental Footprint



PHOTO: BOEING PHOTO

South Carolina is the latest Boeing site to achieve zero waste to landfill. Working with a local recycling vendor, Boeing environmental engineer Hope Gonzalez is one of the site's zero waste to landfill and recycling leaders.

Boeing believes that climate change is a serious environmental challenge that requires credible action. Recognizing this, we are committed to reducing emissions of greenhouse gases from our facilities and products.

We are looking at all aspects of the business including building cleaner factories, improving operational efficiencies, and reducing waste and hazardous chemical use to reduce our environmental footprint and improve productivity. Currently, four major Boeing sites, including the new South Carolina 787 Dreamliner production facility, send zero nonhazardous operational waste to landfills. ■

## Reducing Our Environmental Footprint

# Our Environmental and Climate Change Policies



PHOTO: BOEING PHOTO

With airplanes crossing international borders every day, Boeing believes that a global emissions framework is needed.

Boeing is committed to

- Conducting operations in compliance with applicable environmental laws, regulations, and Boeing policies and procedures.
- Preventing pollution by conserving energy and resources, recycling, reducing waste and pursuing other source reduction strategies.
- Continually improving our environmental management system.
- Working together with our stakeholders on activities that promote environmental protection and stewardship.

Boeing believes that climate change is a serious environmental challenge that

requires credible action. Recognizing this, we are committed to reducing emissions of greenhouse gases from our facilities and products.

As the global community develops approaches to reducing greenhouse gas emissions, we acknowledge that voluntary measures alone may not be enough. Consequently, we support development of mandatory, yet flexible frameworks to address emission reductions. Boeing recognizes that appropriate action may vary from one sector to another. A comprehensive approach should take into account the most effective way to deal with each industry sector.

### Global Approach to Aviation Emissions

Since aviation is a global industry, with airplanes crossing international borders every day, Boeing believes that a global system is needed. We advocate that a global emissions framework for aviation can best be achieved under the auspices of the [International Civil Aviation Organization](#) (ICAO), a United Nations organization.

Working through ICAO, aviation was the first industry to present a clear [plan](#) to the United Nations Framework Convention on Climate Change conference. ICAO calls for global guidelines including the development of a CO<sub>2</sub> standard for

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aircraft, improvements in air traffic control systems to cut air travel-related emissions by up to 12 percent, and continued efforts to promote the commercialization of sustainable alternative fuels — all with the aim of achieving carbon-neutral growth across commercial aviation by 2020.

The aviation industry promoted this approach at the UN climate change conferences in Copenhagen in 2009 and Cancun in 2010. Our industry

is expected to continue advancing this global approach at the 2011 conference in South Africa. Boeing fully supports the ICAO position on controlling aerospace emissions and, along with the rest of the aviation industry, we are working toward meeting these commitments.

Boeing does not believe that isolated regional or national programs to regulate aviation emissions will achieve the desired environmental,

economic and social results. Competitive distortions and delay of financial investment in aviation emissions reductions through technology could result from such localized approaches. ■



## Reducing Our Environmental Footprint Performance Targets



PHOTO: BOEING PHOTO

Kurt Bayer is part of a team that is driving environmental gains at the Renton, Wash., site by separating and recycling liquid hazardous oil waste generated by machines and vehicles.

At our operations in the United States, Boeing has set the following revenue-adjusted targets for the period between 2007 and 2012:

- 25 percent reduction in greenhouse gas emissions.
- 25 percent reduction in energy consumption.
- 25 percent reduction in water intake.
- 25 percent reduction in hazardous waste generation.

At the time these targets were established, Boeing projected that achieving these goals would equate to an approximate 1 percent reduction in greenhouse gas emissions, energy use, water intake and hazardous waste generation during a time of significant growth.

In addition, we committed to increasing the amount of solid waste diverted from landfills to 75 percent, measured on an absolute basis, for the period between 2007 and 2012. Waste is diverted from landfills through a combination of recycling, composting and energy recovery programs.

Since establishing these targets, Boeing has announced increases in production rates for all commercial airplane models. We also added major new manufacturing operations, including the Boeing South Carolina 787 production facilities and the Portland-PDX facility for painting twin-aisle airplanes in Oregon.

Although these changes put pressure on our ability to meet our revenue adjusted targets, Boeing continues

to believe that we will be able to achieve an absolute reduction in our environmental footprint at the same time that we increase our manufacturing production.

For full details of our environmental performance, see the [Measuring Our Progress](#) section of this report. ■

## Reducing Our Environmental Footprint

# Environmental Management



PHOTO: BOEING PHOTO

Houston is one of more than three dozen sites in Australia, Canada, the United Kingdom and the United States certified to the ISO 14001 environmental management standard.

### Environment, Health and Safety Organization

Environmental initiatives inside Boeing are consolidated into one corporate organization — Environment, Health and Safety — which works with Boeing business units to drive an integrated, companywide strategy that includes our products, services, processes and facilities. This strategy also considers the impacts of our suppliers and customers.

Our strategy is guided by the Environment, Health and Safety Policy Council, led by Boeing Chairman, President and Chief Executive Officer Jim McNerney. This Policy Council ensures that strategy and performance targets are set and monitored at the highest levels of the company.

The Environment, Health and Safety organization contains functions focused on occupational safety and health, environmental and regulatory compliance. Responsibilities of this organization include

- Establishing companywide strategies to address current and potential future environmental issues associated with Boeing products, services, facilities and technologies, and those of our suppliers and customers.
- Defining and implementing companywide environmental management systems and tools for integrating environmental capabilities into the company's core operating processes.
- Establishing standards, processes and guidelines for tracking Boeing's performance to these environmental plans and objectives.
- Assisting business partners in tracking their performance to environmental plans and objectives.

### ISO 14001 Certification

Certification to the internationally recognized ISO 14001 environmental management standard has strengthened our ability to meet our aggressive environmental targets. Sites in the following locations are certified to the ISO 14001 standard:

### International Locations

**Australia:** Amberley, Bankstown, Exmouth and Fishermans Bend

**Canada:** Winnipeg

**United Kingdom:** Knaresborough and Welwyn Garden City

### U.S. Locations

**Alabama:** Huntsville

**Arizona:** Mesa

**California:** Anaheim, Cypress, El Segundo, Huntington Beach, Long Beach, Palmdale, Rancho Cucamonga, Seal Beach, Sylmar, Taft and Torrance

**Florida:** Kennedy Space Center

**Georgia:** Macon

**Kansas:** Wichita

**Missouri:** St. Charles and St. Louis

**Oregon:** Portland

**Pennsylvania:** Philadelphia

**Texas:** El Paso, Houston and San Antonio

**Utah:** Salt Lake City

**Washington:** Auburn, Bellevue, Everett, Frederickson, Kent, Renton, Seattle and Tukwila ■



## Reducing Our Environmental Footprint

# Improving Business Operations



PHOTO: BOEING PHOTO

At our newest factory in South Carolina, manufacturing technician Yeakia Johnson is part of the team building the fuel-efficient 787 Dreamliner in a clean new way. The site is using 100 percent renewable energy resources and sending zero solid waste to landfills.

Business operations at the Boeing South Carolina 787 Dreamliner facility reflect the environmental thinking our new airplane represents as the site will send zero solid waste to landfills. Newly constructed buildings will achieve a LEED Silver rating or higher, and the site will be powered entirely by renewable energy.

Renewable energy will be generated, in part, with thin-film solar laminate panels on the 10-acre (4-hectare) roof of the new 787 final assembly building. The solar installation will provide up to 2.6 megawatts of electrical power for the site, enough to power approximately 250 homes. When completed, it will be the largest solar energy-generating facility in the Southeast United States by production capacity, and the sixth largest in the country.

While the solar panels will provide 20 percent of the power needed for

the South Carolina site, the remainder will be purchased from a renewable energy facility, where renewable waste streams are processed to produce energy while generating very low emissions.

In addition to the solar roof on the final assembly building, a second solar installation will help generate energy for the site's new welcome center, which will serve as the point of entry for all visitors to the site.

Construction of the newest Boeing South Carolina facilities is being designed to a LEED Silver rating or higher. LEED, or Leadership in Energy and Environmental Design, provides a rating system based on multiple factors including energy and water efficiency of buildings and the use of sustainable sources during construction. Boeing established a LEED Silver rating standard for all new



▶ [Click to launch video on the website](#)

construction and major renovation projects at Boeing-owned buildings in the United States.

Other Boeing LEED-certified buildings include facilities in California, Texas and Washington state, and the new Boeing Tianjin Composites factory — a joint venture with the Aviation Industries Corporate of China. In addition, Boeing is currently pursuing LEED certification for our corporate headquarters in Chicago and buildings in Philadelphia, Portland, Ore., and Washington, D.C.



(continued from page 23)



BOEING ILLUSTRATION

An artist's rendering of Boeing South Carolina's new 787 Final Assembly building with thin-film solar laminate panels installed. When complete, this installation will be the largest in the Southeast and sixth largest in the United States by energy production capacity.

Boeing received the 2011 ENERGY STAR Partner of the Year award from the U.S. Environmental Protection Agency as well as ENERGY STAR certifications for buildings in California, Texas, Washington state and our corporate headquarters in Chicago.

Reducing waste to landfill is a focus at several major Boeing sites. In addition

to South Carolina, our helicopter manufacturing site in Philadelphia, our Commercial Airplanes parts fabrication facility in Salt Lake City,

packing materials used to ship parts and assemblies, increasing recycling, and sending some waste to energy-generating incineration facilities. Boeing

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Boeing continues to demonstrate remarkable corporate leadership in pursuing renewable and sustainable energy sources. The 787 facility in my home state of South Carolina recently committed to becoming a 100 percent renewable energy site, and the company is involved in sustainable biofuels partnerships worldwide. The fact that Boeing would lead the way is going to make it easier for other businesses to follow.

— U.S. Senator Lindsey Graham

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and our Strategic Missile and Defense Systems facility in Huntsville, Ala., have all stopped sending nonhazardous operational waste to landfills. Other locations around the company currently are pursuing this goal.

Eliminating waste sent to landfill requires improving the efficiency of operations, reducing the amount of

defines "zero waste to landfill" to include, at a minimum, all solid waste generated by operations. It does not include waste generated during construction and remodeling, nor does it include hazardous waste, which is handled in accordance with applicable regulations. ■

## Reducing Our Environmental Footprint

## International Operations and Reporting



PHOTO: BOEING PHOTO

In Australia, Boeing cut emissions by 9 percent compared to the previous reporting period.

### Australia

Boeing's presence in [Australia](#) is the company's largest operational footprint outside the United States. Boeing, which has a heritage in Australia spanning more than 80 years, now has about 2,800 employees working across a range of manufacturing, commercial and defense programs at 28 locations throughout the country.

In October 2010, Boeing filed its second National Greenhouse and Energy report with the [Australian Department of Climate Change](#) detailing greenhouse gas emissions, energy consumption and energy production data. This comprehensive report must be completed by organizations whose energy use and greenhouse gas emissions meet a certain threshold. For the 2009-2010 reporting period, the Australian government released data only for companies emitting more

than 87,500 metric tons of equivalent carbon dioxide (CO<sub>2</sub>-e); Boeing's CO<sub>2</sub>-e emissions in Australia were calculated at 89,100 metric tons.

Boeing cut emissions in Australia by 9 percent compared to the previous 2008-2009 reporting period by reducing the number of company cars, consolidating facilities and reducing the amount of natural gas used at manufacturing facilities.

### Canada

With more than 1,500 employees, Boeing facilities in Canada produce parts, components, assemblies and software applications in support of commercial and defense customers. We report to Canada's [National Pollutant Release Inventory](#), an inventory of pollutant releases and recycling, on an annual basis. For more information, see the Toxic Release Inventory/National

Pollutant Release Inventory data [page](#) provided elsewhere in this Environment Report.

### United Kingdom

The Carbon Reduction Commitment Energy Efficiency Scheme (U.K. CRC), under the Department of Energy and Climate Change, is a mandatory emissions trading scheme aimed at reducing CO<sub>2</sub> emissions in the United Kingdom. Boeing is currently compiling our report for the first reporting period, 2010-2011.

Boeing operations in the U.K. that are required to report on their greenhouse gas emissions under the U.K. CRC consist of multiple units and subsidiaries. Boeing U.K. Training and Flight Services Ltd. operate flight simulators for training on Boeing aircraft at several locations throughout the U.K. Boeing Defense U.K. Ltd. has employees located at

*(continued from page 25)*

multiple locations throughout the U.K. supporting Ministry of Defense and U.S. military programs.

Additionally, greenhouse gas emissions from Boeing subsidiaries Jeppesen U.K. Ltd. and Aviall U.K. Ltd. throughout the U.K. are also included in the total Boeing U.K. CRC reporting requirements.

### **European Union Emissions Trading Scheme (EU ETS) for Aviation**

Starting in 2011, aircraft operators are required to submit emissions reporting of flight operations into, out of and within the European Union. In March 2011, Boeing submitted an Aircraft Emissions Monitoring report, an annual accounting of emissions associated with company-operated aircraft, and a Tonne Kilometer Monitoring report, a one-time submission detailing passenger and

freight loads per flight. This information will be used to determine how many allowances are allocated to Boeing under the EU ETS regional cap-and-trade system. ■



## Reducing Our Environmental Footprint

# Employee Business Travel and Commuting



PHOTO: MIKE GOETTINGS

Boeing materials engineer Kamden Reedy rides 30 minutes to work each day on his bicycle.

As we work with customers and suppliers around the globe, Boeing employees can be found in airports throughout the world. In 2010, our

in-person meetings. In 2010, Boeing employees conducted more than 875,000 virtual meetings that included an estimated 8.8 million attendees.

survey, 34 percent of Boeing employees in the United States are taking actions to get cars off the road. This includes biking, walking, taking public transportation, carpooling or vanpooling to work.

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Since I started riding my bike to work five years ago, there are more and more people commuting by bicycle. Boeing does a lot to encourage it.

— Kamden Reedy, Boeing materials engineer

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employees booked nearly 239,000 business trips, flying more than 814 million miles (1.3 billion kilometers).

When appropriate, we make significant use of virtual conferencing in place of

Boeing provides many programs that encourage employees to find alternatives to a solitary car ride to work. Sites promote alternative commuting programs, and, according to an internal 2010 employee commuter

Overall, by using alternative commuting options, Boeing employees avoided driving just less than 310 million miles (approximately 499 million kilometers) to and from work in single-occupant vehicles in 2010.

Our goal, for the five-year period between 2008 and 2012, is to achieve an 18 percent increase in employee participation in commuting programs. ■

## Reducing Our Environmental Footprint

# Commitment to Remediation



PHOTO: BOEING PHOTO

Boeing employee Tina Marie took part in Duwamish Alive, a semiannual volunteer activity to help clean up the Lower Duwamish Waterway in Seattle.

Boeing is actively cleaning up locations affected by past business practices. Working with national, state and local regulatory agencies, we strive for an open exchange of information with community members, government representatives and other stakeholders. Our goal is to clean up sites in a timely, efficient and protective manner.

Boeing spends approximately \$100 million per year cleaning up former manufacturing facilities and sites where Boeing, or companies we have acquired, shipped chemicals and other waste for treatment, storage or disposal. In many cases, waste-processing facilities that used treatment methods deemed acceptable in the past are being cleaned up to meet or exceed current environmental standards that are more stringent.

We continue to make progress as Boeing completed obligations at six sites in 2010, including locations in Arizona, California, New Jersey, Texas and Washington state. Since acquiring

McDonnell Douglas, parts of Rockwell International and other companies in the late 1990s, Boeing has completed cleanup obligations at nearly 150 sites.

Boeing looks for opportunities to build sustainable remediation practices into these projects, reducing the environmental footprint of a cleanup. Limiting air emissions, minimizing impacts to water quality, conserving natural resources and increasing operational efficiencies are some of the ways Boeing is trying to make its remediation efforts more sustainable.

On our property along the Duwamish Waterway in Seattle, for example, sugar and sugar syrups are being used to promote a biodegradation process that naturally exists in groundwater. And, at Santa Susana, Calif., we treated soils by using food products and other biodegradable materials to help naturally occurring microorganisms clean up perchlorate contamination. This work eliminated the need to haul soil to a hazardous waste facility.



▶ [Click to launch video on the website](#)

### Duwamish Waterway Cleanup

Demolition of the old Plant 2 facility along the Duwamish is well underway. Once the World War II-era buildings have come down, the shoreline will be restored, creating nearly 5 acres (approximately 2 hectares) of intertidal wetlands and enhanced habitat for migratory fish. Boeing will excavate more than 200,000 cubic yards (153,000 cubic meters) of sediment from the waterway, replacing it with clean soil. As part of the demolition of Plant 2, Boeing is removing potential sources of contaminant from building materials, cleaning up soil and groundwater, and installing storm water treatment systems to protect the waterway.

>> To learn more, go to [www.boeing.com/environment](http://www.boeing.com/environment)

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PHOTO: BOEING PHOTO



BOEING ILLUSTRATION

The aging Plant 2 buildings that were used to build more than 6,000 B-17s for use during World War II will be demolished this year, making way for nearly five acres of wetlands and wildlife habitat.

This project is part of a larger cleanup effort that will further reduce the level of polychlorinated biphenyls (PCBs), metals and other chemicals in the waterway.

In 2010, the [Lower Duwamish Waterway Group](#) — which consists of the City of Seattle, King County, the Port of Seattle

Boeing to continue to clean up the site in accordance with the comprehensive consent order we signed with the state in 2007.

Located on top of a mountain just outside of Los Angeles, Santa Susana features herds of deer, groves of

this amount was related to storms that occurred between 2006 and 2009.



PHOTO: BOEING PHOTO

A worker at Santa Susana installs groundwater monitoring wells, which will be tested as part of the site's comprehensive groundwater monitoring program.

## Boeing and EPA have worked closely together to find a solution to treat storm water, including reducing PCB contaminants, to the Lower Duwamish Waterway.

— *Karen Keeley, Duwamish Superfund project manager, U.S. Environmental Protection Agency Region 10*

and Boeing — working with the state of Washington and U.S. Environmental Protection Agency, provided multiple cleanup alternatives for review and community comment. Later this year, the EPA is scheduled to select among the cleanup options.

### Santa Susana Cleanup

At [Santa Susana](#), a former federal government rocket engine and energy testing site in Southern California, Boeing is cleaning up our portion of the 2,850-acre (1,153-hectare) site to ensure that it is safe and to preserve the land as open space for future generations. In April 2011, a U.S. federal court judge ruled in Boeing's favor that Santa Susana should be cleaned up to the same standards that apply to other sites throughout California. This will allow

California oak, multiple protected species and a cave with ancient Native American paintings. Since we acquired the site in 1996 as part of the acquisition of the defense and space businesses of Rockwell International, Boeing has been actively cleaning up the site.

Santa Susana is one of the few sites in the country that must manage storm water runoff to meet strict permit limitations that, in many instances, are cleaner than drinking water. This remains a technical challenge given the steep hillsides and the nature of the infrequent yet heavy rains. In 2010, Boeing met these requirements more than 98 percent of the time. We also paid \$644,100 to the state of California for failing to meet certain water quality standards. Approximately \$575,000 of

We continue to focus on meeting these requirements by working with leading experts in storm water management to install sophisticated filtering systems and holding tanks to treat the storm water with advanced filters and chemicals before release. In April 2011, despite heavy storms that dropped over 22 inches (55.8 centimeters) of rain on the site, we effectively achieved a 98 percent compliance rate with permit requirements.

Boeing holds regular information sharing meetings and tours of Santa Susana so that the public, government officials and other stakeholders can learn more about cleanup progress. ■



## Reducing Our Environmental Footprint

# Environmental Affiliations

Boeing is working with the following organizations to drive environmental improvements throughout our industry and across the globe. In addition, Boeing employees and executives serve on local, national and international environmental organizations in a number of voluntary and professional capacities.

### Algal Biomass Organization

Boeing is a founding member of the [Algal Biomass Organization](#), which promotes research and the commercialization of algae-based energy sources.



### Aircraft Fleet Recycling Association

Boeing is a founding member of the [Aircraft Fleet Recycling Association](#), a working group of companies that has safely recycled more than 7,000 commercial and military aircraft.



### Air Transport Action Group

Boeing is on the board of the Air Transport Action Group, a coalition of companies throughout the globe in the air transport industry. [ATAG](#) advocates the environmentally responsible development of aviation infrastructure, including en route capabilities, airport capacity and ground access in order to meet customers' demand in a timely way.



### Carbon Disclosure Project

Boeing has participated in the [Carbon Disclosure Project](#), an independent nonprofit organization that has become the standard for carbon disclosure methodology and process since 2006. Boeing was named the best performing industrial company and also named to the 2010 Global Carbon Disclosure Leadership Index.



### EarthCorps

EarthCorps is a nonprofit organization founded in 1993 with a mission to build global community through local environmental service. The organization provides one-year intensive programs for young adults to learn best practices in conservation techniques and develop skills in leading volunteers. Boeing has awarded [EarthCorps](#) grants to support their Great Cities — Great Parks and Greener Cities Stewardship projects.



### Engineers Without Borders – USA

[Engineers Without Borders – USA](#) focuses on developing engineering solutions to global dilemmas of clean water, sanitation and renewable energy. Boeing has awarded the non-profit grants to help build its infrastructure, for fundraising and chapter support, and for targeted projects in Africa, India and China.



### The Nature Conservancy

Boeing is a member of The Nature Conservancy's International Leadership Council, one of the world's leading corporate forums on conservation. Boeing supports [The Nature Conservancy](#) through grants for use in planning the protection of natural environments and conserving land and water resources and large corridors of open spaces for wildlife.



### Roundtable on Sustainable Biofuels

Boeing is a member of the [Roundtable on Sustainable Biofuels](#), an international initiative coordinated by the Energy Center at the Ecole Polytechnique Fédérale de Lausanne in Switzerland. The Roundtable brings together farmers, companies, nongovernmental organizations, experts, governments, and intergovernmental agencies concerned with ensuring the sustainability of biofuels production and processing.



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**Sustainable Aviation Fuel Users Group**

Boeing is affiliated with the Sustainable Aviation Fuel Users Group, a group of 14 major airlines from around the world. [SAFUG](#) is focused on accelerating the development and commercialization of sustainable aviation fuels produced from algae, camelina, halophytes, jatropha and other nonfood cellulose.



**Sustainable Biomass Consortium**

Boeing, the École Polytechnique Fédérale de Lausanne ([EPFL](#)) and the Technical University of Lausanne launched a research consortium to drive increased transparency, commonality and collaboration between regional biofuels sustainability standards.



**The Trust for Public Lands**

The [Trust for Public Lands](#) is a national, nonprofit, land conservation organization that conserves land for people to enjoy as parks, community gardens, historic sites, rural lands and other natural places, ensuring livable communities for generations to come. Boeing has supported the organization through grants for the Bloomingdale Trail in Chicago, which will create twelve acres of open space in these densely populated neighborhoods.



**U.S. Green Building Council**

Boeing is a member of the [U.S. Green Building Council](#), a nonprofit organization dedicated to sustainable building practices, which develops and administers the Leadership in Energy and Environmental Design building standards.



**U.S. Environmental Protection Agency ENERGY STAR**

Since 1997, Boeing has been an industrial partner in the EPA [ENERGY STAR](#) program for energy management and conservation efforts. Boeing was named a 2011 ENERGY STAR Partner of the Year and buildings in Chicago, Houston and Long Beach, Calif., have received ENERGY STAR certification for energy-efficient operations.



**U.S. Environmental Protection Agency Climate Leaders**

Boeing joined the industry-government partnership, [Climate Leaders](#), in 2008, committing to reduce the company's environmental impact by completing a companywide greenhouse gas emissions inventory, establishing reduction targets and reporting progress to the EPA on an annual basis.



**Wildlife Habitat Council**

Boeing is a member of the [Wildlife Habitat Council](#), a nonprofit organization dedicated to increasing the quality and amount of wildlife habitat on corporate, private and public lands. The Council devotes its resources to building partnerships with corporations and conservation groups to create solutions that balance the demands of economic growth with the requirements of a healthy, biodiverse and sustainable environment.



**World Environment Center**

We are a member of the [World Environment Center](#), a global nonprofit organization that helps companies around the world implement environmentally sustainable business strategies and operations.



## Measuring Our Progress



PHOTO: BOEING PHOTO

St. Louis employee Mark Stevens is managing an innovative recycling program to minimize hazardous waste in the St. Louis area.

Since 2002, Boeing has reduced carbon dioxide emissions and energy consumption by nearly one-third and cut water intake and hazardous-waste generation by more than 40 percent, as measured on a revenue-adjusted basis.

Data reported in this section reflects environmental performance at the following core metric sites, which represents the vast majority of Boeing's operating locations in the United States:

**Alabama:** Huntsville

**Arizona:** Mesa

**California:** Anaheim; El Segundo; Huntington Beach; and Boeing Defense, Space & Security operations in Long Beach

**Kansas:** Wichita (Boeing Defense, Space & Security operations only)

**Missouri:** St. Charles and St. Louis

**Oregon:** Portland

**Pennsylvania:** Philadelphia

**Texas:** Houston and San Antonio

**Washington:** Auburn, Developmental Center, Everett, Frederickson, Kent Space Center, North Boeing Field/Plant 2 and Renton

Currently, we do not report carbon dioxide emissions, energy consumption, water intake, hazardous waste generation and recycling rates at Boeing

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Boeing has been recognized as part of our Carbon Disclosure Leadership Index in both our global and U.S. market samples for two consecutive years, demonstrating best practice in transparency on climate change risk, opportunity and GHG emissions accounting. We applaud Boeing's efforts to inform their investors and other stakeholders of their activities to address climate change via CDP.

— Paul Simpson, CEO, Carbon Disclosure Project

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In some cases, data from additional sites and office locations are included in the reported value. When that occurs, it is noted in the footnotes accompanying data tables and graphs throughout this Environment Report.

South Carolina. We intend to begin reporting data for Boeing South Carolina once the site starts final assembly and delivery of 787s. It is anticipated that environmental performance data for Boeing South Carolina will be included in the 2012 Environment Report.



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## Summary of Environmental Performance (2007-2010)

	2007	2008*	2009	2010	% Improvement Absolute ('07-'10)
<b>Revenue</b> (U.S. dollars in millions)	\$66,387	\$60,909	\$68,281	\$64,306	
<b>U.S. employment</b> (year end)	159,313	162,191	157,073	160,537	
<b>Energy consumption</b> (in millions of MMBTUs or trillions of British Thermal Units)	12.95	12.68	12.64	12.24	5%
<b>CO<sub>2</sub> emissions</b> (in millions of metric tons)	1.33	1.30	1.29	1.25	6%
<b>Water intake**</b> (in billions of U.S. gallons)	1.83	1.81	1.71	1.63	11%
<b>Hazardous waste***</b> (in thousands of U.S. tons generated)	8.99	7.71	8.15	6.94	23%
<b>Solid waste diverted from landfills</b> (as a percentage of total non- hazardous solid waste generated)	58%	64%	68%	73%	26%
<b>Environmental fines****</b> (U.S. dollars in millions)	\$0.472	\$0.024	\$0.028	\$0.647	

\* 2008 data reflects reduced production as a result of a labor strike.

\*\* Water intake data for 2007–2009 has been adjusted to reflect additional intake from a previously unrecorded water meter in Auburn, Wash., as well as a billing error in Everett, Wash.

\*\*\* Hazardous waste data for 2007–2009 has been restated to reflect the addition of Portland – PDX, a facility in Oregon used by Boeing to paint twin-aisle airplanes.

\*\*\*\* Majority of 2007 and 2010 fines relate to settlements for storm water permit violations at Santa Susana, Calif.

In our 2010 Environment Report, Boeing provided aggregate data for emissions of nitrogen oxides, sulfur oxides and volatile organic compounds for those manufacturing sites that exceeded local, state and/or national thresholds for filing public reports. The sites that are required to report vary widely in each calendar year. Consequently, while Boeing continues to report this information to

local, state and national authorities, we have elected not to provide aggregate data in this year's Environment Report as it does not provide meaningful year-over-year comparative data to track performance.

The graphs on the following pages are labeled with information rounded to two or three decimal places. However,

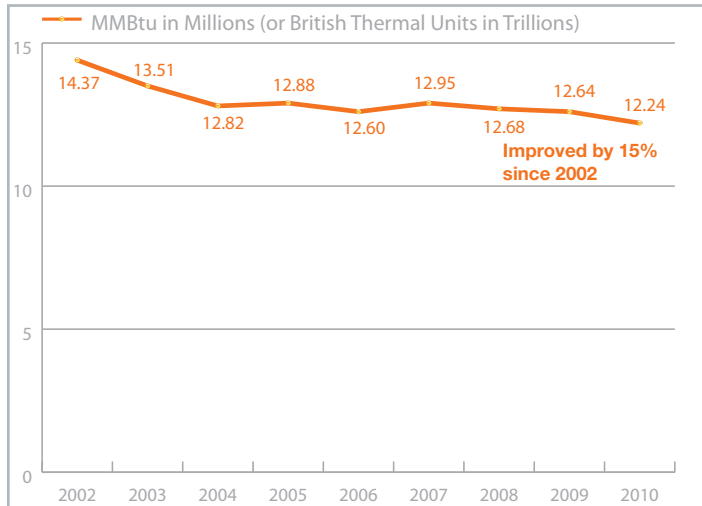
graphs throughout this Environment Report are calculated using actual values. Consequently, some slight variation may occur for the purpose of creating visual presentations. ■

## Measuring Our Progress

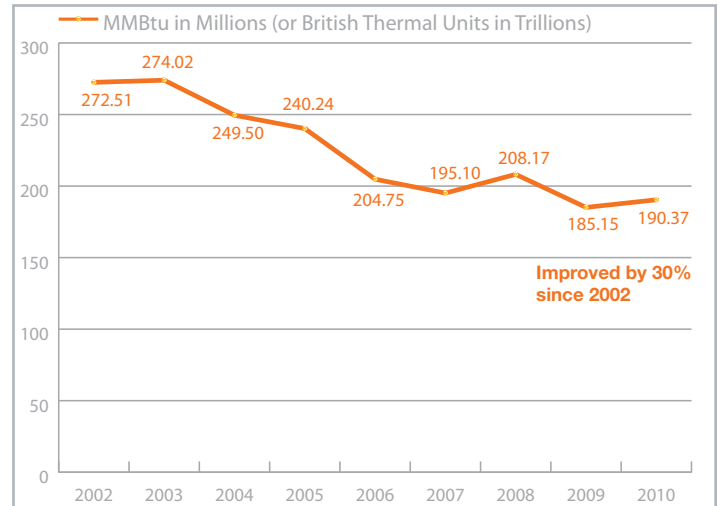
# Energy Conservation

Boeing reduced absolute energy consumption by 3 percent in 2010 compared with the previous year, and has reduced energy consumption on a revenue-adjusted basis by 30 percent since 2002.

**Energy Use at Major U.S. Sites – Absolute**



**Energy Use at Major U.S. Sites – Revenue Adjusted**



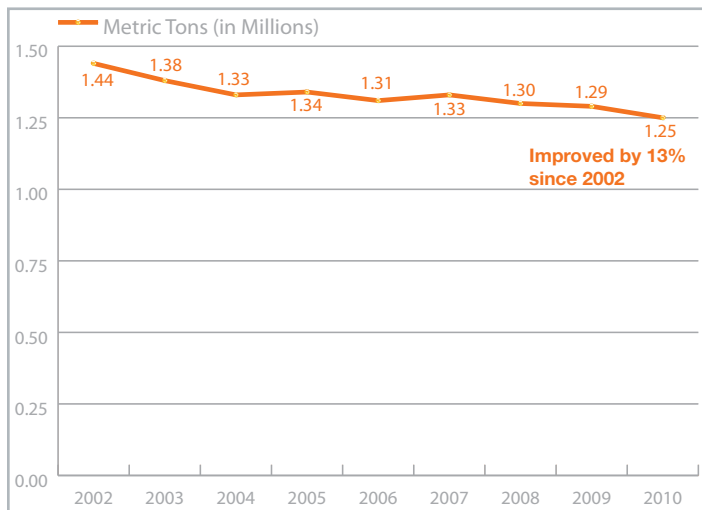
- Includes data from core metric sites, Bellevue, Wash.; Corporate Headquarters, Chicago, Ill.; Boeing Commercial Airplanes operations in Long Beach, Calif.; Seal Beach, Calif.; and West Hills, Calif.
- Energy use is calculated from consumption of electricity, natural gas and fuel oil. Consumption of other fuels is not represented.
- Five additional sites were included in data collection beginning in 2008. Energy consumption totals for previous years were adjusted to reflect this change in reporting practices.
- 2008 data reflects reduced production as a result of a labor strike.
- Data in the chart is normalized for divestitures by excluding Boeing Commercial Airplanes operations in Wichita (now Spirit AeroSystem) from 2002 to 2005. Boeing Defense, Space & Security's Wichita operations are included in this data.

## Measuring Our Progress

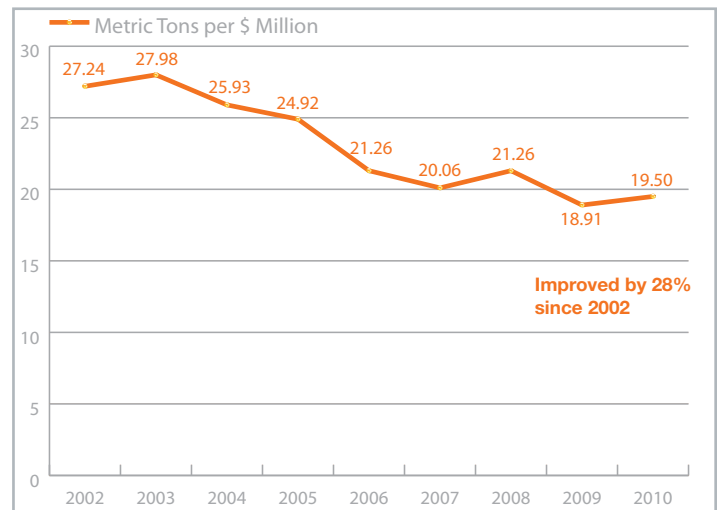
# Carbon Dioxide Emissions

Boeing's CO<sub>2</sub> emissions primarily result from energy consumption. By focusing on conservation and efficiency improvements, we reduced absolute CO<sub>2</sub> emissions by 3 percent in 2010 compared with the previous year. Boeing has reduced CO<sub>2</sub> emissions by 28 percent on a revenue-adjusted basis since 2002.

**CO<sub>2</sub> Emissions at Major U.S. Sites – Absolute**



**CO<sub>2</sub> Emissions at Major U.S. Sites – Revenue Adjusted**



- Includes data from, core metric sites, Bellevue, Wash.; Corporate Headquarters, Chicago, Ill.; Boeing Commercial Airplanes operations in Long Beach, Calif.; Seal Beach, Calif.; and West Hills, Calif.
- 1 metric ton = approximately 1.1 U.S. ton (or approximately 2,200 pounds).
- CO<sub>2</sub> emissions are calculated based on consumption of electricity, natural gas and fuel oil. (Our facility in Philadelphia is the only major U.S. site that uses fuel oil for heating.) Consumption of other fuels is not represented.
- Emissions from purchased electricity is calculated using regional eGRID 2007 electricity CO<sub>2</sub> factors. Emissions from natural gas and fuel oil are calculated using the emission factors provided in the U.S. EPA greenhouse gas mandatory reporting rule.
- 2008 data reflects reduced production as a result of a labor strike.
- Data in the chart is normalized for divestitures by excluding Boeing Commercial Airplanes operations in Wichita (now Spirit AeroSystem) from 2002 to 2005. Boeing Defense, Space & Security's Wichita operations are included in this data.

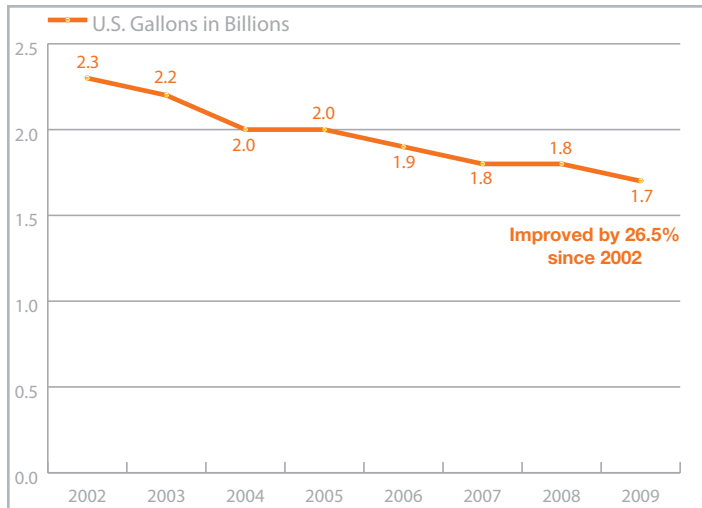


## Measuring Our Progress

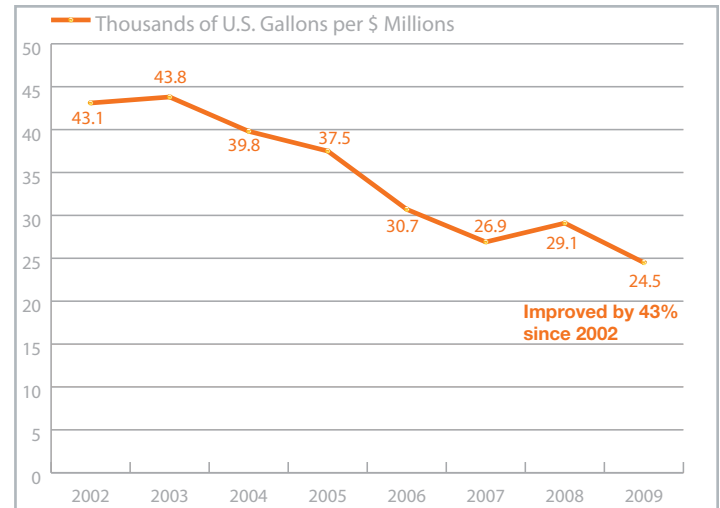
# Water Intake

Boeing reduced absolute water intake by 5 percent in 2010 compared with the previous year, and has reduced water intake on a revenue-adjusted basis by 41 percent since 2002.

### Water Intake at U.S. Sites – Absolute



### Water Intake at U.S. Sites – Revenue Adjusted



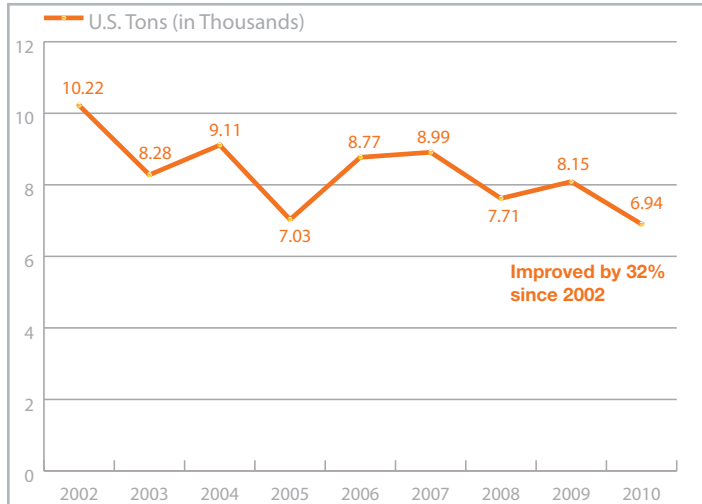
- Includes data from core metric sites, Bellevue, Wash.; Corporate Headquarters, Chicago, Ill.; Boeing Commercial Airplanes operations in Long Beach, Calif.; Seal Beach, Calif.; and West Hills, Calif.
- 1 U.S. gallon = approximately 3.79 liters.
- Data in the chart is normalized for divestitures by excluding Boeing Commercial Airplanes operations in Wichita (now Spirit AeroSystems) from 2002 to 2005. Boeing Defense, Space & Security's Wichita operations are included in this data.
- 2008 data reflects reduced production as a result of a labor strike.
- Data for 2007-2009 has been adjusted to reflect additional intake from a previously unrecorded water meter in Auburn, Wash., as well as a billing error in Everett, Wash.

## Measuring Our Progress

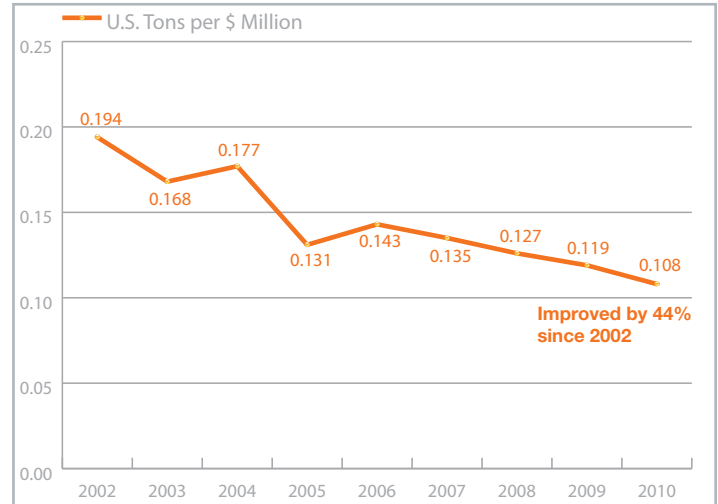
# Hazardous Waste

Boeing has reduced operational hazardous waste on a revenue-adjusted basis by 44 percent since 2002. Operational hazardous waste does not include wastes derived from construction or remediation activities. On an absolute basis, Boeing decreased operational hazardous waste generation by 15 percent in 2010 from the previous year, reflecting enhanced management of chemical tank line operations.

### Hazardous Waste at U.S. Sites – Absolute



### Hazardous Waste at U.S. Sites – Revenue Adjusted



- Includes data from core metric sites; El Paso, Tex; Heath, Ohio; Macon, Ga.; Palmdale, Calif.; Portland — PDX, Ore.; Salt Lake City, Utah; and Sylmar, Calif.
- 1 U.S. ton = approximately 0.91 metric tons.
- Hazardous waste data for 2007–2009 has been restated to reflect the addition of Portland – PDX, a facility in Oregon used by Boeing to paint twin-aisle airplanes.
- 2007 and 2008 data has been restated because a site misclassified operational hazardous waste as nonoperational hazardous waste.
- 2008 data reflects reduced production as a result of a labor strike.
- Operational hazardous waste does not include wastes derived from remediation and construction activities.
- Total normalized for divestitures by excluding Boeing Commercial Airplanes Wichita (now Spirit AeroSystem) from 2002 to 2005. Boeing Defense, Space & Security's Wichita operations are included in this data.

Measuring Our Progress

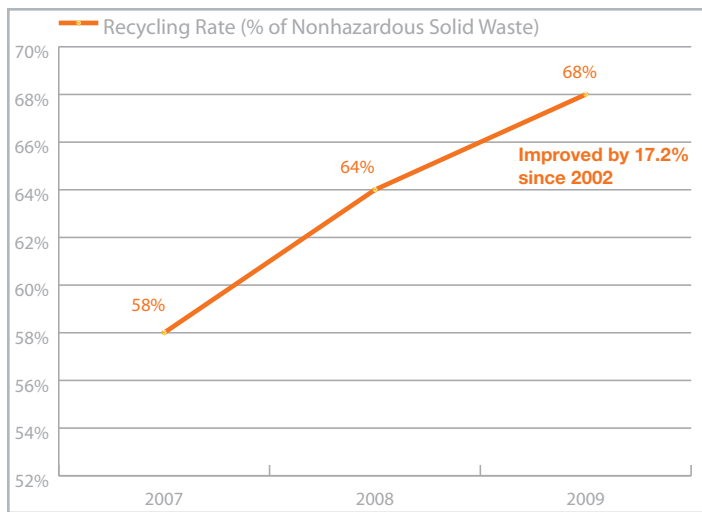
# Solid Waste Diverted From Landfills

In 2010, 73 percent of the solid waste we generated was diverted from landfills, up from 68 percent the previous year.

Waste is diverted from landfills through a combination of recycling, composting and energy recovery programs.

Boeing measures non-hazardous solid waste generated by our operations. This includes waste streams such as metals, wood, paper, cardboard, plastics and organic materials. It does not include hazardous waste, construction waste, remediation waste or asbestos abatement activities.

## Solid Waste Diverted From Landfills at U.S. Sites – Absolute



- Includes data from core metric sites, Bellevue, Wash.; Boeing Commercial Airplanes operations in Long Beach, Calif., and Seal Beach, Calif.
- Calculated by dividing the amount of operational nonhazardous solid waste recycled by the total amount of operational nonhazardous solid waste generated.



## Measuring Our Progress

## Toxic Release Inventory/National Pollutant Release Inventory

Boeing reports to Canada's National Pollutant Release Inventory (NPRI), which is similar to the U.S. Toxic Release Inventory report.

Boeing has reduced toxic releases by 60 percent since 2002, while overall transfers of chemicals to offsite facilities have increased 32 percent during the same period. This increase largely is the result of increased shipment of metal to off-site recyclers.

## United States Toxic Release Inventory (TRI) and Canada NPRI

	2002	2003	2004	2005	2006	2007	2008	2009
<b>Releases</b>	(U.S. only)	(U.S. only)	(U.S. only)	(U.S. only)	(U.S. only)	(U.S. & Canada)	(U.S. & Canada)	(U.S. & Canada)
Total release (millions of lb)	1.27	1.06	0.88	0.47	0.25	0.25	0.21	0.24
Wichita	0.66	0.59	0.55	0.27				
Total release less BCA Wichita	0.61	0.47	0.33	0.20	0.25	0.25	0.21	0.24
Percentage change	0	-23%	-46%	-67%	-59%	-58%	-66%	-60%
Normalized to revenue (lb/million \$ rev.)	12	9	6	4	4	4	3	4
Percentage change from normalized	0	-18%	-45%	-67%	-65%	-67%	-70%	-69%
<b>Transfers</b>								
Total (millions of lb)	8.17	6.78	6.80	4.75	3.27	24.07	2.57	2.74
Wichita	6.09	5.09	5.01	3.06				
Total transfers less BCA Wichita	2.08	1.69	1.79	1.69	3.27	24.07	2.57	2.74
Percentage change		-19%	-14%	-19%	58%	1058%	24%	32%
Normalized to revenue (lb/million \$ rev.)	39	34	35	32	53	363	42	40
Percentage change from normalized		-13%	-12%	-20%	35%	820%	7%	2%
<b>Total release and transfers (millions of lb) (less BCA Wichita)</b>	2.69	2.16	2.11	1.90	3.52	24.32	2.78	2.98
Percentage change		-20%	21%	-30%	31%	804%	3%	11%
Normalized to revenue (lb/millions \$ rev.)	51	44	41	35	57	366	46	44
Percentage change from normalized		-14%	-19%	-31%	12%	618%	-11%	-14%

- Normalized for divestitures by excluding Boeing Commercial Airplanes Wichita (now Spirit AeroSystem) from 2002 to 2005. Boeing Defense, Space & Security's Wichita operations are included in this data.
- 2007 increase in offsite transfer was a result of a Boeing Integrated Defense Systems Wichita transfer of old tooling and scrap metal to recycler.
- 2008 data reflects reduced production as a result of a labor strike.
- 2007-2009 includes Canada NPRI data; prior years do not.
- 2010 data will be submitted to the U.S. and Canadian governments after the publication of this report. Boeing will disclose 2010 data when we issue our next Environment Report in mid-2012.

## Measuring Our Progress

# Carbon Disclosure Project



PHOTO: CARBON DISCLOSURE PROJECT

Click the image above to read the [Carbon Disclosure Project Global 500 Report 2011](#). Participating companies are assessed on the quality and completeness of their disclosure and actions taken to mitigate climate change; disclosure scores are normalized to a 100-point scale and performance is rated a letter grade. Boeing received a 92 for disclosure and a B for performance.

Boeing has participated in the Carbon Disclosure Project, an independent nonprofit organization that has become the standard for carbon disclosure methodology and process, since 2006. For the third consecutive year, Boeing

was named to the Carbon Disclosure Leadership Index. For more information, read [Boeing's 2011 submittal](#) or visit the [Carbon Disclosure Project's website](#). ■

## Measuring Our Progress

# Environmental Awards and Recognition



PHOTO: BOEING PHOTO

Boeing has five ENERGY STAR-certified buildings, including our corporate headquarters building in Chicago.

Boeing received environmental awards and recognition from a number of local, national and international organizations in 2010. These included the following:

- Carbon Disclosure Project: Boeing listed on both the S&P 500 and Global 500 Leadership Indexes.
- ENERGY STAR Partner of the Year from the U.S. Environmental Protection Agency.
- Corporate Energy Management award by the Association of Energy Engineers.
- Chief of Naval Operations and Secretary of the Navy awards for team Environmental Excellence for the F/A-18E/F and EA-18G programs.
- Waste Reduction Award from the California Department of Resources

Recycling and Recovery in El Segundo, Calif.

- Air Pollution Control Achievement and Clay Durrett Air Quality Stewardship awards from the city of Huntsville, Ala.

Kent, Wash., Long Beach, Calif., Portland, Ore., Renton, Wash., Torrance, Calif., and Wichita, Kan. ■

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Boeing's robust energy management program is a national model. Effective energy management not only helps the bottom line, but it also is our most cost-effective climate strategy.

— Elizabeth Craig, acting director of EPA's Office of Atmospheric Programs

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- METRO Rideshare Diamond Award for an innovative rideshare program in El Segundo, Calif.
- Local water quality awards presented by water treatment districts in multiple locations including El Paso, Texas,



For more information about The Boeing Company, visit [www.boeing.com](http://www.boeing.com) and the sites below:



### **2011 Environment Report**

Complete version of Boeing's 2011 Environment Report is available at:

[www.boeing.com/environment](http://www.boeing.com/environment)



### **2010 Boeing Annual Report**

Read about the operational and financial performance of The Boeing Company in 2010.

[www.boeing.com/companyoffices/financial](http://www.boeing.com/companyoffices/financial)



### **Corporate Citizenship Report**

Every day, Boeing people are applying the same expertise and inventive spirit that go into developing our innovative products and services to help strengthen communities.

[www.boeing.com/companyoffices/aboutus/community/2010\\_report/index.html](http://www.boeing.com/companyoffices/aboutus/community/2010_report/index.html)

Boeing Corporate  
100 North Riverside  
Chicago, Illinois 60606  
[www.boeing.com](http://www.boeing.com)