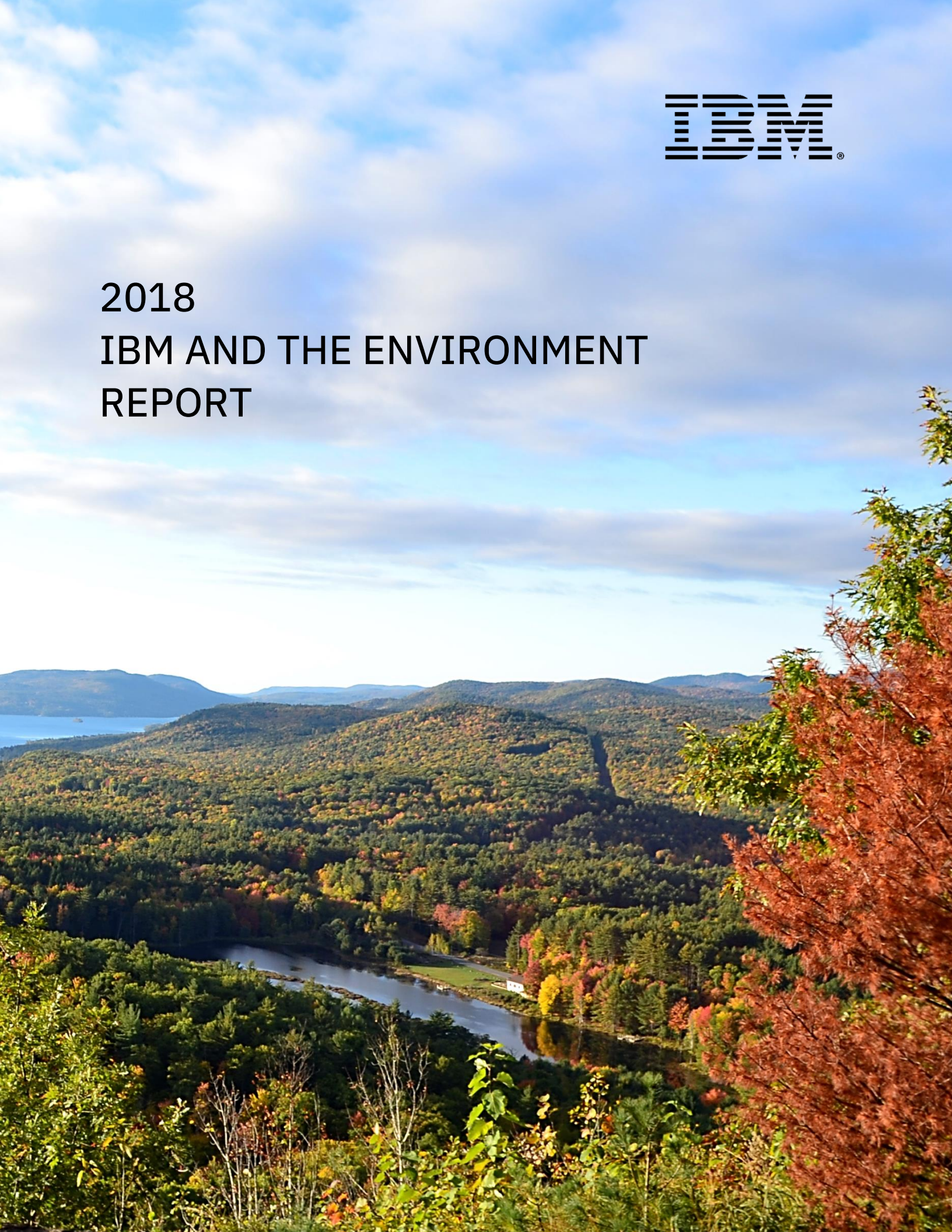

2018
IBM AND THE ENVIRONMENT REPORT

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2018 IBM and the Environment Report

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About this report

This report marks the 29th consecutive year that IBM has published an annual environmental report. The data in this report covers our 2018 fiscal year (January 1 to December 31, 2018). Monetary figures are in U.S. dollars. Unless otherwise specified, all environmental performance data included in this report applies to IBM's operations.

One exception is our greenhouse gas (GHG) emissions and energy use data. In 2018, IBM established a second-generation goal for the use of renewable electricity and a fourth-generation goal to reduce CO_2 emissions. We also expanded the scope of the goals to capture the energy use and CO_2 emissions associated with data centers located in facilities managed by third parties where IBM does not procure the energy. All energy and GHG emissions inventory data reported for 2018 reflect the expanded scope of our goals.

IBM's environmental data is subject to internal and external audits in line with our global environmental management system (EMS) and International Organization for Standardization (ISO) 14001 and ISO 50001 certification at the corporate level. IBM's corporate GHG emissions inventory process is also audited by an independent registrar and the results detailed in a GHG verification statement.

For more information about our EMS, related audits and certifications, and environmental sustainability initiatives, please visit our IBM and the Environment website. Details about IBM's other corporate responsibility initiatives can be found in our annual Corporate Responsibility Report and on our IBM.org website.

Commitment, performance, and trust

IBM has been committed to environmental leadership for decades. Our environmental programs extend back over 50 years. Our first formal corporate policy statement regarding the environment was issued in 1971. IBM has sustained its commitment regardless of economic cycles, changes in business and technology, and even changes in the topic's popularity. The reason is simple. Corporate environmental leadership is the right thing to pursue for our employees, our clients, our communities, and the world in which we live – for the long term.

This report marks our 29th consecutive year of publishing an annual corporate environmental report. It details our current performance and results. You can read about how IBM is addressing energy efficiency, climate change, product design, the use of materials, and more. You can also learn how we are using IBM's technology and innovation to underpin new solutions to difficult environmental challenges. For example, you'll read about how IBM is:

- Leveraging its decades of polymer research to develop a new catalytic recycling process which can efficiently digest mixed polyethylene terephthalate (PET) plastic waste, separate contaminants, and transform it into a monomer that can be directly used to make new PET plastic products;
- Working with government and water agencies in Kenya to apply analytics and IBM's cloud-based Water Management as a Service Platform to help them provide safe drinking water;
- Applying data, hyperlocal weather forecasts, and machine learning to predict crop yields, identify disease and pest indicators, and estimate soil moisture to optimize irrigation and planting schedules in agriculture; and
- Developing small, autonomous microscopes connected via an Internet of Things to predict threats to our food supply by monitoring the movements of microscopic plankton in the ocean.

I am very proud of my IBM colleagues across the world. They continue to achieve results that are consistent with environmental leadership. You can trust IBM to sustain its environmental commitment. It is good not only for our planet, but also for our company.

Wayne S. Balta
Vice President, Corporate Environmental Affairs & Product Safety
July 2019

Year in review

In 2018, IBM continued to demonstrate environmental leadership through strong execution of its environmental management system (EMS) and continued improvement against key performance goals and metrics.

Global governance and management system

(Learn more here.)

EMS certification

21 years

of ISO 14001 certification

In 1997, IBM became the first major multinational company to earn a single global registration of its EMS to the ISO 14001 environmental management systems standard.

Public disclosure

29 years

of disclosure

This report marks IBM's 29th consecutive year of annual corporate environmental reporting.

Fines and penalties

0

IBM received 58 governmental agency inspections at facilities worldwide with no resulting fines or penalties.

Energy conservation and climate protection

(Learn more here.)

Energy conservation

3.3%
conserved

IBM's energy conservation projects across the company delivered annual savings equal to 3.3% of our total energy use, surpassing the corporate goal of 3.0%.

$15.5 million
saved

Approximately 1,900 projects, implemented at nearly 300 global locations, avoided the consumption of 151,000 megawatt-hours of energy, an associated 53,000 metric tons of carbon dioxide (CO_2) emissions, and saved $15.5 million in expense.

Renewable electricity

37.9%
consumed

IBM directly contracted with its utility suppliers to purchase 19.3% of its global electricity from renewable sources. When we include electricity that IBM received via the grid, 37.9% of the electricity we consumed came from renewable sources.

CO_2 emissions reduction

3.0%
reduction in 2018

IBM's operational CO_2 emissions associated with the use of fuel and electricity were reduced by 3.0% from 2017 to 2018.

32.2%
reduction since 2005

IBM's 2018 operational CO_2 emissions were reduced by 32.2% versus our goal's 2005 baseline.

Water conservation and waste management

(Learn more here.)

Water conservation

0.4%
reduction in withdrawals

IBM reduced water withdrawals at data centers and other large IBM locations in water-stressed regions by 0.4% from 2017 to 2018.

Nonhazardous waste

89.5%
recycled

IBM sent 89.5% (by weight) of the nonhazardous waste it generated to be recycled, surpassing our goal of 75%.

Hazardous waste

51.3%
recycled

IBM sent 51.3% (by weight) of the hazardous waste it generated to be recycled.

Product and materials stewardship

(Learn more here.)

Product end-of-life management

0.7%

sent to landfill

IBM's product end-of-life management operations worldwide processed 28,300 metric tons of end-of-life products and product waste and sent approximately 0.7% (by weight) of the total to landfills or incineration facilities for treatment — better than IBM's corporate goal of sending 3% or less.

Product energy efficiency

30-60%

more work per kilowatt hour

IBM's S922, S924 and E950 POWER9™-based servers improved the work delivered per unit of power consumed, as measured by the Standard Performance Evaluation Corporation Server Efficiency Rating Tool, by 30 to 60% over previous generation POWER8® servers.

ENERGY STAR

11 products

certified

As of May 2019, IBM had three Power Systems servers and eight storage products certified to the U.S. Environmental Protection Agency's (EPA) ENERGY STAR requirements, meeting our goal to certify at least two-thirds of eligible new server products and at least one storage product in each of three categories to the U.S. EPA's ENERGY STAR program criteria.

Paper and packaging

99%

from sustainable sources

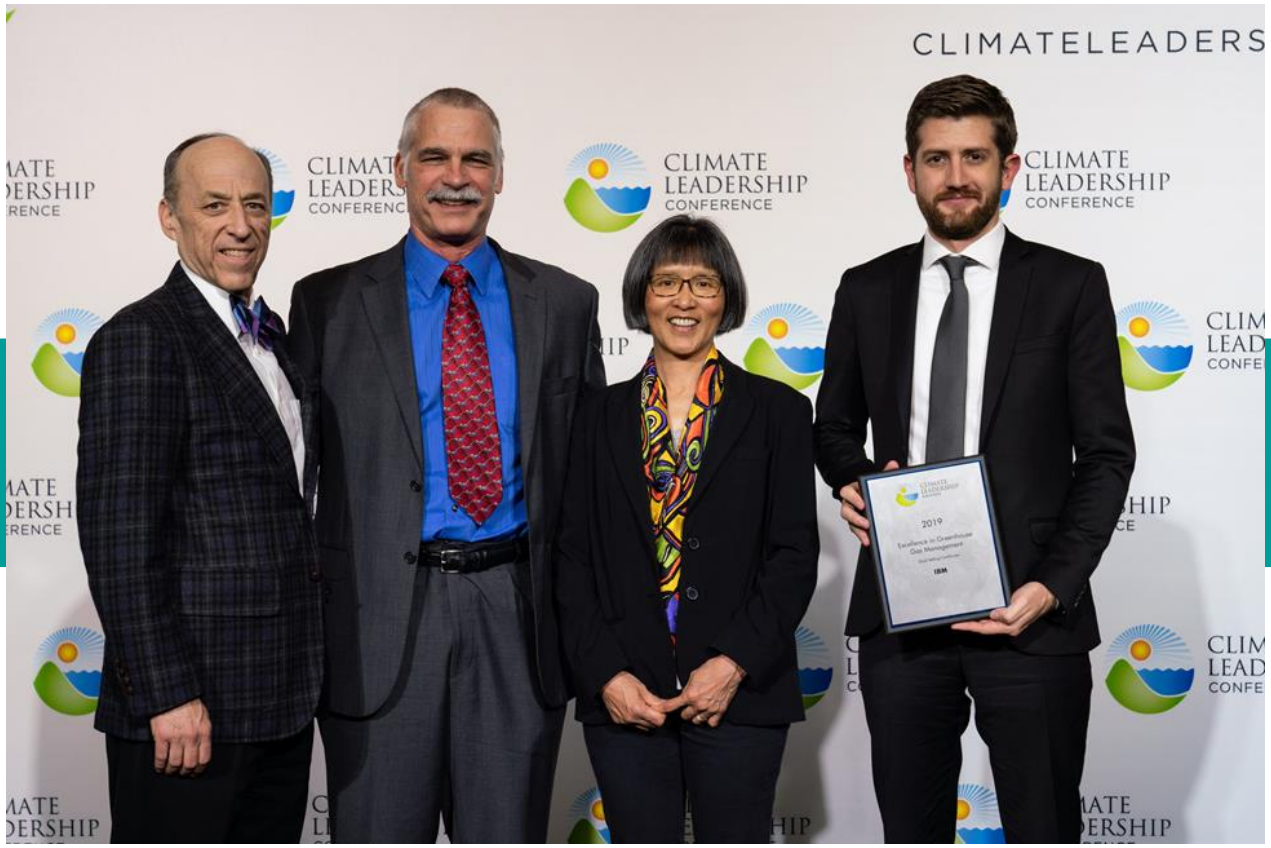
99% of the paper and paper/wood-based packaging IBM directly procured worldwide came from suppliers who warranted that the source was derived from forests managed in an ecologically sound and sustainable manner.

Materials

40 years

of material stewardship

IBM has 40-plus years of leadership in voluntarily prohibiting or restricting substances of concern from our processes and products — before regulations required that we do so.

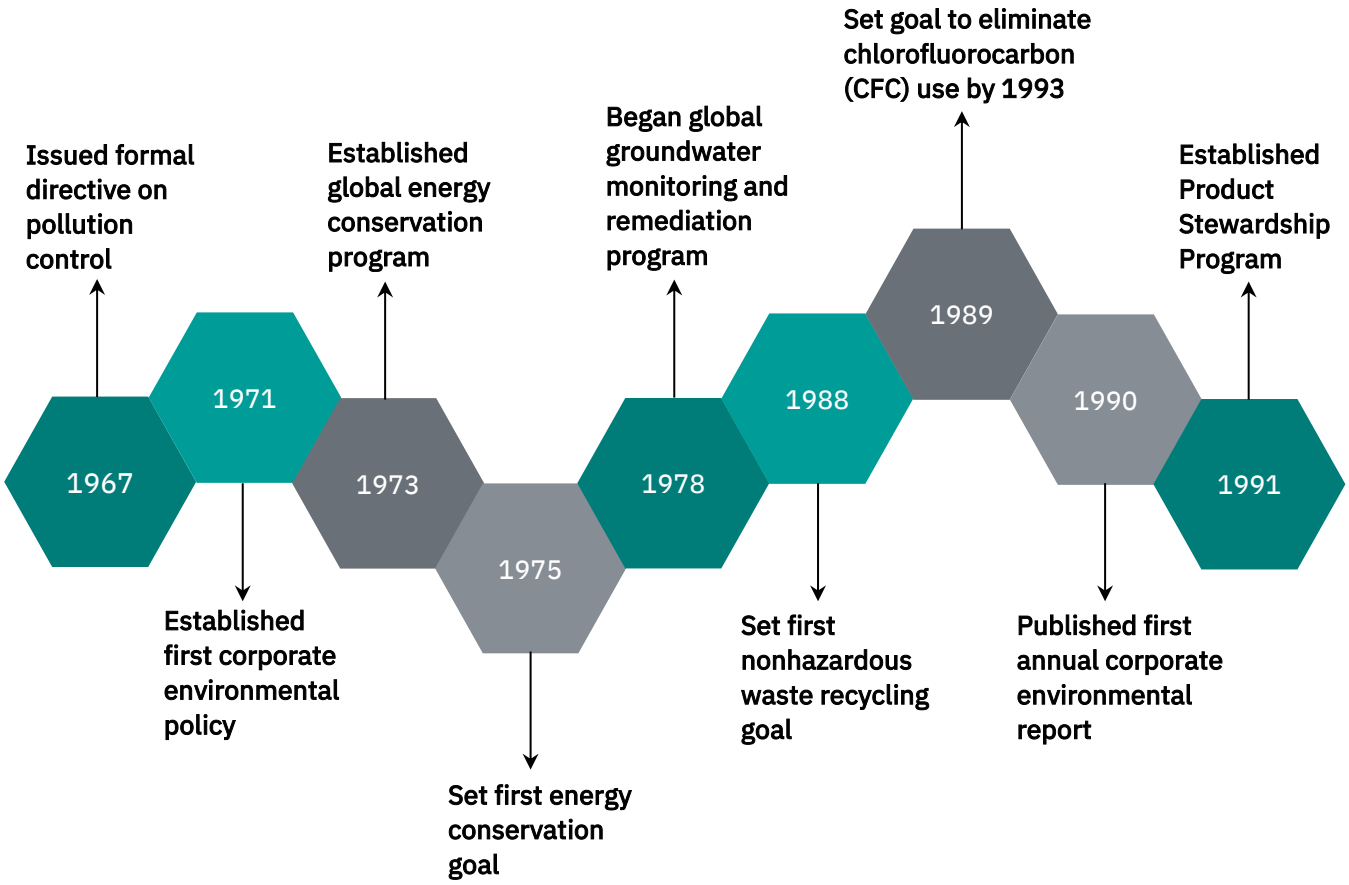


IBM received a 2019 Climate Leadership Award for Excellence in Greenhouse Gas Management Goal Setting from the Center for Climate and Energy Solutions and The Climate Registry. (Left to right) Marc Williams, IBM Government and Regulatory Affairs Executive; Jay Dietrich, Program Manager, IBM Corporate Environmental Affairs; Edan Dionne, Vice President, Environmental, Energy and Chemical Management Programs, IBM Corporate Environmental Affairs; and Andres Rodriguez, Program Manager, IBM Corporate Environmental Affairs.

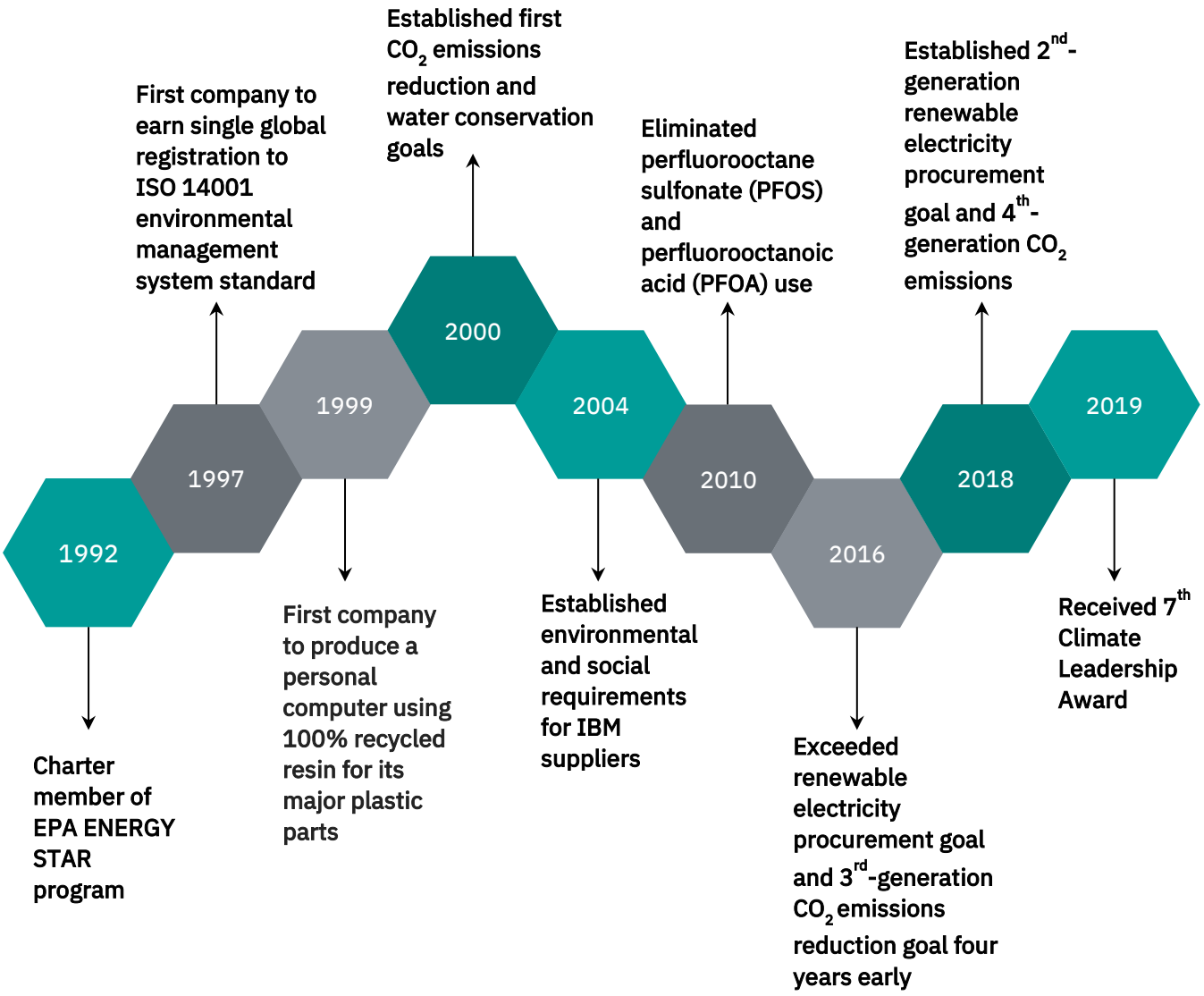
Commitment to environmental leadership

IBM's leadership in environmental responsibility is a long-term commitment which began in 1967 with its first published directive on pollution control. Times, technologies and IBM itself have changed, but we remain focused on protecting the environment we all share. Today, that includes not only managing our operations to be protective of the environment, but also applying analytics, Internet of Things, artificial intelligence, blockchain and other technologies via the IBM Cloud™ to address critical challenges. This report provides some examples of how we are doing that and also highlights our 2018 performance in areas such as energy conservation and climate protection, product stewardship, and water conservation and waste management.

50 Years of


1967
Issued formal directive on pollution control
1971
Established first corporate environmental policy
1973
Established global energy conservation program
1975
Set first energy conservation goal
1978
Began global groundwater monitoring and remediation program
1988
Set first nonhazardous waste recycling goal
1989
Set goal to eliminate chlorofluorocarbon (CFC) use by 1993
1990
Published first annual corporate environmental report
1991
Established Product Stewardship Program

Environmental Leadership



Awards and recognition

2019 Climate Leadership Award from the Center for Climate and Energy Solutions and The Climate Registry for setting its 4th-generation GHG emissions reduction goal and accompanying 2nd-generation renewable electricity procurement goal.

2019 United Nations Sustainable Development Goals Action Award citing the use of IBM Blockchain technology by Plastic Bank in reducing ocean plastic.

2018 Energy Management National Award from the Canadian Industry Partnership for Energy Conservation for IBM's energy management system.

2018 Golden Peacock Environmental Management Award from the Institute of Directors, India, for our longstanding environmental system practices and focus on continual improvement.

Other awards

IBM: 2018 European Union Code of Conduct for Data Centres Award from the European Commission – Largest number of data centers by single company achieving energy efficiency criteria

IBM Austin, Texas: Austin Green Business Leaders Program — Platinum Level

IBM Boulder, Colorado: Environmental Leadership Program by the Colorado Department of Public Health — Gold Leader

IBM Research Triangle Park, North Carolina: Business Conservationist of the Year from the North Carolina Wildlife Federation

IBM Hong Kong: Hong Kong Awards for Environmental Excellence — Class of Excellence Wastewi$e Label

Voluntary partnerships

IBM is committed to participation in voluntary environmental programs that generate real and desired results, having founded or joined many such initiatives and partnerships with governments and environmental nongovernmental organizations (NGOs) over the years.

In 1992, IBM became a charter member of the U.S. Environmental Protection Agency's (EPA) ENERGY STAR computer program and helped to develop the first ENERGY STAR criteria for personal computers. Since then, we have continued our support for the ENERGY STAR program and assisted in the development of new criteria for certifying server and storage products.

In January 2012, the European Commission awarded 27 IBM data centers in 15 European Union (EU) countries "Participant" status in the EU Code of Conduct (CoC) for Energy Efficiency in Data Centres program. Over the last six years, we have registered additional data centers while consolidating and closing some of the data centers that were originally included, bringing the total number of data centers currently participating in this program to 38 across 18 countries. IBM's registered data centers represent the largest portfolio from a single company to receive this recognition.

In 2019, IBM joined the Renewable Energy Buyers Alliance (REBA) which combined the corporate renewable energy initiatives of the Business Renewables Center, Business for Social Responsibility, World Resources Institute and World Wildlife Fund into a single organization. As a community of renewable energy developers, retailers and purchasers, REBA's mission is to accelerate the zero-carbon energy future for the benefit of all energy consumers.

Examples of IBM's voluntary partnerships

Government

- EU Code of Conduct for Energy Efficiency in Data Centres
- U.S. EPA ENERGY STAR Program

Environmental NGOs

- Best Workplaces for Commuters
- Center for Climate and Energy Solutions
- Environmental Law Institute
- The Conservation Fund
- The Green Grid
- Wildlife Habitat Council
- World Environment Center
- World Resources Institute Special Clean Power Council for Customers and Utilities

Biodiversity conservation: IBM Silicon Valley Laboratory, California

IBM's Silicon Valley Laboratory (SVL) campus includes more than 1,000 acres of unaltered natural habitat situated in Coyote Valley, an important wildlife corridor and a part of the Pacific Flyway, a major north-south migratory bird route from Alaska, United Sates, to the Patagonia region in South America.

IBM SVL has maintained Wildlife Habitat Council (WHC) Conservation Certification of its wildlife habitat management and conservation education program since 2005. Employees participate in annual nest monitoring and bird counting from February to June. They also engage in bioblitzes, identifying and recording the variety of species around the site using a mobile app. To promote pollination, there are 29 active honey beehives on the campus grounds. In addition to SVL, four other IBM locations in the United States have achieved WHC Conservation Certification of their wildlife habitat management and conservation education program: IBM corporate headquarters, Armonk, New York; Boulder, Colorado; Research Triangle Park, North Carolina; and IBM Research—Almaden, San Jose, California.

IBM awards grants for climate change research

In 2018, IBM awarded grants of technology and computing power through World Community Grid® and data from The Weather Company® to Emory University, Far Eastern Federal University and Delft University to study research problems in climate and environmental sciences.

Emory University – Researchers will investigate the impact of climate change on public health.

Far Eastern Federal University - Scientists will use computing power from World Community Grid to study the impact of aerosols on climate change.

Delft University - Researchers will work to improve weather models for sub-Saharan Africa, where localized rainstorms are difficult to predict.

To learn more, visit the World Community Grid website.

Chairman’s Environmental Award

IBM established its Chairman’s Environmental Award Program in 1991 to encourage leadership and recognize achievement and progress in environmental affairs by IBM’s internal organizations.

For more than 25 years, the Chairman’s Environmental Award has promoted the contributions of IBM’s business units toward the objectives of IBM’s Corporate Environmental Policy. Recipients are selected based on their leadership, initiative and results.

IBM’s Global Technology Services (GTS) received the 2018 Chairman’s Environmental Award. GTS designs, builds, runs and maintains critical infrastructure systems across clients' IT environments worldwide. The GTS team has put its expertise to work, deploying technology and innovations, in the pursuit of environmental leadership. Following are highlights of the environmental accomplishments they achieved during the 2015-2017 timeframe covered by their nomination:

Martin Jetter, Senior Vice President and Chairman IBM Europe, receives the 2018 Chairman’s Environmental Award from Ginni Rometty, IBM Chairman, President and CEO.

Between 2015 and 2017, the GTS team reduced energy consumption by 11.7% (577 gigawatt-hours). That’s enough electricity to light 172,000 households for a year.

- GTS virtualized and decommissioned over 152,000 servers from 2015 to 2017, saving 245 gigawatt-hours of electricity and $32.1 million.
- GTS increased its purchases of renewable electricity to 26.4% of its total electricity consumption. Including the 20% of renewable electricity obtained through the grid mix, 46.4% of their electricity consumption came from renewable sources.
- As a result of GTS efforts, IBM was recognized once again by the European Commission for the largest number of data centers operated by a single company achieving "Participant" status in the European Union (EU) Code of Conduct for Data Centres program (38 data centers in 18 EU countries).

While only one organization is selected each year to receive the Chairman’s Environmental Award, the competition highlights the company’s worldwide commitment to environmental leadership.

IBM's environmental policy calls for environmental leadership in all of our business activities. Our global EMS enables execution of a full range of programs to support this leadership commitment.

Global governance and management system

IBM has established and maintained a strong worldwide environmental management system (EMS) for decades. Through this EMS, we manage our operations around the globe to minimize their potential impact on the environment.

The Vice President of Corporate Environmental Affairs and Product Safety (VP of CEA&PS) is the top environmental executive of IBM. This person is authorized to set IBM's strategy for environmental affairs, including those matters related to climate change, and to establish the company's environmental requirements, goals, and management system to drive consistent execution across IBM's global operations and achieve results consistent with environmental leadership.

The Directors and Governance Committee of the IBM Board of Directors oversees IBM's environmental affairs programs and performance and is responsible for reviewing and considering IBM's position and practices on issues related to corporate responsibility such as protection of the environment, corporate citizenship, and philanthropic contributions. The VP of CEA&PS briefs the board committee annually on IBM's environmental programs, performance, challenges and emerging issues.

Environmental management system

IBM's environmental policy provides the strategic framework for the company's global EMS. This policy calls for environmental leadership in all of the company's business activities. Achieving leadership is enabled through the implementation of our EMS, which integrates corporate directives governing IBM's conduct and operations worldwide.

In 1997, IBM became the first major multinational company to earn a single global registration of its EMS to the ISO 14001 environmental management systems standard.

IBM's global energy management programs are integrated into the company's EMS. When ISO issued the ISO 50001 standard on energy management systems in June 2011, IBM achieved verification of conformity of our EMS against this newly published standard within one year.

IBM employs a variety of mechanisms to monitor and measure the effective implementation of its EMS requirements. These include comprehensive annual self-assessments by business functions, internal audits conducted by IBM's corporate audit function, and ISO 14001 audits conducted by third-party auditors.

Learn more here.

Risk identification and management

The identification and management of environmental risks, including those related to climate change, is an aspect of IBM's overall enterprise risk management processes. Environmental risks are assessed and managed by IBM senior management, who provide regular updates to the Board and to the Directors and Corporate Governance Committee. Our risk management processes assess to the best of our abilities the potential for disruptive events such as fires, windstorms, and flooding, and enable us to establish plans to help ensure business continuity as well as asset protection. We also follow a process for identifying significant environmental aspects of our business as part of our EMS to assess the company's business intersections with the environment.

Potential environmental risks include extreme weather events or interruptions in the availability of energy, water and other critical materials, which could cause short-term disruptions to IBM's internal operations or supply chain; inability to comply with environmental laws and regulations which could disrupt manufacturing operations or product deliveries; liabilities associated with inadequate or improper disposal of wastes and other materials generated from operations, including end-of-life products; and impacts to our reputation associated with perceived failure to responsibly manage the environmental impacts of our operations.

IBM manages its operations to meet its business objectives while minimizing potential risks, including those related to environmental matters. IBM's global EMS defines responsibilities for identification and compliance with environmental laws and regulations. This is also addressed in IBM's environmental requirements for suppliers and our Business Conduct Guidelines course and certification which all IBMers must complete annually.

Stakeholder Engagement

At IBM, we have a formal system for tracking and responding to inquiries from interested parties on environmental issues. In addition, we proactively engage and collaborate with stakeholders from a cross-section of nongovernmental organizations (NGOs), governments, investors, communities and other interested parties, and publicly disclose information on our environmental strategy, goals and targets, performance, and continual improvement activities widely through this report and external voluntary reporting programs.

IBM's community outreach programs include support of and participation in local environmental projects and education efforts, including Earth Hour, Earth Day, and World Environment Day. IBM also engages employees through site environmental awareness events and local clean air activities focused on the use of public transportation.

Another important element of IBM's stakeholder engagement is our collaborative work with business partners, clients, universities and other organizations to apply IBM technologies and solutions to solve environmental problems. One example is IBM's partnership with Rensselaer Polytechnic Institute and The FUND for Lake George to better understand this beautiful lake ecosystem. The Solutions section of this report highlights some additional examples of our work in this area.

IBM Research scientists Mike Kelly (left) and Harry Kolar (right) deploy an array of sensors that capture data which will be analyzed to help manage and protect New York's Lake George.

Six years ago, The Jefferson Project at Lake George was created through a partnership between IBM, Rensselaer Polytechnic Institute and The FUND for Lake George. The goal of this partnership was to measure, understand and predict environmental factors associated with this natural ecosystem. These partners have collaborated to build the world's most advanced environmental monitoring system with a sensor network that gathers more than nine terabytes of physical and chemical data annually. As a result, computer models have been developed that depict the flow of water, nutrients and contaminants through the watershed and the lake, and, detailed surveys of aquatic animals that inhabit the lake and streams have been made. The monitoring system also conducts ongoing experiments to test the impacts of human activities on the Lake George ecosystem.

The next step for the project is to predict how future changes, such as road salt inputs, excessive nutrients, and invasive species, will affect the lake by means of a "scenario engine" being developed by IBM Research™. The scenario engine draws on data from sensors, long-term surveys of water chemistry and food webs, experiments, and computer models to predict future changes in water quality. With this capability, we can ask how human activities and proposed mitigation efforts will affect the lake and the surrounding watershed. This will help ensure the protection of Lake George and other lakes around the world by providing guidance to decision makers regarding a wide range of "what if" scenarios.

The Jefferson Project
at Lake George

Environmental investment and return

IBM has tracked and publicly disclosed environmental expenses related to our facilities, corporate operations and site remediation efforts since 1992. Over the past five years, IBM has spent $54.6 million in capital and $421.8 million in operating expense to build, maintain and upgrade the infrastructure for environmental protection at our facilities, and to manage our worldwide environmental programs.

Environmental capital and expense worldwide ($M)					
	2014	2015	2016	2017	2018
Capital Cost	20.3	16.7	7.3	4.5	5.8
Operating Expense	86.4	83.1	68.6	110.9	72.8
Total	106.7	99.8	75.9	115.4	78.6

In 2018, total environmental expenses associated with IBM's operations were $78.6 million. Operating expense went down by 34.4% from 2017 to 2018, primarily due to a non-routine 2017 payment of approximately $38 million to cover the disposal of polychlorinated biphenyl (PCB)-containing capacitors and ballasts in Japan from 2017 to 2021.

IBM estimates savings it has realized from its environmental leadership practices. These include savings from energy, material and water conservation; recycling; and reductions in waste. Ongoing savings from previous years' initiatives are not carried over in this calculation, yielding very conservative estimates.

In addition, IBM estimates the avoidance of costs that likely would have occurred if its EMS were not in place. This cost avoidance is difficult to quantify, so a reasonable attempt has been made to estimate. In 2018, IBM's combined, estimated environmental savings and cost avoidance totaled $105.9 million.

IBM's experience has shown that annual savings from its focus on conservation, pollution prevention and design for the environment typically exceed environmental expenses, thereby demonstrating the value of proactive environmental programs.

2018 environmental expenses worldwide ($M)	
Superfund and former IBM site remediation	29.8
Personnel	22.9
Waste and materials recycling	6.9
Waste treatment and disposal	4.1
Surface water and wastewater management operations	3.1
Consultant and legal fees	1.0
Laboratory fees	0.8
Permit fees	0.3
Groundwater protection operations	0.1
Air emission control operations	0.1
Other environmental operations	3.7
Total	72.8

2018 estimated environmental savings and cost avoidance worldwide ($M)	
Energy conservation and cost avoidance	66.3
Pollution prevention operations	14.6
Compliance cost efficiency*	14.6
Corporate operations**	3.9
Spill remediation cost avoidance***	2.6
Avoidance of potential fines, penalty and litigation costs****	2.3
Superfund and site remediation efficiencies	1.6
Total	105.9

* Compliance cost efficiency considers costs avoided through proactive efforts to stay ahead of environmental regulations and requirements.

** Savings or costs avoided by having internal professional staff and tools versus using external consultants and tools.

*** These savings are estimated considering IBM's actual experience with remediation costs.

**** The estimation for the avoidance of potential fines, penalties and litigation does not include cost avoidance of potential business interruption or fines related to noncompliance with product environmental laws and regulations (e.g., EU REACH or RoHS requirements).

In 2018, IBM received 58 agency inspections at its locations worldwide with no resulting fines or penalties.

Accidental releases

IBM locations around the world report environmental incidents and accidental releases to IBM management through the company's Environmental Incident Reporting System (EIRS). IBM's environmental incident reporting criteria are equal to or more stringent than applicable legal reporting requirements, and every event meeting IBM's criteria must be reported through the EIRS. Each IBM location must have a documented incident prevention program and reporting procedure.

In 2018, six accidental releases of substances to the environment related to IBM operations were reported through the EIRS — four releases to air, one release to land and one release to water. The four releases to air were all refrigerants used in cooling systems. The release to land was diesel fuel. The release to water was a water and propylene glycol mixture. The root causes were investigated for all releases and corrective actions were taken as appropriate. None of the releases was of a duration or concentration to cause long-term environmental impact.

Fines and penalties

One significant measure of a company's proactive approach to pollution prevention and environmental performance is its record of fines and penalties. Over the past five years, IBM has paid four fines totaling $7,125.

Fines and penalties worldwide ($ in thousands)					
	2014	2015	2016	2017	2018
Number	4	0	0	0	0
Fines	$7.1	0.0	0.0	0.0	0.0

At IBM, we remain focused on energy conservation, not only because of the efficiencies it brings to our operations, but because energy use drives our greatest potential climate impact.

Energy conservation and climate protection

IBM's long-standing commitment to energy conservation dates back to the 1970s when we issued a corporate-wide policy on energy conservation and set our first energy conservation goal. As such, energy conservation has been a corner stone of our climate protection program.

Our worldwide strategy to reduce greenhouse gas (GHG) emissions includes:

- Optimizing the use of energy across our operations
- Purchasing renewable electricity where it makes both business and environmental sense
- Designing energy-efficient products
- Providing services and solutions that support our clients' efforts to improve their operational efficiency and reduce their climate impacts

In addition to focusing on our own activities, we also require IBM's suppliers to maintain an environmental management system, inventory their energy use and GHG emissions, set goals, and publicly report results.

IBM's updated energy and climate goals

In October 2018, IBM established a second-generation goal for the use of renewable electricity and a fourth-generation goal to reduce carbon dioxide (CO_2) emissions. Our new goals are to:

- Procure 55% of the electricity IBM consumes worldwide from renewable sources by 2025. This includes (a) renewable electricity in the grid mix IBM receives from utilities or energy retailers, and (b) renewable electricity for which IBM specifically contracts over and above the renewables in the grid mix.
- Reduce operational CO_2 emissions associated with IBM's energy consumption 40% by 2025 against a base year 2005, adjusted for acquisitions and divestitures.

IBM expanded the scope of these updated goals by adding the energy use and CO_2 emissions associated with data centers located in facilities managed by third parties where IBM does not procure the energy. The updated goals include all of IBM's global activities, whether they take place in real estate managed by IBM or in a facility managed by a third party.

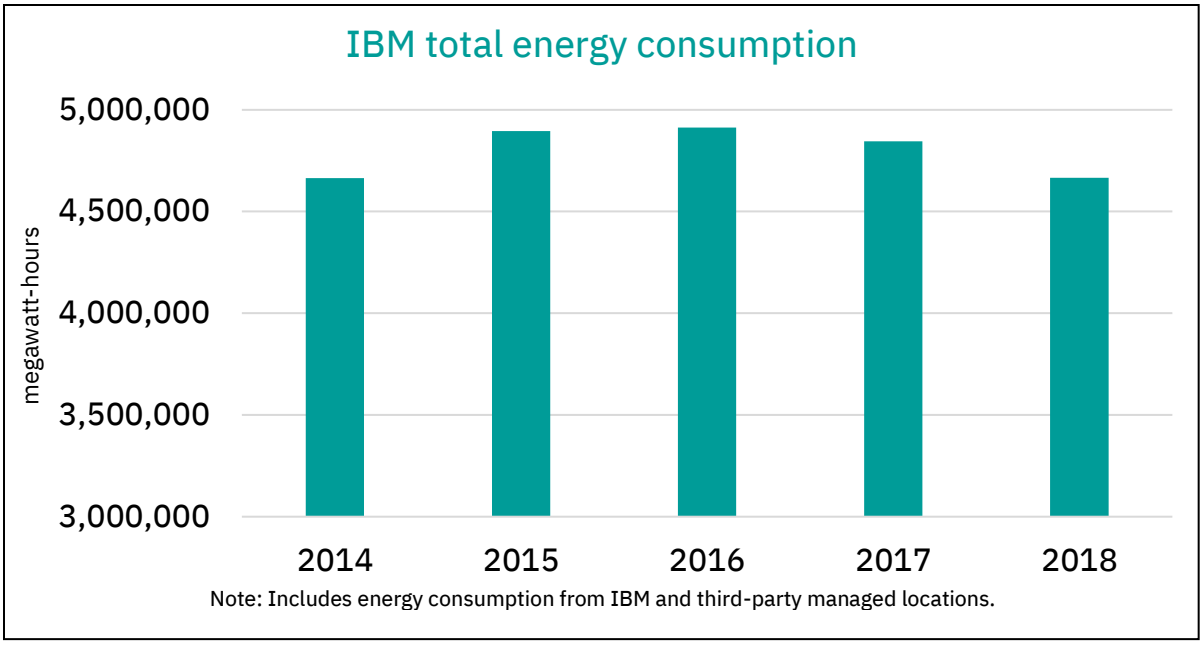
We expanded the scope of our energy conservation goal similarly and adjusted the target to conserve energy equal to 3% of annual energy consumption, versus our previous goal of 3.5%. This change recognizes the larger universe of locations now subject to the goal, and our more limited ability to deliver savings at facilities managed by third parties.

IBM's energy conservation, renewable electricity, and CO_2 emissions data reported for 2018 reflect our performance against the updated goals. Data from previous years has also been adjusted to reflect the expanded scope and allow for year-over-year comparisons.

In March 2019, IBM received a Climate Leadership Award from the Center for Climate and Energy Solutions and The Climate Registry. IBM is the only company to win a Climate Leadership Award seven times in the program's eight-year history.

Energy conservation

Implementation of IBM's Smarter Buildings solution has contributed to making buildings like IBM's Armonk, New York, headquarters more energy efficient.



Note: Includes energy consumption from IBM and third-party managed locations.

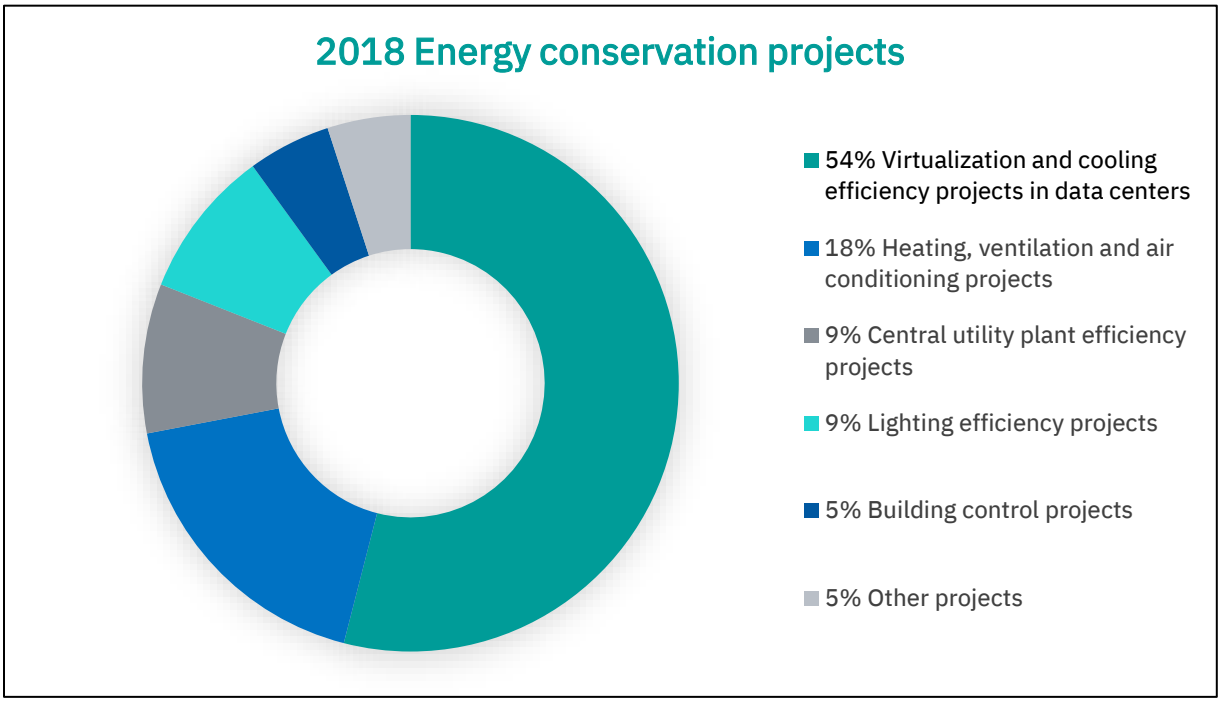
IBM implemented approximately 1,900 energy conservation projects at nearly 300 locations in 2018. These conservation projects delivered annual energy savings (151,000 MWh) equal to 3.3% of our total energy use, surpassing the corporate goal of 3%. They also avoided emissions of an associated 53,000 metric tons of CO_2 and saved $15.5 million in expense.

In measuring performance against IBM's energy conservation goal, we only include the first year's savings from projects. Accordingly, IBM's total energy savings and CO_2 emissions avoidance from these conservation actions is actually much greater than this simple summation of the annual results. We do not include reductions in energy consumption resulting from downsizings, the sale of operations, and cost-avoidance actions, such as fuel switching and off-peak load shifting, in our energy conservation results.

Automated, analytics-based systems accounted for a significant percentage of IBM's energy conservation savings in 2018. These systems reduce IT hardware requirements by increasing the utilization of servers and storage equipment, improve data center cooling efficiency, and enable the real-time identification of building system anomalies to optimize energy use. For more information, see the IBM Smarter Buildings solution in the Solutions for Environmental Sustainability section.

$632 million saved

From 1990 through 2018, IBM conserved 7.5 million MWh of electricity, avoiding 4.5 million metric tons of CO_2 emissions and saving $632 million.



Data centers

IBM has a diverse portfolio of data centers supporting our clients and our internal operations worldwide. We take a holistic approach to managing our data centers — from improving existing space to derive more workload per area, equipment and energy utilized, to building or leasing new, higher-efficiency space.

In 2018, we completed over 750 projects to increase system virtualization and improve cooling efficiency at nearly 200 data center locations, reducing energy use by 81,000 MWh while saving $8.9 million. Virtualizing server and storage systems allows individual systems to support multiple applications or images, reducing the amount of equipment required to complete a set of tasks.

IBM calculates the Power Usage Efficiency (PUE) at many of the data centers we manage. PUE is the ratio of the total energy consumed by the data center, divided by the energy consumed by the IT equipment. The closer the value is to 1, the more efficient the cooling delivery.

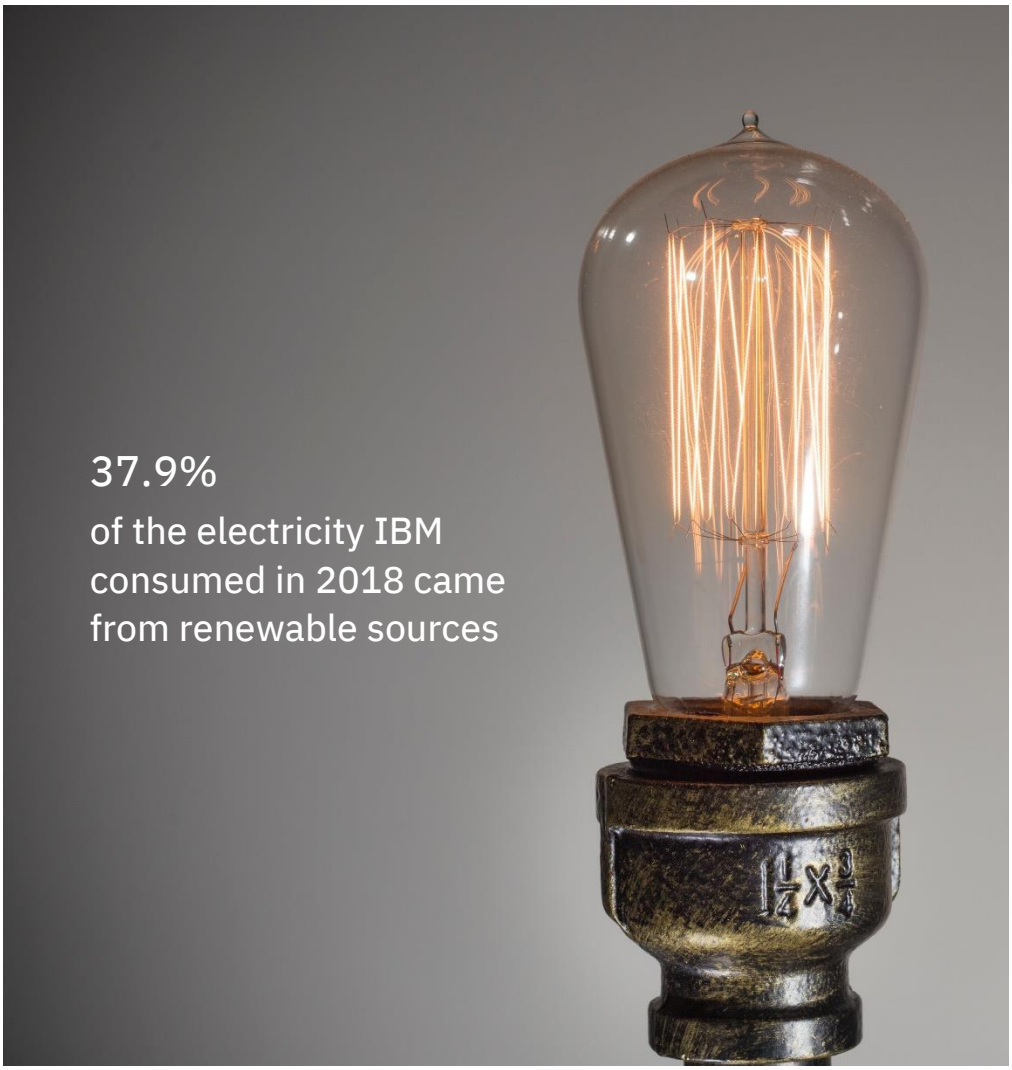
Using data reported from IBM managed data center locations which represent 59% of our global data center electricity consumption, we calculated the average PUE for their raised-floor space to be 1.76. The PUE range for the reporting facilities was 1.1 to 3.4.

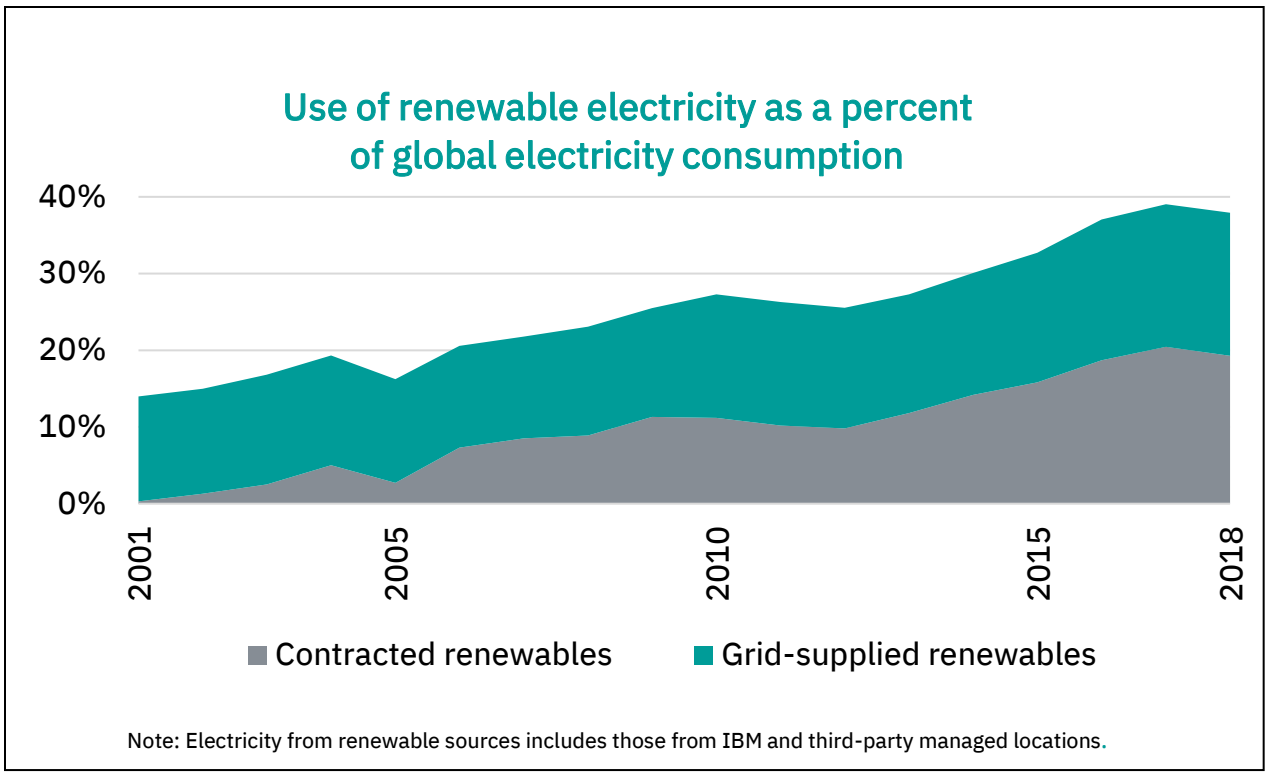
As one of the longest-term providers of service in the IT industry, IBM's data center portfolio consists of spaces and equipment of varying vintages. Improving data center energy efficiency requires thoughtful planning and execution to meet operational objectives and commitments to clients. IBM has made — and will continue to make — significant investments to reduce energy demand and improve the PUE of our data centers.

Renewable electricity

In 2018, 37.9% (1,520,000 MWh) of the electricity consumed across IBM's operations came from renewable sources. Of this total, IBM directly contracted to purchase 19.3% through its utility suppliers, which avoided 236,000 metric tons of CO_2 emissions. The remaining 18.6% was part of the mix of electricity we received from the grid.

IBM procures renewable electricity generated from wind, large and small hydropower plants, biomass, and solar installations around the globe. We report all of our contracted renewable electricity purchases and their associated CO_2 emissions avoidance — whether from new or existing generation sources, "additional" or otherwise, without discriminating against large hydro installations. Our rationale is that all purchases signal to suppliers our desire for them to maintain and broaden their renewable electricity offerings.





Note: Electricity from renewable sources includes those from IBM and third-party managed locations.

Data center renewable electricity use

In 2018, approximately 40% of the electricity consumed in our data centers came from renewable generation sources, including both contracted and grid-supplied.

On December 31, 2018, IBM put two large-scale solar installations into operation at its Bastogne and Vaux-sur-Sŭre Data Centers in Belgium. These installations will provide a total of three megawatts (MW) of peak power and supply 6-8% of the electricity consumption at the two data centers.

In March 2018, IBM finalized a power purchase agreement to acquire all of the electricity — roughly 10,000 MWh per year — generated by a 10 MW solar array to be constructed at IBM's Boulder, Colorado, facility. The array is expected to go into production in mid-2019.

Solar installation at IBM Vaux-sur-Sŭre Data Center

IBM's renewable electricity strategy

IBM's strategy is to purchase renewable electricity that is generated in the grid regions where our consumption of electricity occurs.

This approach enables IBM to actually consume the renewable electricity when the time of its generation and our consumption coincides, and calls for renewable electricity in the places where we are actually powered. We do not purchase 'unbundled' Renewable Energy Certificates (RECs) to assert that IBM is either x% renewable or is powered by the renewable energy that such certificates represent.

It is not possible in today's market, or in the foreseeable future, for IBM's business operations to actually consume 100% renewable electricity given our presence in over 170 countries along with the need for uninterrupted power usually made possible by fossil fuel and nuclear generation sources.

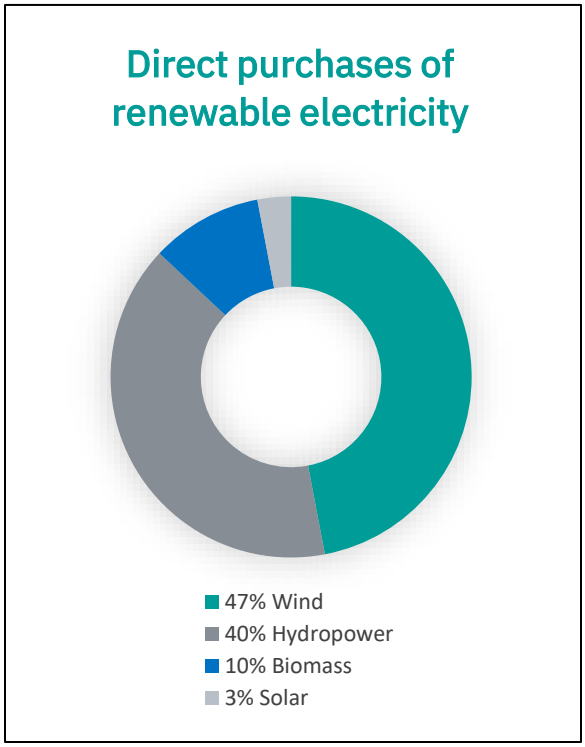
In the interest of transparency, we categorize our procurement as (a) physical consumption and (b) matched consumption with bundled RECs. Physical consumption means the time of generation and consumption within the same grid region coincides.

Matched consumption with bundled RECs means generation and consumption occur at different times, but still within the same grid region. We allocate our renewable electricity consumption among these two categories as follows based upon our understanding of the sources and profiles of their output:

- Wind — 40% physical consumption and 60% matched consumption
- Solar — 20% physical consumption and 80% matched consumption
- Hydropower – 70% physical consumption and 30% matched consumption
- Biomass — 100% physical

IBM continues to work with industry peers, utilities, NGOs and other renewable energy industry participants to increase access to renewables for commercial and industrial consumers. We discuss some of these collaborations in the Voluntary partnerships section of this report.

For more details on IBM's renewable electricity purchasing strategy, please visit our website.



Allocation of renewable electricity IBM received during 2018	
Total renewable electricity received (contracted purchases and grid-supplied)	1,520,415 MWh
Percent of renewable electricity in IBM's total electricity supply	37.9%
• Percent supplied through the grid	18.6%
• Percent obtained through contracted purchases	19.3%
Renewable electricity procurement by category	
• Physical consumption	56.5%
• Matched consumption with bundled RECs	43.5%
• Unbundled RECs	0%

Operational CO_2 emissions goal

IBM's operational CO_2 emissions reduction goal covers emissions associated with energy used to power our global operations. These emissions include more than 96% of IBM's total Scope 1 and Scope 2 GHG emissions. They also include emissions associated with the generation of electricity consumed at IBM data centers which are located in facilities managed by third parties. Although most IBM data centers are located in facilities managed by IBM, the data centers at locations managed by third parties are also an integral part of IBM's business operations. Scope 1 and Scope 2 emissions not covered in our operational CO_2 emissions reduction goal are those resulting from the use of fuels for transportation and from the use of refrigerants and chemicals with a global warming potential. Together these excluded emissions made up 3.9% of IBM's combined Scope 1 and Scope 2 emissions during 2018.

From 2017 to 2018, IBM reduced operational CO_2 emissions by 3% (43,000 metric tons) to 1,375,000 metric tons. When measured against our 2005 baseline, we reduced CO_2 emissions by 32.2%. Our energy conservation projects and the migration of IT workloads to the IBM Cloud platform primarily contributed to this reduction.

Reduced CO_2

IBM's 2018 operational CO_2 emissions were reduced by 32.2% versus the 2005 baseline.

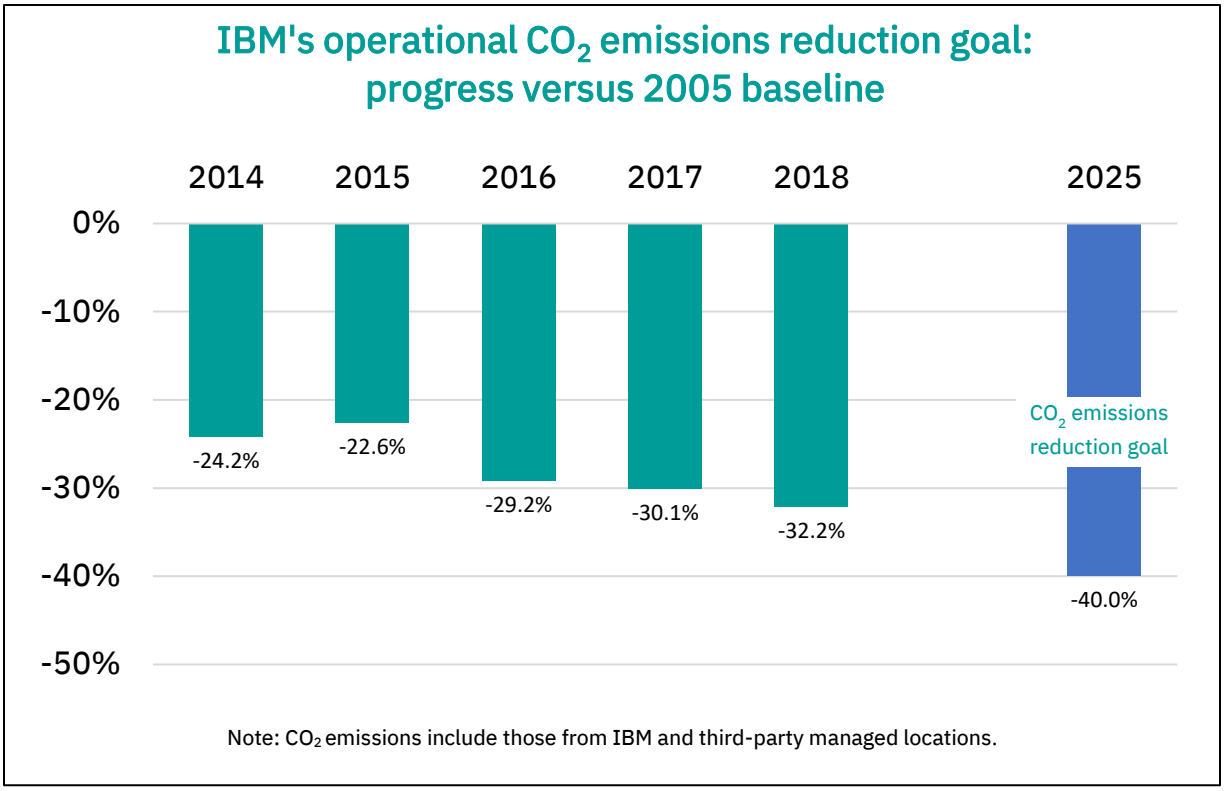
IBM's operational CO_2 emissions associated with the use of fuel and electricity were reduced by 3% from 2017 to 2018.

IBM's GHG emissions subject to its 4th generation operational CO_2 emissions reduction goal

	2018
Emissions associated with IBM's use of fuels for operations such as heating	82,314
Emissions associated with IBM's purchased electricity and energy commodities	963,304
Emissions associated with the generation of electricity consumed by IBM's data centers located in third-party managed facilities	329,409
Total emissions covered by goal	1,375,027
Operational CO_2 emissions reduction against 2005 baseline	-32.2%

GHG emissions inventory (see our IBM and the Environment website)

IBM's overall GHG emissions inventory includes 100% of our Scope 1 and Scope 2 emissions. It also includes estimates of emissions in five Scope 3 categories for which we either were able to make credible assumptions or had reliable data. IBM does not attempt to estimate Scope 3 emissions in other categories. Although broad approximations of Scope 3 GHG emissions can be helpful in identifying where the greatest amounts of GHG emissions may be generated during the lifecycle of a general process, product, or service on a macro level, the assumptions that must be made to estimate Scope 3 emissions in most categories do not enable credible, factual numbers.


IBM's operational CO_2 emissions reduction goal: progress versus 2005 baseline
2014
2015
2016
2017
2018
2025
0%
-10%
-20%
-30%
-40%
-50%
-24.2%
-22.6%
-29.2%
-30.1%
-32.2%
CO_2 emissions reduction goal
-40.0%
Note: CO_2 emissions include those from IBM and third-party managed locations.

IBM is using Internet of Things based sensors at Lake George, in New York, in order to collect data that can be used to improve the freshwater ecosystem.

We continue to seek opportunities to reduce our use of water and avoid the generation of waste. When waste is generated, our goal is to reuse and recycle as much as possible.

Water conservation and waste management

The preservation of water resources and the protection of watersheds are important areas of focus for IBM. Our first water conservation goal was established in 2000, focusing on the significant use of water in our microelectronics manufacturing operations. With the divestiture of IBM's semiconductor manufacturing operations in 2015, our water use decreased significantly. IBM's current water use is primarily associated with cooling and humidity control at offices and data centers, domestic consumption at the workplace, building fire protection systems, and landscape irrigation.

In 2016, IBM established a new water conservation goal to achieve year-to-year reductions in water withdrawals at larger IBM locations and data centers in water-stressed regions. We used the World Resources Institute's Water Risk Atlas, which highlights regions around the world where water resources are stressed to meet human and ecological demand, to identify IBM locations in areas of "high" or "extremely high" baseline water-stress.

In 2018, we decreased water withdrawals at these IBM locations by 0.4% versus 2017. This was a smaller reduction than in previous years, due to business activities that increased water demand at some locations. We avoided water withdrawals equivalent to 5.1% of total annual water use through process water reuse and wastewater recycling in cooling tower systems and for landscape irrigation activities.

Annual reduction in water withdrawals at IBM locations in water-stressed regions			
	2016	2017	2018
Annual reduction in water withdrawals (% of total withdrawals from previous year)	6.6%	2.9%	0.4%

IBM also continues to implement water conservation projects at manufacturing, hardware development and research locations that are not in water-stressed regions. Some 2018 examples were:

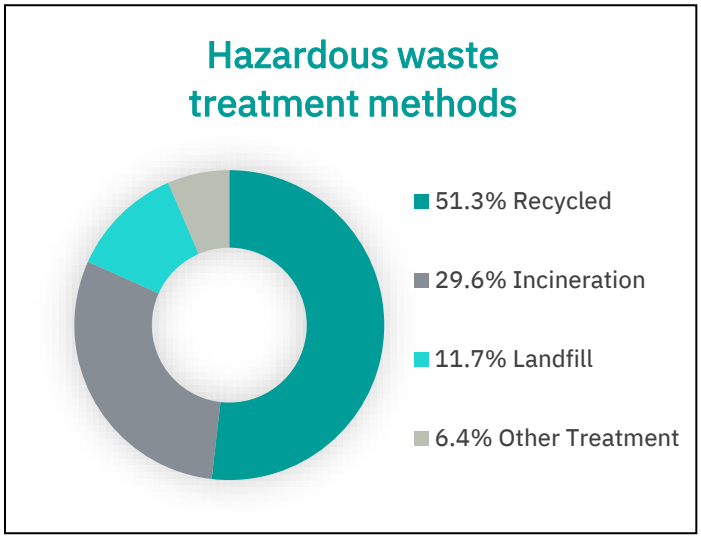
- IBM's Bromont, Canada, manufacturing location implemented water conservation projects that avoided 12,100 cubic meters of water withdrawals per year. Reductions were the result of improvements in the efficiency of the deionized water purification system and installation of water saving devices in the washrooms. A further 4,900 cubic meters of wastewater was recycled for use in the cooling towers after being treated. These water conservation activities avoided water withdrawals of 10% of the location's total annual water use.
- IBM's Thomas J. Watson Research Center, in New York, reused 32,300 cubic meters of water rejected from the site's deionized water purification system, returning it back to the system for re-purification or using it in cooling towers. This action avoided water withdrawals of 17% from the location's previous year's total.

Waste management

The best way to prevent pollution is to reduce the generation of waste at its source. This has been a basic philosophy behind IBM's pollution prevention program since 1971. For the waste that is generated, we focus on preventing pollution through a comprehensive, proactive waste management program. IBM's waste management hierarchy defines our strategic management practice in order of preference as: (1) prevention, (2) reuse, (3) recycling, (4) recovery, (5) other treatment, and (6) land disposal.

Hazardous waste

IBM generated 1,760 metric tons of hazardous waste in 2018. Although this is a small part of IBM's overall waste, the amount increased by 20% in 2018 due to the one-time demolition of groundwater treatment facility systems at two former IBM locations in the United States.



Nonhazardous Waste

IBM established its first voluntary environmental goal to recycle nonhazardous waste streams in 1988. Since then, we have expanded the goal to include nonhazardous chemical waste, end-of-life IT equipment from our own operations, IBM-owned equipment that is returned by external customers at the end of a lease, and nonhazardous waste generated at larger leased locations.

Our current goal is to send 75% (by weight) of the nonhazardous waste IBM generates worldwide to be recycled. In 2018, we sent 89.5% of the 34,200 metric tons of nonhazardous waste that we generated for recycling. This represents a 1.7% increase over 2017. Disposition methods that are not considered recycling include incineration (i.e., without energy recovery) and landfilling and treatment, such as aqueous treatment or biodegradation of organics. Materials recovered from nonhazardous waste and sent to be recycled included: paper and cardboard, metals, plastics, wood, construction debris, cafeteria waste and end-of-life IT equipment. Sanitary wastewater transported to publicly owned treatment systems is not included in our nonhazardous waste totals.

Total annual nonhazardous waste quantity and recycling performance (Metric Tons x 1,000)

	2014	2015	2016	2017	2018
Total sent for recycling	91.7	45.6	38.4	32.4	30.6
Total generated	106.7	53.5	44.5	36.9	34.2
% recycled (by weight)	85.9%	85.2%	86.3%	87.8%	89.5%

We design our products to be energy efficient, incorporate recycled content and environmentally preferable materials, and facilitate reuse and recycling at their end-of-life.

Product and materials stewardship

IBM established its product stewardship program in 1991 as a proactive and strategic approach to the environmental design and management of our products.

IBM's product stewardship objectives and requirements are implemented through our global environmental management system (EMS), internal standards, product specifications and applicable IBM offering management processes. Information on product environmental attributes such as energy efficiency, materials content, chemical emissions, design for recycling, end-of-life management, and packaging are documented in IBM's Product Environmental Profile (PEP) tool and reviewed at various checkpoints during the development process. Compliance management tools such as the Product Content Declaration for IBM Suppliers support the assessments required for a complete PEP prior to product release.

Product stewardship objectives

Develop, manufacture and market products that:

- are increasingly energy efficient,
- incorporate recycled content and environmentally preferable materials and finishes,
- can be upgraded, refurbished, remanufactured and reused to extend product life, and
- can be dismantled, recycled and disposed of safely

Regulatory and legislative requirements affecting electrical and electronic equipment continue to proliferate globally and are increasingly complex. This complexity is further compounded by the lack of harmonization across jurisdictions or among new and existing legislation. Integrated within IBM's global EMS, we have robust processes and state-of-the-art tools that help ensure our continued compliance with worldwide environmental laws and regulations. In 2018, we identified 164 new or modified product-related environmental laws and regulations and acted upon them as necessary to meet their requirements. For additional information on IBM's product compliance process, please see our IBM and the Environment website.

IBM's goals for product energy efficiency

- Improve the computing power delivered for each kilowatt-hour of electricity consumed for new server products as compared to equivalent, previous-generation products.
- Certify at least two-thirds of eligible new server products and at least one storage product in each of three categories to the U.S. Environmental Protection Agency's (EPA) ENERGY STAR program criteria.

We met both of these goals. IBM released four POWER9-based servers eligible for ENERGY STAR and certified three (models S922, S924 and E950). These products improved the work delivered per unit of power consumed, as measured by the Standard Performance Evaluation Corporation (SPEC) Server Efficiency Rating Tool (SERT), by 30-60% over previous-generation POWER8®-based servers. IBM also certified the new IBM FlashSystem® 900 storage product to ENERGY STAR criteria. As of May 2019, IBM had three Power Systems servers and eight storage products certified to ENERGY STAR requirements.

Following are some additional examples of how new IBM products are helping our clients increase the performance of their IT systems while minimizing energy use.

IBM Z® Mainframes

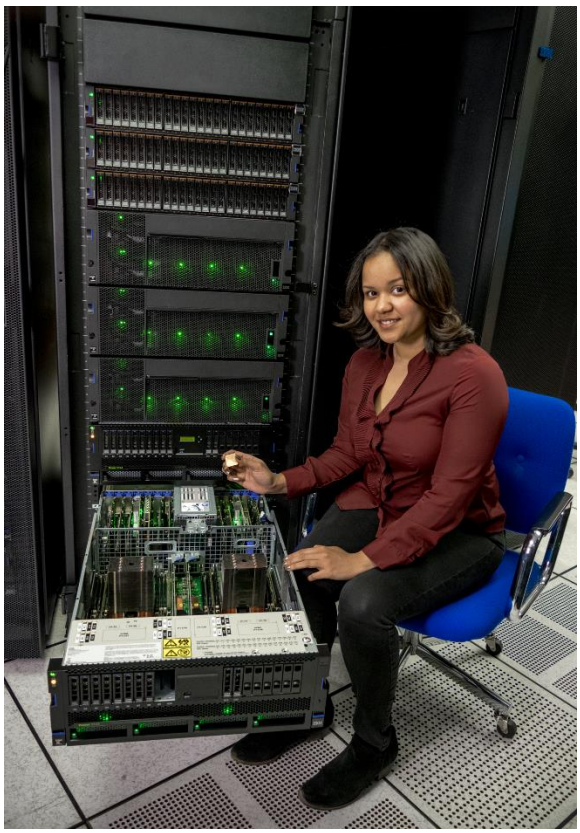
The IBM z14® is designed to be cloud connected and fully encrypted with the capability to efficiently manage blockchain, AI and high-volume transactional workloads securely. With its high utilization rates, the z14 offers one of the most efficient computing platforms when measured by the workload delivered per unit of energy consumed. The z14 also offers several energy-saving options, including:

- Optional high-voltage direct current power reducing conversion losses and increasing energy efficiency.
- A water-cooled option, which delivers 6% more computing capacity per kilowatt compared to the air-cooled model.
- Capability to operate at temperatures of up to 40°C for defined periods of time, enabling use of direct air cooling to reduce cooling costs.

IBM Power Systems

IBM's POWER9 processor-based servers are designed to deliver unprecedented performance for high performance computing (HPC), analytics, and artificial intelligence (AI). This increased performance provides an opportunity for clients to reduce the number of servers required to perform a given workload and the energy demand and consumption of their data centers.

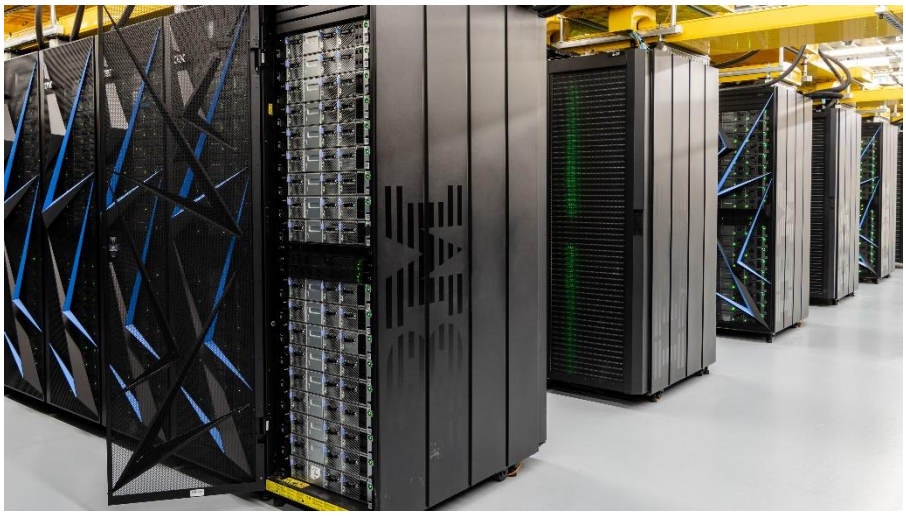
IBM Power Systems servers can make material improvements in the efficiency of data center operations. One client deployed a POWER9 L922 server with a comparable configuration to its existing POWER8 L822 servers to compare performance and power demands for computationally intense workloads for analyzing large seismic data sets. The POWER9 L922 server was able to increase the performance by 100% without increasing power usage.



IBM engineer Ana Santos De Leon tests an IBM Power Systems server in Austin, Texas.

IBM Supercomputers

In 2018, IBM deployed two supercomputers for the U.S. Department of Energy – Summit and Sierra – which not only rank first and second in the Top500 list of the world's fastest, but also third and eighth for energy efficiency in the Green500 list for energy efficiency. In fact, four of the top eight most energy efficient supercomputers in the world, based on the June 2019 Green500 list, were manufactured by IBM. The speed and expandability of IBM's HPC products and solutions have enabled users — in the business and scientific community as well as governments — to carry out complex simulations and address a wide range of problems on topics such as life sciences, astronomy, climate and many other applications.



IBM Storage

IBM offers a broad range of storage products — including the IBM FlashSystem 900, the IBM XIV®, the Storwize® family, the DS8880 enterprise storage family, and tape systems — to address our clients' needs. These products are supported by software-defined storage and capacity optimization methods (COMs) through IBM's Spectrum Scale storage offerings that maximize the utilization of available storage capacity and assign data to the storage tier commensurate with the importance of the data. COM functions include software-based data management capabilities such as Easy Tier®, thin provisioning, data compression and deduplication, and storage virtualization. These capabilities can reduce the storage hardware and energy footprint as well as the capacity required to accomplish a given storage task.

Storage client solutions:

- One client upgraded its storage system with Storwize V5000 hardware and IBM Spectrum Scale and Virtualize software which achieved a 75% compression of stored data with over an 80% reduction in the footprint of the storage system with a commensurate reduction in energy consumption.
- Another client, a cloud services provider, deployed an IBM FlashSystem A9000 with data compression and deduplication features for its storage infrastructure. The use of the data compression and deduplication capabilities reduced the required storage capacity from 250 terabytes (TB) to 90 TB with an overall 90% floor space reduction and commensurate reduction in energy consumption.

Materials use

At IBM, we take a precautionary approach in selecting the materials that we use in our products and processes, endeavoring to select materials that are safe to use and that have the least impact on the environment.

As an integral part of its global environmental management system, IBM monitors and manages the substances used in its research, development and manufacturing processes, and in its products.

IBM strives to use substances and materials in its internal development and manufacturing activities that are protective of both employees and the environment. Prior to the use of new chemicals or materials in commercial products, processes or technologies, IBM requires those chemicals or materials to undergo an extensive environmental, health and safety evaluation called the upstream chemical review. This has been a long-standing practice within IBM to ensure that we are using the least hazardous chemicals possible for a specific application, and it is a key element of IBM's approach to chemical management.

The IBM Q Network™ explores practical applications of quantum computing for business and science, offering organizations access via the IBM Cloud to the most advanced and scalable universal quantum computing systems available.

IBM's precautionary approach to materials and process stewardship is informed by our global chemical management staff, industrial hygienists and toxicologists. As a result, IBM has proactively prohibited or restricted the use of certain hazardous substances in our products and processes well in advance of potential regulatory actions. Some examples include:

- Polychlorinated biphenyls (PCBs)
  IBM initiated a multi-year effort to eliminate PCBs from use in our products in 1974 and achieved elimination in 1978, per the standards of the United Nations Stockholm Convention.

- Chlorofluorocarbons (CFCs)
  In 1989, IBM became the first major IT manufacturer to announce a phase-out of CFCs, a Class I ozone-depleting substance, from our products and manufacturing and development processes. IBM completed the phase-out of Class I ozone-depleting substances in 1993. Subsequently, IBM eliminated Class II ozone-depleting substances from our products and processes in 1995.

- Trichloroethylene (TCE), ethylene-based glycol ethers and dichloromethane
  Examples of other chemicals that IBM voluntarily prohibited from our manufacturing processes include TCE in the late 1980s, ethylene-based glycol ethers in the mid-1990s and dichloromethane in 2003.

- Polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs)
  IBM prohibited PBBs and PBDEs from its product designs in the early 1990s and then extended the prohibition to purchased commodities through our procurement specifications in 1993.

- Cadmium
  IBM prohibited the use of cadmium in inks, dyes, pigments and paints in 1993, in plastics and plating in 1994, and in cathode ray tube monitors along with nickel cadmium batteries in the mid-1990s.

- Polyvinyl chloride (PVC) and tetrabromobisphenol A (TBBPA)
  IBM ceased the specification of PVC in our IT system enclosures in 2000, and in 2007, we prohibited the use of TBBPA as an additive flame retardant in IT system enclosures for newly released products.

- Specific perfluorinated compounds (perfluorooctane sulfonate [PFOS] and perfluorooctanoic acid [PFOA])
  IBM prohibited the use of PFOS and PFOA in the development of new materials in 2005, in new manufacturing applications in 2007, and eliminated their use in existing manufacturing, development and research processes as of January 31, 2010.

- Indium and indium compounds
  In 2017, IBM developed, peer-reviewed, and adopted a new internal Occupational Exposure Limit (OEL) for indium and indium compounds after a team of IBM toxicologists, industrial hygienists and occupational physicians concluded that the available scientific evidence suggested that current OELs recommended by government agencies for indium should be lowered as an added precaution.

Product Packaging

IBM has focused on the environmental attributes of its product packaging since the late 1980s. A key priority is to design products which can be shipped with a minimum amount of packaging materials. Beyond that, we choose packaging materials that have the least possible adverse impact on the environment, collaborating with suppliers to use recycled and recyclable materials and to promote reuse.

Our corporate environmental requirements for product packaging are embedded in various engineering specifications and procurement documents, which extend their reach beyond IBM to include our supply chain and other business partners. These specifications address:

- Materials selection and source reduction
- Ozone-depleting and synthetic greenhouse gas substances
- Restricted heavy metals and other substances of concern
- Reusable packaging systems
- Recyclable packaging

All product packaging suppliers that pack or ship products to customers on behalf of IBM worldwide must submit packaging environmental data to IBM, along with other relevant compliance and performance data. Suppliers that do not conform to an IBM specification or other requirement must submit and implement improvement plans to close out the identified issues within an agreed timeframe.

For additional information on IBM's packaging programs please visit our IBM and the Environment website.

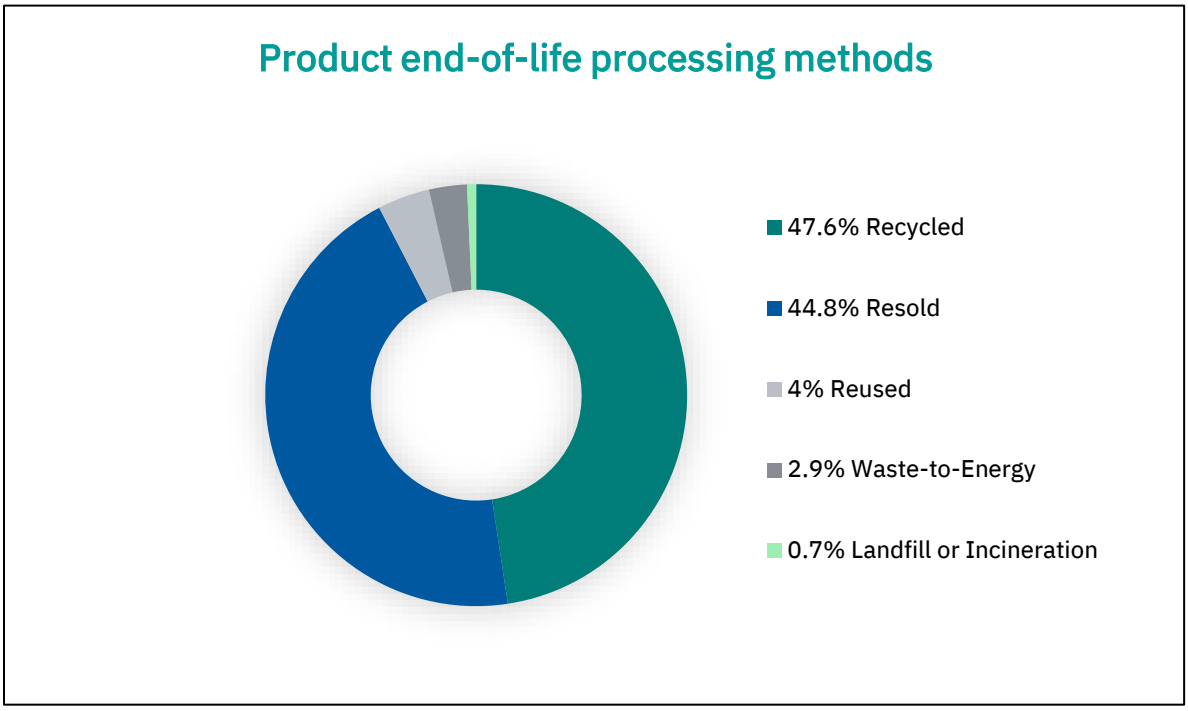
IBM z Systems® mainframe racks are shipped in reusable wooden crates. Crates are covered with a polyethylene bag to keep out rain and moisture during shipment.

Product recycling and reuse

IBM develops products with consideration for their reuse, recyclability and recoverability, to extend product life and minimize the amount of product waste sent to landfills or for incineration. IBM began offering product takeback programs for clients in Europe in 1989 and has extended and enhanced these activities over the years. Today, IBM's Global Asset Recovery Services organization offers Asset Recovery Solutions to commercial customers in many countries generating business value from reusing a large portion of our IT assets.

When assets cannot be reused, they are refurbished or remanufactured and then certified using rigorous processes and original manufacturing standards. Products may also be rebuilt to meet specific client requirements. This practice reduces the impact of products on the environment by extending the life of existing IT equipment and eliminating the need to manufacture new products. Only after all refurbishment and reuse opportunities are exhausted will the remaining fractions be sent for recycling and recovery operations.

IBM's goal is to reuse or recycle end-of-life products such that the amount of product waste sent by our operations to landfills or to incineration facilities for treatment does not exceed a combined 3% by weight of the total amount processed. IBM's global product end-of-life management (PELM) operations processed 28,300 metric tons of end-of-life products and product waste in 2018. More than 96% (by weight) was recycled, resold or reused, and only 0.7% was sent by IBM to landfill or incineration facilities for disposal. From 1995, when we first began including product recovery in our annual corporate environmental report, through the end of 2018, IBM has documented the collection and processing of approximately 1.07 million metric tons (more than 2.35 billion pounds) of product and product waste.



Our greatest opportunity to contribute towards the environmental sustainability of our planet comes from the innovative technologies and solutions that we deploy to help our clients and society address environmental challenges.

Solutions

Our world and our environment are becoming more connected every day. Barriers that once seemed impossible to overcome are being removed. Solutions that we could once only dream of are being developed and implemented. At IBM, our strength and our passion are solving challenging problems. IBMers from a multitude of disciplines come together to research, develop, and implement environmental solutions to benefit our world. The following are examples of innovative solutions we are developing and implementing that have a direct impact on water, energy, and agriculture.

Artificial intelligence to help farmers check the health of soil and water

It is estimated that small farms produce nearly 80% of the food for the developing world. Therefore, the quality and safety of these small farms is critical. Environmental analysis for agriculture can be expensive and time consuming, creating a barrier for small family-run farms. IBM Research-Brazil has developed a way to make it easier for farmers to monitor the health of their soil and water.

The IBM team developed AgroPad, an exploratory prototype, which enables real-time, on location, chemical analysis of a soil or water sample using artificial intelligence (AI). A drop of water or soil sample is placed on the AgroPad, a paper device about the size of a business card. The microfluidics chip inside the card performs an on-the-spot chemical analysis of the sample, providing results in less than 10 seconds. The set of circles on the back of the card provide colorimetric test results with the color of each circle representing the amount of a particular chemical in the sample. Using a smartphone, the farmer can then take a photo of the AgroPad, and by using a dedicated mobile application, immediately receive a chemical test result. In addition, this data can be streamed to the cloud to further assist the farmers in understanding the health of their soil over time. Armed with a better understanding of the chemical make-up of their soil, the farmer can make adjustments to maximize crop production. Learn more at IBM Research.

The AgroPad - a set of circles on the back of the card provide colorimetric test results; the color of each circle represents the amount of a particular chemical in the sample.

Watson™ Decision Platform for Agriculture

By the year 2050, it is estimated that the world population will reach nearly 10 billion people. To help address the increasing food demands for this population, IBM Research in Brazil and India, together with IBM Watson® and The Weather Company, have built a suite of agribusiness tools and solutions to help the agriculture industry use AI to make more informed decisions about their crops – the Watson Decision Platform for Agriculture. Using big data, including hyperlocal weather forecasts, and machine learning, apps on the platform can be used to predict crop yields months in advance, identify disease and pest indicators, and estimate soil moisture to optimize irrigation. The foundation of the platform is the IBM PAIRS GEOSCOPE which has the ability to process geospatial data (maps, satellite, weather, drone, IoT) and assist in the storing and running of agricultural queries. The platform will help the agriculture industry find and implement innovative approaches to improve the quality and sustainability of their crops while reducing impact to the environment. Learn more at IBM Research.

Microscopes in the ocean to monitor plankton

Plankton, the tiny organisms living in bodies of water, produce at least 50% of the oxygen we breathe. They are the food for practically every species of fish and are therefore critically important in the food chain. IBM researchers are building small, autonomous microscopes to be placed in bodies of water to monitor the health of plankton by observing their three-dimensional movement and shape. Since plankton are highly sensitive to even slight changes in water quality, their movement is a key indicator to their health. The data gathered from these seagoing microscopes will be used to better understand plankton behavior and ultimately predict threats to our food and water supply. See the video here.

IBM researcher, Tom Zimmerman, evaluates a seagoing microscope which will be used to analyze plankton.

Helping harness safe water

IBM Research-Africa has collaborated with local governments and private and public-sector partners, including the Millennium Water Alliance (MWA) as part of the Kenya Resilient Arid Lands Partnership for Integrated Development (Kenya RAPID). The MWA has created a water-management platform to address the local water needs of Kenyans and livestock in the remote regions where access to a reliable and safe drinking water supply is lacking. The IBM Research software being used in this effort, known as the Water Management as a Service Platform (WMaaSP), is accessible on both web and mobile apps, and assists local water officials' decision making by predicting water demand based on population trends, ground and surface water supplies, climatic patterns, land use, and maintenance. Learn more at ibm.com.

Kenyans access safe water in a kiosk constructed with the support of Kenya RAPID at the opening of the Kapedo Community Water Project.

New IBM Research app shines a light on solar energy for Africa

According to the South African National Energy Development Institute (SANEDI), more than 600 million people in sub-Saharan Africa live off the energy grid. To improve access to energy, IBM scientists in Johannesburg, South Africa, developed a free, web-based tool called the IBM Research Empower Solar app. The app designs a personalized solar photovoltaic system, including solar panels and storage batteries, for homes and businesses based on the direct sunlight at the location, the direction of the roof, and a list of electrical appliances to be powered. The app also provides an overall cost estimate for the installation, giving users the information they need to implement a solar energy system. Currently, the app is targeted at users in South Africa, but the Research team expects to add more countries in the near future. Learn more here.

Two of the IBM researchers who developed the IBM Research Empower Solar app, Toby Kurien (left) and Ashley Gritzman.

Making new plastic from old

IBM researchers in Almaden, California, have discovered a catalytic chemical process that digests polyethylene terephthalate or “PET”, a common plastic used in bottles, fabrics, and carpet, into a substance which can be fed directly back into the plastic manufacturing process to make new products. The process, known as VolCat, uses a volatile catalyst in a reactor with ethylene glycol and waste PET to selectively digest the waste PET, separating contaminants (e.g., other polymers, food residue, glue, dirt, dyes, and pigments) from the material that is useable for new PET. The useable matter (called a monomer) takes the form of a white powder, which can be fed directly into a polyester reactor to make new plastic.

Mixed plastic waste (right) is converted to pure monomer (left) using IBM's VolCat selective digestion process.

Currently, manufacturers use ingredients derived from petroleum to manufacture PET. The IBM Research team who discovered the process believes the VolCat system can be implemented at polyester manufacturing plants worldwide in the next five years, replacing ingredients derived from fossil fuels with waste PET. Unlike conventional plastic recycling processes, the Volcat process requires no sorting or washing of the waste plastic to be recycled, and it can be used to recycle difficult to recycle items such as colored plastic, clothing or carpeting. Learn more here.

Smarter Buildings

The IBM Smarter Buildings solution combines IBM's real estate management, software and services expertise with analytics to reveal a building's hidden failings and to identify opportunities for improving building performance and efficiency. What began as a pilot at one IBM location in 2009 is now deployed at 25 major IBM campuses, encompassing 174 buildings and over 24.8 million square feet of space around the globe. This solution captures 41% of IBM's energy usage and 35% of our energy spending.

The solution compiles real-time operating data from field data sources (e.g., air conditioning systems, boilers, chilled water systems) every 15 minutes. Smarter Buildings sends out automatic alerts when systems are operating outside of optimal conditions, with a specific focus on energy efficiency, so that personnel can take corrective action and implement operational modifications.

In 2018, IBM's global energy management team utilized Smarter Buildings to reduce energy consumption by 17,000 MWh, with associated annualized savings of over $1 million. The implementation has demonstrated on average a positive return on investment after one to two years, while energy savings have increased in each year of operation. Due to the outstanding results of IBM's internal Smarter Buildings implementation, IBM offers the service to its clients as Building Optimization with IoT. To learn more about the IBM Smarter Building solution and other resources, click here.

AI to detect and locate pipe leaks in oil transmission lines

Leaks from oil pipelines can cause devastating environmental damage. Bridger Pipeline wanted to ensure that it could respond rapidly and effectively shut off leaks immediately. Working with IBM, Bridger Pipeline built a deep-learning AI solution running on the IBM PowerAI Enterprise platform that uses historical data to help recognize leaks and to detect abnormal conditions within the oil transmission pipeline.

As a result of this data-driven AI solution, leaks are detected in one-fifth of the previous time, minimizing potential environmental damage. In addition, the solution is capable of filtering out vast numbers of false alarms, thereby reducing the number of incidents that need to be investigated. To learn more about this solution, click here.

IBM is committed to doing business with environmentally responsible suppliers. Wherever in the world the suppliers may be located, we help them build their environmental capabilities, and encourage them to report transparently on their environmental impacts.

Supply chain

IBM does business with suppliers that are environmentally and socially responsible and encourages environmental leadership among them.

Since 2010, IBM has required that all of its first-tier suppliers maintain a management system to address their social and environmental responsibilities. Our objective is to help our suppliers build their own capability to succeed in this area.

Environmental requirements for IBM suppliers

- Define, deploy and sustain a management system that addresses the intersections of their operations with employees, society and the environment
- Measure performance and establish voluntary, quantifiable environmental goals in the areas of waste, energy and greenhouse gas emissions
- Publicly disclose results associated with these voluntary environmental goals and other environmental aspects of their operations
- Conduct self-assessments and audits, as well as management reviews, of their management system
- Cascade these requirements to their suppliers who perform work that is material to the products, parts and/or services supplied to IBM

The full set of requirements may be found on IBM's social and environmental management system supplier requirements webpage..

Supplier Code of Conduct

IBM is a founding member of the Responsible Business Alliance (RBA), formerly the Electronic Industry Citizenship Coalition, a nonprofit industry group that helps manufacturers support continuous improvement in the social, environmental and ethical responsibility of their supply chains. We require our suppliers to adhere to the RBA Code of Conduct, which contains environmental requirements as well as provisions on labor, health and safety, ethics, and management systems.

We communicate our requirement for RBA code compliance at the initial stages of supplier onboarding. Each year, a subset of our suppliers is assessed using the RBA's Validated Audit Process to verify their compliance with the code. For more information on IBM's supplier audit requirements and results, please see our 2018 Corporate Responsibility Report.

Responsible Business Alliance

Advancing Sustainability Globally

Suppliers managing chemicals, wastes and end-of-life equipment

IBM has established additional environmental requirements for suppliers who:

- Execute processes for which IBM has specified or furnished chemicals or process equipment
- Provide hazardous waste treatment and/or disposal services
- Recycle and/or recover end-of-life products

Environmental requirements are documented in our internal procedures, as well as in our contracts with these suppliers, and include requirements related to chemical content, chemical management, waste management, spill prevention, health and safety, downstream supplier management, and reporting. We evaluate these suppliers prior to entering into a contract with them, and then approximately every three years thereafter, to ensure their operations and commitment to workplace safety and sound environmental practices continue to meet our requirements. Suppliers are managed to the same high standards, wherever in the world they operate.

Hazardous wastes are treated, recycled or disposed of at IBM approved facilities within the country where they are generated, whenever possible. If there are no suppliers in a country that meet IBM's environmental and safety requirements, the waste is shipped to facilities in other countries where those requirements can be met — in compliance with country laws and regulations and in accordance with international treaties. IBM does not ship hazardous wastes from countries that are members of the Organisation for Economic Co-operation and Development (OECD) to countries that are not members of the OECD. In rare cases, IBM will store wastes and product end-of-life materials in properly contained and managed storage facilities, as allowed by law, until suitable processing facilities are available. For more information on IBM's requirements for suppliers managing chemicals, wastes and end-of-life equipment, please visit our IBM and the Environment website.

Paper and paper/wood-based packaging material sourcing

IBM established its voluntary environmental goal for the responsible sourcing of paper and paper/wood-based packaging in 2002. It required that the paper and paper/wood-based packaging directly procured by IBM must come from suppliers that source from sustainably managed forests where such sources exist. IBM has attained this goal consistently for more than 95% of the paper and paper/wood-based packaging that we directly procure. We enhanced the goal in 2016 to require suppliers either to disclose their sources for paper/wood to IBM, or to provide evidence that their sources have been certified to be from sustainably managed forests by an accredited third-party certification scheme. Requirements in support of this goal are incorporated into our standard supplier specifications for paper and paper/wood-based packaging.

In 2018, 99% of the paper and paper/wood-based packaging IBM directly procured worldwide came from suppliers that warranted that the source was derived from sustainably managed forests.

Supply chain environmental milestones

1972 - Established a corporate directive requiring the environmental evaluation of suppliers of hazardous waste services

1980 - Expanded our environmental evaluations of suppliers by establishing a second corporate directive to require the environmental evaluation of certain production-related suppliers

1991 - Further expanded our environmental evaluations of suppliers, adding a requirement that product recycling and product disposal suppliers be evaluated

1993 - Established product environmental compliance specification 46G3772 with environmental requirements for parts and products IBM procures from suppliers

2002 - Added a requirement to assess our suppliers and certain subcontractors they may use to handle recycling and/or disposal operations in countries outside the sOECD

2005 - Created a part and product compliance declaration form (referred to as Product Content Declaration or PCD) to facilitate transfer of part and product compliance information from the supply chain to IBM

2010 - Required suppliers having a direct relationship with IBM to establish a management system that addresses their social and environmental responsibilities and to cascade these requirements to their suppliers who perform work that is material to the products, parts and/or services supplied to IBM

2013 - Incorporated the assessment of product environmental compliance requirements into the supply chain audit process, and introduced reviews via a sampling approach of PCD forms for data integrity

2014 - Expanded supplier evaluation program to include suppliers providing collective solutions for the management of IBM's end-of-life product wastes

2016 - Established an environmental goal to have first-tier suppliers providing product end-of-life management, recycling and disposal services in the U.S., Canada and the European Union to achieve third-party certification to an acceptable electronic product recycling standard, or to demonstrate compliance with an IBM approved alternative

2017 - Established a three-stage supplier environmental evaluation process, with increasing levels of due diligence, depending on the level of risks associated with the supplier's operation

Installation of a groundwater monitoring well at the former IBM Montpellier, France, site.

As a company with more than a 100-year history, we take swift actions to clean up environmental contamination where found at our current and former sites, and we are committed to taking proactive actions to prevent future contamination.

Remediation

When groundwater contamination was first discovered at one of IBM's sites in 1977, the company voluntarily initiated groundwater monitoring at all of its manufacturing and development locations worldwide. Today, IBM has 2,457 monitoring wells and 85 extraction wells in place at its current and former locations.

IBM operated remediation systems that extracted approximately 13,000 pounds of solvents from groundwater at three currently operating IBM locations and 12 former IBM locations in 2018. IBM also has financial responsibility for remediation at two additional former locations.

Under the U.S. Superfund law, IBM is involved in remediation activities at some non-IBM sites in the United States. The Superfund law creates retroactive responsibility for all parties that may have sent waste or otherwise contributed to contamination at a site, regardless of whether the site's operations and/or the shipments of waste to that site were legal, or even best practices, at the time. As of year-end 2018, IBM had received notification (through federal, state or private parties) of its potential liability at 116 such sites since the beginning of the U.S. Superfund program in 1980. At most of the 116 sites, IBM has either resolved its liability or has demonstrated that it has none. Currently, IBM is participating in remediation activities or bears some financial responsibility at 19 Superfund sites.

When an environmental investigation and/or remediation at a site for which IBM has responsibility is probable, and the costs for future activities can be reasonably estimated, IBM establishes financial accruals for loss contingency. As of December 31, 2018, the total amount accrued for all such environmental liabilities and associated activities was $255 million.

IBM employees use a televiewing system to assess performance of a groundwater extraction well.

Performance summary

IBM maintains goals covering the range of its environmental programs including climate protection, energy and water conservation, pollution prevention, waste management and product stewardship.

Energy conservation

IBM's goal is to achieve annual energy conservation savings equal to 3% of IBM's total energy use in IBM managed space and data centers located in third-party co-location facilities.

Energy conservation KPI	2014	2015	2016	2017	2018
As % of total energy use	6.7	6.1*	4.8*	3.6*	3.3

**Data has been restated to reflect the expanded scope of our goal which now includes data centers located in third-party managed facilities.*

Renewable electricity procurement

IBM's second-generation renewable electricity procurement goal is to procure 55% of the electricity IBM consumes globally from renewable supplies by 2025, including both the amount directly contracted by IBM and amounts received automatically through the grid regions in which we operate.

Renewable electricity procurement KPI	2014	2015	2016	2017	2018
As % of total electricity consumption	30.1	32.7*	37.0*	39.0*	37.9

**Data has been restated to reflect the expanded scope of our goal, which now includes data centers located in third-party managed facilities, and was further revised to address an error in the original report published in July 2019.*

CO_2 emissions reduction

Our fourth-generation CO_2 emissions reduction goal is to reduce operational CO_2 emissions associated with IBM's energy consumption at both IBM and third-party managed locations 40% by 2025 against the 2005 baseline, adjusted for acquisitions and divestitures.

CO_2 emissions reduction KPI	2014	2015	2016	2017	2018
As % of 2005 baseline CO_2 emissions	24.2	22.6*	29.2*	30.1*	32.2

**Data has been restated to reflect the expanded scope of our goal which now includes data centers located in third-party managed facilities.*

Water conservation

IBM established a new goal in 2016 to achieve year-to-year reductions in water withdrawals at data centers and other large IBM locations in water-stressed regions.

Water conservation KPI	2016	2017	2018
% annual reduction in water withdrawals at data centers and other large IBM locations in water-stressed regions	6.6	2.9	0.4

Nonhazardous waste recycling

Our goal is to send an average of 75% (by weight) of the nonhazardous waste generated at locations managed by IBM to be recycled.

Nonhazardous waste recycling KPI	2014	2015	2016	2017	2018
% by weight sent for recycling of total generated*	85.9	85.2	86.3	87.8	89.5

**Nonhazardous waste does not include sanitary wastewater transported to publicly owned treatment systems.*

Product energy efficiency KPI

IBM's product energy efficiency goal is to improve the computing power delivered for each kilowatt-hour of electricity used for each new generation of servers. In early 2019, IBM released three POWER9-based servers, the S922, S924 and E950. These products improved the work delivered per unit of power consumed, as measured by the Standard Performance Evaluation Corporation (SPEC) Server Efficiency Rating Tool (SERT), by 30 to 60% over previous generation POWER8-based servers.

ENERGY STAR certified products KPI

IBM has a goal to certify at least two-thirds of eligible new server products – and at least one storage product in each of three categories – to the U.S. Environmental Protection Agency's (EPA) ENERGY STAR program criteria. We certified the new IBM FlashSystem 900 storage product (9840-AE3) in 2018. In April 2019, IBM certified three POWER9-based servers, the S922, S924 and E950, representing three of the four ENERGY STAR eligible POWER9 server products.

As of May 2019, IBM had three Power Systems servers and eight storage products certified to the ENERGY STAR requirements. The Power Systems servers meet the EPA's requirements for power-supply efficiency, idle power limits or power management capability, and SPEC SERT metric data reporting. The storage products meet requirements for power-supply efficiency and reporting of the Storage Networking Industry Association Emerald Power Efficiency Measurement Specification results.

Product end-of-life management KPI

IBM's goal is to reuse or recycle end-of-life IT products such that the amount of product waste sent by IBM's product end-of-life management (PELM) operations to landfills or incineration for treatment does not exceed a combined 3% (by weight) of the total amount processed.

Product end-of-life management	2014	2015	2016	2017	2018
% by weight of total processed sent by IBM's PELM operations to landfill or incineration for treatment	0.5	0.7	0.6	0.7	0.7

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Please recycle