## *IBM and Climate Change*

- IBM recognizes climate change is a serious concern that warrants meaningful action on a global basis to stabilize the atmospheric concentration of greenhouse gases (GHGs).
- IBM believes all sectors of society, the economy and governments worldwide must participate in solutions to climate change.
- IBM supports joint efforts by the private and public sectors to reduce global GHG emissions. These initiatives are most effective when they are implemented through market-driven mechanisms and are economically efficient, environmentally effective and sustainable.
- IBM believes a diverse energy portfolio is necessary to achieve an orderly adaptation to a world in which GHG emissions are constrained while maintaining successful economies and secure supplies of energy, and also meeting the needs of humanity.
- IBM considers energy conservation to be a cornerstone of climate protection. IBM will continue to conserve energy and continually improve the energy efficiency of its operations, products and services while collaborating with and encouraging its global suppliers to do likewise.
- Consistent with its values, IBM will collaborate with its clients to create new innovations and solutions that are protective of the climate.



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IBM

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STEWARDSHIP

# IBM: Early Action for Climate Protection

*building on a legacy of leadership*

IBM

# IBM: Early Action for Climate Protection

*building on a legacy of leadership*

## Long-standing Commitment

Climate change is one of the most critical global environmental challenges facing the planet. There exists scientific consensus that global warming is occurring and that it is affected by emissions of greenhouse gases (GHGs) related to human activities. Although the understanding of the effects of climate change continues to evolve, climate change could impact the economy and the quality of life for this and future generations.

IBM has been committed to protecting the environment for more than three decades. The company's first formal environmental and energy conservation corporate policies date back to 1971 and 1974 respectively, and programs supporting them have been embedded within IBM's global environmental management system since that time. The policies have been a cornerstone of IBM's energy management and climate protection programs.

## Comprehensive and Multifaceted Programs

IBM is committed to leadership in energy efficiency and climate protection. Its focus includes:

- Reducing GHG emissions associated with the company's operations by:
  - Conserving energy
  - Using renewable energy
  - Supporting alternate employee commute options
  - Reducing perfluorocompound (PFC) emissions
  - Increasing the efficiency of its logistics
- Developing energy efficient products and providing diverse solutions for energy efficient data centers
- Collaborating with its clients and others on innovations that help protect the world's climate, consistent with IBM's values: dedication to every client's success, innovation that matters—for our company and the world, and trust and personal responsibility in all relationships

## Results of IBM's Operational Leadership

***Conserving Energy:*** Energy conservation and related GHG emissions reductions are major components of IBM's climate protection programs.

### $CO_2$ Emissions Reductions

From 1990-2006, IBM saved **4.5 billion** kWhr of electricity consumption, avoided nearly **3 million** metric tons of $CO_2$ emissions (equal to **44%** of the company's 1990 global $CO_2$ emissions) and saved over **$290 million** through its annual energy conservation actions.

These results include only those energy conservation projects which actually reduced or avoided energy use. Reductions from downsizings or the sale of operations are not included.

To further extend this significant achievement, IBM set a new goal in 2006 to reduce $CO_2$ emissions associated with its energy use 12 percent between 2005 and 2012 through:

a) energy conservation;
b) use of renewable energy; and/or
c) funding an equivalent $CO_2$ emissions reduction by the procurement of Renewable Energy Certificates (RECs) or comparable instruments.

***Using Renewable Energy:*** Another important way IBM is reducing its GHG emissions is its increasing use of renewable energy. Between 2005 and 2006 alone, IBM's purchase of renewable energy grew by over 180 percent.

### Procurement of Renewable Energy

IBM's procurement of renewable energy and RECs increased from **11 million kWh** in 2001 to **368 million kWh** in 2006 which accounted for **7.3%** of IBM's total 2006 global electricity purchases.

***Supporting Alternate Employee Commute Options:*** IBM pioneered programs to reduce employee commuting and has sustained them for nearly two decades. Two key aspects are its (a) work-at-home program, and (b) mobile employees program. Today, nearly 1/3 of the company's global work force (over 100,000 employees) telecommute in one of these programs. IBM also deployed a human resources IT tool that manages the programs and tracks progress.

In the U.S. alone, IBM's work-at-home program conserved approximately 8 million gallons of fuel and avoided more than 61,600 metric tons of $CO_2$ emissions in 2006. In addition, more than 3,600 metric tons of $CO_2$ emissions were avoided in the same year by employees using other commute-choice programs such as carpooling, vanpooling, bicycling, walking, etc.

***Reducing PFC Emissions:*** In 1998, IBM became the first semiconductor manufacturer to publicly announce a specific PFC emissions reduction target. IBM met its goal in August 2002. Since then, IBM has developed industry-leading technology to enable even greater reductions.

### PFC Emissions Reductions

From 2000-2006, IBM reduced PFC emissions by **55%** from its semiconductor manufacturing.

***Increasing the Efficiency of its Logistics:*** IBM is reducing the $CO_2$ emissions associated with transporting parts and products through the efficient design of its packaging, working with suppliers on their packaging designs and optimizing logistics. IBM joined the U.S. Environmental Protection Agency's (EPA) SmartWay℠ Transport Partnership and encourages its suppliers to do the same.

# Innovation that Matters for Energy Efficiency and Climate Protection

IBM's commitment to energy efficiency and climate protection spans the breadth of its global business—from its operations to its technology, products and services.

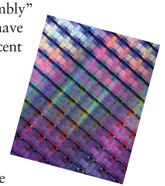
The company's focus on energy and climate—and the integration and innovation it includes—has enabled IBM to be a leader in energy efficiency in its own operations and in providing energy efficient products and solutions for its clients.

*Examples of IBM's innovative solutions for product and data center energy efficiency follow.*

## *Innovations*—Energy Efficient Microprocessors

IBM has a rich history of innovation that has enabled significant increases in the energy efficiency of microprocessors. Beginning with the use of copper for chip wiring, IBM announced 10 semiconductor innovations over 10 years that have made possible the production of computers and many other kinds of electronic devices that are smaller, less expensive, more powerful and more energy efficient. Some of the newest innovations announced in May 2007 include:

***Airgap Microprocessors***—The natural pattern-creating process that forms snowflakes has been harnessed by IBM to form trillions of holes that create insulating vacuums around miles of nano-scale wires. IBM plans to use this innovation inside next generation microprocessors. Using this breakthrough "self-assembly" technology, researchers have proven that these chips can consume 15 percent less energy compared to the most advanced chips using conventional methods.



***POWER6™ Microprocessor***—The fastest microprocessor ever built, the POWER6 chip contains many technological breakthroughs that provide twice the performance with virtually no increase in energy consumption.

## *Innovations*— Product Energy Efficiency

An early leader in addressing the environmental design of its products, IBM established a formal Product Stewardship program in 1991. This program brought additional focus to the development of products with improved energy efficiency and other environmental attributes.


Energy efficient products require the integration of innovative energy management and energy technology. Below are some of IBM's Cool Blue™ Portfolio of technologies and solutions that are providing significant advancements in product energy efficiency:

- **Active Energy Manager**—the first energy management software tool that can provide clients with a view of actual power used, as opposed to benchmarked power consumption, and can effectively allocate, match and cap power and thermal limits in a data center at the system, chassis or rack level
- **Rear Door Heat eXchanger**—"cooling doors" that reduce server heat output in data centers up to 60 percent by utilizing chilled water to dissipate heat generated by computer systems while requiring no additional fans or electricity
- **Calibrated Vectored Cooling™**—allows dual paths of air to each component to improve uptime and longevity while also reducing wasteful air movement

## *Innovations*—Energy Efficient Data Centers

IBM has led the IT industry in energy-smart innovation for over 40 years, from radical breakthroughs in mainframe cooling efficiency to the development of the world's fastest and most energy efficient supercomputer in Blue Gene®. Now the company is using its energy-smart innovations in an initiative to dramatically increase the energy efficiency of data centers, which includes new products and services for IBM and its clients to sharply reduce data center energy consumption. IBM is redirecting $1 billion per year across its businesses in support of this initiative. By using the same solutions it is offering clients, IBM expects to double the computing capacity of its data centers within the next three years without increasing power consumption. Two of the service offerings for clients:

***IBM Data Center Energy Efficiency Assessment***—IBM offers an energy efficiency assessment for clients' data centers that can reduce energy costs by up to 40 percent.

***Mobile Measurement Technology***—This new mobile measurement machine from IBM Research measures 3-D temperature distributions in data centers. The machine includes a position monitoring system and up to 100 sensors used to gather thermal data with unprecedented speed and accuracy as it moves through the data center. It identifies hot spots, air leakages and other inefficiencies.

## *Innovations*—Leading by Example

With over 8,000,000 square feet of data center space, IBM operates the world's largest and most sophisticated data center operations. And the company is demonstrating how to increase its own data center energy efficiency by putting its new initiative into practice:

***Consolidating IBM's Own Servers onto System z™***—IBM announced it will consolidate about 3,900 computer servers onto about 30 System z mainframes running the Linux® operating system. The company anticipates the new server environment will consume approximately 80 percent less energy than the current setup and expects significant savings over 5 years in energy, software and system support costs. Since 1997, IBM has consolidated its own strategic worldwide data centers from 155 to 7.

***IBM Boulder Data Center Expansion***—The company also announced an $86 million data center expansion that will add an additional 80,000 square feet of data center space to its Boulder facility. IBM plans to install high density computing systems utilizing virtualization technology, along with its Cool Blue Portfolio of energy efficient power and cooling technologies. These technologies, in conjunction with the energy efficient design and construction, will allow IBM to reduce its overall $CO_2$ emissions compared to standard data centers and lessen the impact to the environment.

## Collaborating and Partnering on Voluntary Initiatives

An important aspect of IBM's climate protection programs is its collaboration and participation with governments and nongovernmental organizations through numerous voluntary agreements and partnerships.

*Examples of IBM's leadership in these areas:*

| | |
|---|---|
| 1992 | Charter member of U.S. EPA's ENERGY STAR® Computers Program |
| 1995 | One of the first 3 manufacturers to report under U.S. Department of Energy (DOE) Voluntary Greenhouse Gas Emissions (1605b) Reporting at its inception |
| 1996 | Signed Memorandum of Understanding (MOU) with U.S. EPA to voluntarily reduce PFC emissions from semiconductor manufacturing processes |
| 2000 | Charter member of World Wildlife Fund's (WWF) Climate Savers Program |
| 2000 | First IT company invited to join Pew Center on Global Climate Change's Business Environmental Leadership Council |
| 2000 | Charter member of World Resources Institute's (WRI) Green Power Market Development Group |
| 2002 | Signed second MOU with U.S. EPA, which commits to an absolute reduction in PFC emissions |
| 2002 | Charter member of U.S. EPA's Climate Leaders program |
| 2002 | Participated in the Carbon Disclosure Project (CDP) at its inception (and in all the CDPs since) |
| 2003 | Charter member of Chicago Climate Exchange® |
| 2006 | Joined U.S. EPA's SmartWay Transport Partnership |
| 2007 | Founding member of The Green Grid℠ |

## History of Accomplishments

IBM has continually expanded its energy efficiency focus and has enhanced its record of leadership in climate protection. Some of IBM's milestones since 1990 >

**1990**
Received World Environment Center's Gold Medal for International Corporate Environmental Achievement

**1990**
Initiated programs to reduce work-related commuting

**1991**
Established formal Product Stewardship program

**1992**
Received U.S. President's Environment and Conservation Challenge Award

**1992**
Charter member of U.S. EPA's ENERGY STAR Computers Program

**1995**
One of 3 manufacturers to begin voluntary reporting of GHG emissions under U.S. DOE program

**1996**
Established corporate-wide energy conservation goal

**1996**
Signed MOU with U.S. EPA to voluntarily reduce PFC emissions from semiconductor manufacturing – extended this U.S. commitment worldwide

**1998**
Received U.S. EPA's Climate Protection Award in its first year

**1998**
First semiconductor manufacturer to publicly announce a numeric PFC emissions reduction goal – IBM met its goal early, before year-end 2002

**1998**
Named U.S. EPA's ENERGY STAR Computer Partner of the Year

**1998**
Received Alliance to Save Energy's Star of Energy Efficiency Award

**1999**
Named U.S. EPA's ENERGY STAR Computer Partner of the Year

**1999**
Received U.S. EPA's Climate Wise Partner Achievement Award

**2000**
Joined Pew Center on Global Climate Change's Business Environmental Leadership Council

**2000**
Charter member of WRI's Green Power Market Development Group

**2000**
Charter member of WWF's Climate Savers Program – met goal in 2004

**2001**
Received U.S. EPA's ENERGY STAR Excellence in Corporate Commitment Award

**2001**
IBM's North Castle, N.Y., facility earned ENERGY STAR Buildings Label

**2002**
Signed second MOU with U.S. EPA, which commits to an absolute reduction in PFC emissions

**2002**
IBM's Tivoli building in Austin, Texas, certified by the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Green Building Rating System™

**2002**
Charter member of U.S. EPA's Climate Leaders program – exceeded both $CO_2$ and PFC emissions reduction goals in 2005

**2003**
Charter member of Chicago Climate Exchange – committed to reduce IBM's direct and indirect $CO_2$ emissions from its energy use

**2004, 2005, 2006**
Named in U.S. EPA's Top 20 Best Workplaces for Commuters among the FORTUNE 500 Companies

**2004**
IBM Zurich's headquarters building received the Minergie® Certificate of the Swiss Minergie Association

**2005**
Received Low Carbon Leaders Award from The Climate Group in the U.K.

**2005**
Recognized by WWF for attaining the company's Climate Savers goal

**2006**
Purchased 96 million kWh of RECs and 272 million kWh of electricity generated by wind turbines, solar panels or biomass

**2006**
Recognized by U.S. EPA under the Climate Leaders program for attaining its Climate Leaders goals

**2006**
Joined U.S. EPA's Green Power Partnership

**2006**
Received U.S. EPA/DOE's Green Power Leadership Award

**2006**
Joined WRI's Green Power Market Development Group-Europe

**2006**
Received U.S. EPA's Climate Protection Award – first company to receive the Award twice

**2007**
Announced second generation GHG reduction goal through U.S. EPA's Climate Leaders program

**2007**
Received U.S. EPA's SmartWay Excellence Award