Letter from the Chairman and CEO

Arvind Krishna
Chairman and Chief Executive Officer

IBMers have always applied their time, talent, and technology to make a meaningful impact in the world, evolving the nature of their work over time to meet the most urgent needs of society. This is true in both IBM's core business and in the many ways IBMers engage with the global community.

Today, that includes standing with the people of Ukraine. IBM condemns Russia's war against Ukraine in the strongest terms. We suspended business in Russia and are taking steps to protect IBMers in that country who may be facing difficult circumstances. We covered the costs of relocating IBM employees in Ukraine to neighboring countries and are providing for their physical and mental health. IBMers are supporting the Red Cross in Ukraine, and IBM is matching all employee donations to the organization.

Environmental impact
In 2021, we continued IBM's long tradition of conserving natural resources and reducing pollution, using renewable energy, and developing solutions to climate change. IBM set a new 2025 greenhouse gas emissions reduction goal that exceeds the rate of reduction that the UN Intergovernmental Panel on Climate Change indicates is necessary to limit Earth's warming 1.5 degrees Celsius above pre-industrial levels. This is another milestone in our roadmap to achieve net-zero greenhouse gas emissions by 2030. We are also applying our technology and expertise to help make net zero a reality for our clients. Earlier this year we announced the acquisition of Envizi, a leader in environmental performance management. Building on other IBM investments in AI-powered software, Envizi will help organizations create more resilient and sustainable operations and supply chains. IBM also increased its waste recycling goal, committing to divert 90% of IBM's total nonhazardous waste from landfills and incineration by 2025.

Equitable impact
IBM is proud of its inclusive culture and the programs we have established globally to provide wider access to critical skills and training. This focus on inclusivity extends across our business. In 2021, IBM again grew the percentage of women and underrepresented minorities in our workforce as a whole as well as in our executive ranks. We also committed to dedicating 15% of our first-tier diversity supplier spending to Black-owned businesses by 2025. Through IBM's career-building programs and more than 170 new academic and industry partnerships, we are committed to skilling 30 million people globally by 2030. IBM is investing $250 million by 2025 in our apprenticeship and new collar programs, which offer alternative paths to in-demand skills and tech industry jobs. And we established a target of 4 million IBM volunteer hours by 2025.

Ethical impact
As a responsible steward of technology, IBM is focused on developing policies and practices that prioritize ethics, trust, transparency, and accountability. Our clients and partners must drive innovation while delivering the highest standards of security, privacy, data protection, and compliance. We are committed to supporting them as the most trusted and ethical technology partner of the 21st century. That is why IBM will train 1,000 partners in technology ethics by the end of 2022. It is also why we added a diversity modifier to our executive compensation program to reinforce accountability for building a diverse workplace, a key organizational goal.

I invite you to read more about our efforts to make an impact wherever it is needed. As always, we stand ready to collaborate with our clients, partners, and governments to build a safer, more equitable, and peaceful future. I am humbled and inspired by IBMers' dedication to this critical work. Thanks to them, IBM is well positioned to fulfill its purpose—to be the catalyst that makes the world work better—for decades to come.

Arvind Krishna
Chairman and Chief Executive Officer

Environmental impact

For more than 50 years, IBM has committed to environmental responsibility—a commitment formalized by our first corporate environmental policy in 1971, which integrated environmental responsibility throughout the fabric of our business.

IBM views environmental leadership as a long-term strategic imperative, demonstrated today as we continue to set ambitious goals and apply our technologies to accelerate solutions to global environmental challenges.

Global environmental management system

IBM's corporate environmental policy provides the strategic framework for the company's global environmental management system (EMS). IBM has sustained a formalized EMS for decades, and it is continually updated to reflect our company's intersections with environmental matters. The global applicability and scope of IBM's EMS covers hardware product design, manufacturing, data centers, real estate operations, procurement, logistics, asset recovery services, and business services.

This year marks the 25th anniversary of IBM's single global registration to the ISO 14001 EMS standard and 10th anniversary of IBM's single global registration of its EMS to the ISO 50001 energy management systems standard. Both registrations have been maintained continuously.

21 goals for environmental sustainability

In 2021, IBM announced an updated set of 21 comprehensive, voluntary environmental sustainability goals that address the ways in which today's IBM intersects with the environment. Collectively, the goals cover energy and climate change, conservation and biodiversity, pollution prevention and waste management, supply chain and value chain, and our global EMS. We establish near-term goals that are transparent and authentic to drive real progress and accountability. We work hard to avoid opaque representations of achievement. For detailed information about each of these goals, please see "Driving progress with 21 goals for environmental sustainability."

Stakeholder engagement and voluntary collaborations

We proactively engage and collaborate with stakeholders from a cross-section of nongovernmental organizations (NGOs), government agencies, businesses, industry associations, investors, academia, communities, and employees. Some examples:

As a founding member of the United Nations Environment Programme's Science-Policy-Business Forum on the Environment (UNEP-SPBF), IBM is helping to demonstrate how data and advanced information technology can underpin new solutions to persistent environmental problems. In 2021, IBM participated in the launch of the UNEP-SPBF Asia chapter, sharing information on how:

- Farmers are using insights enabled by data and AI to improve crop yields.
- The Plastic Recovery Insight and Steering Model platform (PRISM)—co-developed by IBM and the Alliance to End Plastic Waste—is digesting disparate data and applying analytics to help inform decisions to reduce plastic waste leakage.
- The IBM-developed VolCat process can turn PET (a type of plastic commonly used in food packaging and polyester clothing) into a renewable resource.
- IBM is identifying new catalysts that enable efficiency improvements in the conversion of carbon dioxide (CO_2) to new materials such as aliphatic polycarbonates.

IBM joined the Climate Neutral Data Centre Pact in 2021. As a member, IBM will continue to increase energy efficiency, purchase additional renewable electricity, conserve water, and facilitate the reuse and repair of IT equipment at our data centers.

Also in 2021, IBM became a founding member of the European Green Digital Coalition (EGDC). The EGDC is a group of companies committed to supporting the green and digital transformation of the European Union. In joining the coalition, IBM pledged to continue developing digital technologies and services that are more energy- and material-efficient, along with methods and tools to measure the environmental impacts of these technologies.

IBM joined a dozen other enterprises as inaugural members of the Massachusetts Institute of Technology Climate and Sustainability Consortium, whose mission is to accelerate the large-scale, real-world implementation of solutions to address the threat of climate change.

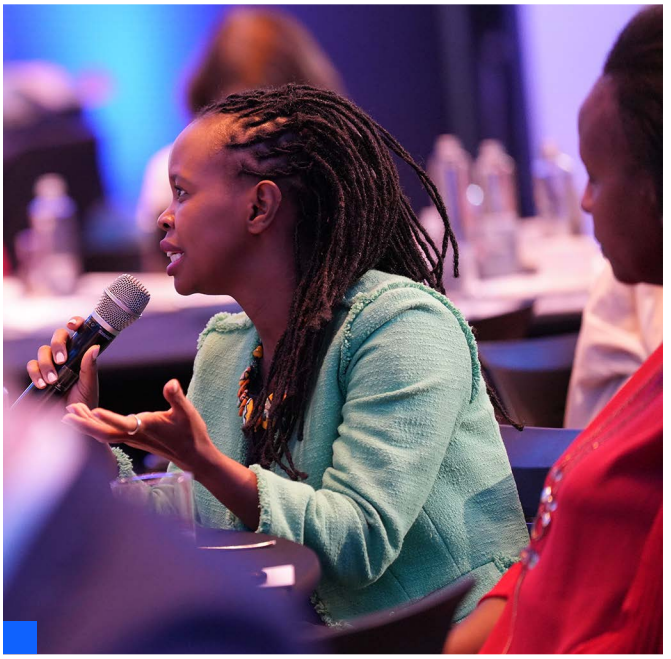


Photo credit: DSkilton/UN-SPBF

Charity Wayua of IBM Research Africa spoke at a UN Environment Assembly meeting on big data for the environment in March 2022.

Spinoff of IBM's managed infrastructure services business

IBM completed the spinoff of its managed infrastructure services business, now a publicly traded company called Kyndryl, in early November 2021. Accordingly, the environmental information in this report includes 10 months of data for that business. When we publish results for calendar year 2022, they will cover a notably different base of operations.

Energy and climate change

IBM has been demonstrably committed to addressing climate change for three decades. As a founding partner, IBM helped the US Environmental Protection Agency (EPA) launch ENERGY STAR in 1992. We began disclosing CO_2 emissions in 1994, and made our first purchase of renewable electricity in 2001. IBM published its policy position on climate change in 2007, long before today's acute focus, recognizing that climate change is a serious concern that warrants timely, meaningful action on a global basis.

In 2015, IBM voiced its support for the Paris Agreement, and reaffirmed such support in 2017. IBM became a founding member of the Climate Leadership Council in 2019 and continues to support the council's bipartisan plan for a carbon tax, with its proceeds—a "carbon dividend"—to be returned to citizens.

Updated goals

In 2021, IBM established its third consecutive goal for the use of renewable electricity; its fifth consecutive goal to reduce greenhouse gas (GHG) emissions; a goal to achieve net-zero GHG emissions; and related goals for energy conservation, data center energy efficiency, energy-efficient product design, suppliers, and client engagements. Nine of our goals involve climate change. Five are described below, and the others are cited in this report's sections regarding product energy efficiency and supplier environmental goals:

- Procure 75% of the electricity IBM consumes worldwide from renewable sources by 2025, and 90% by 2030.
- Reduce IBM's GHG emissions 65% by 2025, against base year 2010, adjusted for acquisitions and divestitures.
- Reach net-zero GHG emissions by 2030, using feasible technologies to remove emissions in an amount which equals or exceeds IBM's residual emissions. Aim for residual emissions of 350,000 metric tons of CO_2 equivalent or less by 2030.

  - + With reference to the voluntary Greenhouse Gas Protocol, this addresses Scope 1, Scope 2, and Scope 3 emissions associated with electricity consumption at third-party co-location data centers.
  - + IBM has also committed to initiating 100 client engagements or research projects by 2025, in which IBM solutions have enabled demonstrable environmental benefits. For example, IBM Research is supporting the development of new carbon-removal solutions by accelerating the discovery of enabling materials.
- Implement a minimum of 3,000 new energy conservation projects to avoid the consumption of 275,000 megawatt-hours (MWh) of energy from 2021 to 2025.
- Improve average data center cooling efficiency 20% by 2025, against base year 2019.

IBM's new 2025 GHG emissions reduction goal achieves a rate of reduction that exceeds what scientists from the UN Intergovernmental Panel on Climate Change (IPCC) indicate is necessary to limit Earth's warming to 1.5 degrees Celsius above pre-industrial levels.

Our energy and emissions goals and reporting cover all activities taking place in IBM-owned or leased facilities (inclusive of Red Hat). These facilities also include IBM data centers located in facilities managed by third parties where IBM does not procure the energy or control the operations of the buildings—also known as co-location data centers.

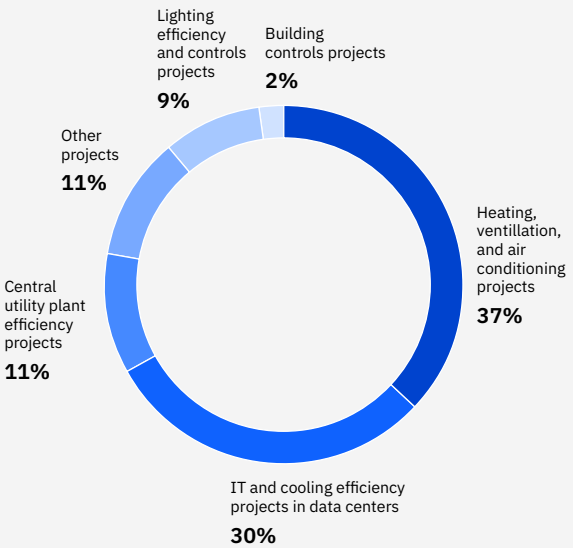
Energy conservation

Continuing IBM's five decades of commitment, we implemented 936 energy conservation projects in 2021 across more than 190 locations globally, avoiding 90,000 MWh of energy consumption and 26,500 metric tons (MT) of CO_2 emissions, and saving $9.9 million.[1]

We adjusted schedules for lighting levels, temperature and other building systems to avoid unnecessary consumption of energy during the COVID-19 pandemic, when buildings were underutilized. We also implemented projects in our data centers to improve the energy efficiency of both cooling and IT equipment, retrofitted lighting, and improved the operational efficiency of our building infrastructure.

IBM will publish year-end 2021 progress against its new renewable electricity and GHG emissions reduction goals in June 2022, once we have completed our annual external limited assurance audit of our GHG emissions calculation process and underlying data.

2021 energy conservation savings by project type



[1] 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 projects are greater than this simple summation of the annual results. We do not include reductions in energy consumption resulting from downsizings, the sale of operations or cost-avoidance actions, such as fuel switching and off-peak load shifting, in our energy conservation results.

	2017	2018	2019	2020	2021
Energy and climate change					
IBM total energy consumption in megawatt-hours	4,845,695	4,666,514	4,455,805	4,118,636	†
Renewable electricity procurement as % of total electricity consumption (goal 75% by 2025)	39.0	37.9	47.5	59.3	†
CO_2 emissions reduction as % of 2005 base year CO_2 emissions (previous goal 40% by 2025)	30.1	32.2	39.7	56.6	†
IBM total operational CO_2 emissions in metric tons	1,417,985	1,375,027	1,222,623	880,188	†

Note: Energy and emissions goals and reporting cover all activities taking place in IBM-owned or leased facilities (inclusive of Red Hat). These facilities include co-location data centers. Renewable electricity procurement includes contracted purchases and renewable electricity that automatically comes to IBM via routine grid power. CO_2 emissions reduction data is adjusted for acquisitions and divestitures.

†IBM will publish its 2021 energy and climate change data in June 2022, after we have completed an external limited assurance audit of our GHG emissions process and underlying data.

We have deployed IBM's Internet of Things (IoT) and analytics solution at 25 major IBM campuses covering 190 buildings and encompassing 41% of IBM's global energy consumption. During 2021, this program helped identify energy conservation opportunities that resulted in the avoidance of 3,400 MWh of energy and $356,000 in expense.

From 1990 through 2021, IBM conserved 9.9 million MWh of energy—equivalent to more than double IBM's current annual energy consumption—saving $670 million and avoiding 4.6 million MT of CO_2 emissions.

Data center energy efficiency

We take a holistic approach to managing and improving the energy efficiency of our data centers—from improving existing space to derive more workload per area; to modernizing our IT infrastructure and reducing its energy consumption; to building or leasing new, higher-efficiency space.

IBM calculates the power usage effectiveness (PUE)[1] at many of the data centers we manage and obtains PUE data from landlords of co-location data centers. For the limited number of data centers where we are unable to obtain PUE data, we use industry average data. Using this approach, we calculated our 2021 weighted average PUE to be 1.53.[2] This puts us on track to achieve our goal to improve the average cooling efficiency of our data centers by 20% by 2025 against a base year of 2019.

Following the spinoff of IBM's managed infrastructure services business in 2021, the majority of IBM's data centers reside in third-party managed locations. We have developed and negotiated lease terms that enable us to engage and collaborate with landlords to improve the efficiency of support infrastructure toward meeting our goal.

Use of renewable electricity

In 2020, 59.3% of the electricity consumed across IBM's global operations came from renewable sources. That total includes 43.3% directly contracted from IBM's power suppliers, in addition to the other 16% already in the electricity mix we received from the grid. We continued to increase our usage of renewable electricity in 2021, executing seven new renewable electricity contracts and expanding our supply of renewables in six existing contracts and leases across seven countries. IBM will publish its full 2021 progress in June 2022, when it releases its 2021 GHG emissions inventory.

When reporting our consumption of renewable electricity, we count only what is generated in the grid regions where our consumption actually occurs. We do not purchase unbundled renewable energy certificates representing energy we cannot consume, which would inflate our results. For more information about how IBM calculates its consumption of renewable electricity, please visit our website.

[1] Power usage effectiveness (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 energy efficient the data center and its cooling delivery are.

[2] Includes only those data centers that remained with IBM after the Kyndryl spinoff.

CO_2 emissions reduction

In 2020, IBM's operational CO_2 emissions decreased by 56.6% against base year 2005, adjusted for acquisitions and divestitures. IBM does not purchase nature-based carbon offsets to claim any reduction of IBM's emissions. IBM will publish its 2021 progress against its new GHG emissions reduction goal in June 2022, together with its 2021 GHG emissions inventory.

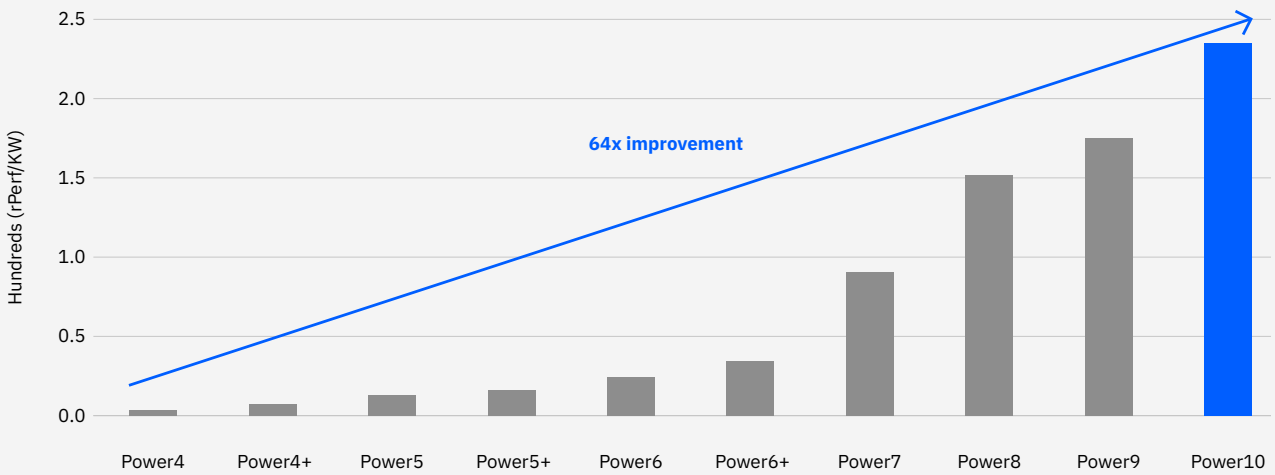
Product energy efficiency

IBM designs its products to be energy efficient, incorporate recycled content and environmentally preferable materials, and facilitate reuse and recycling at their end of life. For more than two decades, IBM has maintained a goal to improve the computing power delivered for each kilowatt-hour of electricity consumed for new server products as compared to equivalent, previous-generation products with a valid upgrade path. IBM's latest Power10-based server, the E1080, was released in 2021 and improved the work delivered per unit of power consumed (rPerf/kilowatt [KW]) by 34% over previous-generation IBM Power9-based servers.

IBM Power® has a 20-plus-year history of improved system performance per watt. Since the release of our first system with Power4 processors in 2001, to the release of our Power10 processor-based servers in 2021, the IBM Power family has improved its performance by a factor of 43. When performance is measured per unit of power consumed (rPerf/KW), the IBM Power processor-based servers show a 64x improvement.

IBM continues to certify products under the US EPA ENERGY STAR program. In 2021, IBM had five Power9-based server models subject to ENERGY STAR criteria, and four of them were certified (models S914, S922, S924, and E950). No IBM Power10 servers released in 2021 were subject to the ENERGY STAR criteria. IBM also had four storage products certified to ENERGY STAR in 2021.

IBM Power relative performance per kilowatt energy consumed (rPerf/KW) improvement



References:
IBM Power Performance Report Power7 to Power10
IBM Power Systems Performance Report Archive (Power8, Power7, Power6, and Power5)

Notes:
- Comparisons are made for Power processors generation to generation based on a possible server upgrade path from machine to machine.
- Values for Power4 through Power6+ are based on rPerf SMT2. For Power7, high-end rPerf values are based on SMT4. Power8 and Power9 rPerf SMT4 values are used.
- Power consumption values published are based on the IBM "Maximum Measured Power Consumption," which is the greatest overall power consumption based on the largest configuration and highest utilization. While the rPerf configurations are smaller and may not be operating at 100% utilization, for a fair comparison between models with a power consumption consistently published, the maximum measured power consumption is used.

Conservation and biodiversity

IBM has comprehensive programs and goals that help conserve natural resources and protect the biodiversity of our ecosystems.

Water conservation

Preserving water resources and safeguarding watersheds are important priorities. IBM's water conservation goal is to achieve year-to-year reductions in water withdrawals at larger IBM locations and data centers in water-stressed regions. In 2021, withdrawals at these locations decreased by 1.2% versus 2020.

IBM's primary use of water at locations subject to this goal is cooling and humidity control at offices and data centers (40% of total water withdrawals), irrigation (31% of total water withdrawals), and domestic water use in the workplace (29% of total water withdrawals). In 2021, water withdrawal reduction efforts consisted of installing automatic irrigation systems and decreasing overall landscape irrigation, upgrading cooling tower equipment and water storage tanks, and ongoing maintenance of water pipes. In addition, IBM reused or recycled over 26,500 cubic meters of water for landscape irrigation and to supplement makeup water used in cooling tower systems. Further, IBM is raising awareness of the importance of efficient use of water and conservation during new employee onboarding.

IBM also continues to look for opportunities to reduce water use at locations outside of water-stressed regions. In 2021, more than 40,000 cubic meters of water were saved through various conservation projects, including upgrades to reverse osmosis deionized water systems at IBM Research locations to allow for reuse of reject water.

Paper and paper/wood-based packaging

IBM has sustained a voluntary goal for the responsible sourcing of paper and paper/wood-based packaging since 2002, requiring that paper and paper/wood-based packaging directly procured by IBM come from suppliers that source from sustainably managed forests. Suppliers must either disclose their sources for paper and paper/wood-based packaging to IBM or provide evidence that their sources have been certified to be from sustainably managed forests by an accredited third-party certification program such as the Forest Stewardship Council, Programme for the Endorsement of Forest Certification, Sustainable Forestry Initiative, or the Canadian Standards Association Group Sustainable Forest Management System standard. In 2021, over 99% (based on spend) 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.

Biodiversity

IBM has been a member of the Wildlife Habitat Council (WHC) since 1991. Four IBM sites (IBM Corporate Headquarters, New York; IBM Research Triangle Park, North Carolina; and IBM Almaden Research Center and IBM Silicon Valley Laboratory, California) have maintained WHC Conservation Certification for their wildlife habitat management and conservation education programs for over 17 years. In 2021, we worked with the WHC to develop education materials on how to create pollinator-friendly habitats and provided them to IBM employees worldwide. We also set a goal to plant 50 pollinator gardens at IBM locations globally by year-end 2023. Planning and design are underway as we work toward this goal.

IBM considers climate-related risks in its enterprise risk management process. See page 15 for more information.

	2017	2018	2019	2020	2021
Water conservation					
% annual reduction in water withdrawals at data centers and other large IBM locations in water-stressed regions (goal year-over-year reduction)	2.9	0.4	2.0	6.7	1.2

Local EcoTeams—employees who volunteer to participate in a variety of local environmental initiatives—lead projects to support ecosystem diversity and protection. IBM's 28 EcoTeams, which span 70 IBM locations across 21 countries, completed approximately 180 activities in 2021: holding learning events; planting trees; maintaining pollinator gardens, bird boxes, and beehives; participating in beach cleanups; and more.

Pollution prevention and waste management

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

Nonhazardous waste

In 2021, IBM updated its nonhazardous waste goal to divert 90% or more (by weight) of IBM's total nonhazardous waste from landfill and incineration by 2025, through reuse, recycling, composting, and waste-to-energy processes, and to use waste-to-energy processes for no more than 10% (by weight) of the diverted waste. This goal builds upon IBM's prior waste management goals across several decades.

In 2021, our operations generated 20,700 MT of nonhazardous waste worldwide, including IBM-owned nonhazardous end-of-life machines, parts, and materials, which accounted for 48% by weight of IBM's total nonhazardous waste generated worldwide. We diverted 94.2% (by weight) of IBM's total nonhazardous waste from landfill and incineration. Only 9.7% (by weight) of the total nonhazardous waste diverted from landfill and incineration was sent to waste-to-energy processes.

These results were achieved through proper management of end-of-life IT materials by IBM's global network of equipment recovery centers that enhance IT product reuse and recycling; improved office, cafeteria, and yard waste collection infrastructure resulting in better waste separation; and the elimination of some nonessential, single-use plastic items and packaging from our cafeterias. In addition, IBM avoided the generation of 424 MT of waste and saved an estimated $200,000 in disposal costs through a newly launched Furniture Donation Program for employees and external organizations in 2021.

	2017	2018	2019	2020	2021
Nonhazardous waste landfill and incineration avoidance					
Total generated (metric tons × 1,000)	36.7†	34.0†	31.5†	22.1†	20.7
% by weight diverted from landfill or incineration (goal 90% by 2025)	87.7†	89.4†	87.3†	83.3†	94.2
% by weight of diverted waste sent to waste-to-energy processes (goal no more than 10%, established in 2021)	–	–	–	–	9.7

† Some batteries managed appropriately as hazardous waste were erroneously reported as nonhazardous waste during 2017–20. Although the change is extremely small, we have updated the results with the quantity of this hazardous waste removed.

Product reuse and recycling					
% by weight of total IT product waste sent by IBM's product end-of-life operations to landfill or incineration for treatment (goal not to exceed a combined 3% by weight)	0.7	0.7	0.8	0.5	0.3

Nonessential, single-use plastics in cafeterias

IBM set a goal in 2021 to further our efforts to eliminate nonessential, single-use plastic items (e.g., cups, straws, cutlery, plates, carry bags, and food containers) from IBM-managed cafeteria operations globally by 2025. Our focus in 2021 was to engage with our largest cafeteria vendor to identify single-use plastic items used in IBM-managed cafeterias at 37 locations spanning 17 countries. Alternatives for nonessential, single-use plastic items that are either reusable or compatible with each site's local recycling/composting infrastructure were identified and will begin to roll out in 2022.

Product packaging

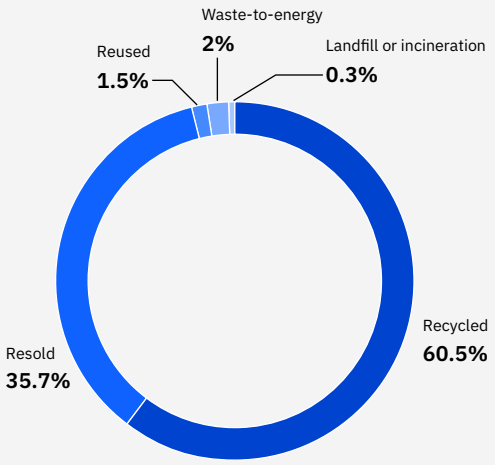
IBM set a goal in 2021 to eliminate nonessential plastic from the packaging of IBM logo hardware by year-end 2024. For essential plastic packaging, our goal is to ensure such packaging is designed to be 100% reusable, recyclable, or compostable, or incorporates 30% or more recycled content where technically feasible. We established a team of packaging engineering and logistics experts to execute the goal. The team completed an inventory of plastic packaging items and determined whether the items were essential. We have started to eliminate nonessential items and identify possible alternatives for the remaining items.

To date, 18 single-use plastic packaging elimination and material substitution projects have been identified and are at various stages of investigation and implementation. Two specific projects completed in 2021 were:

- The elimination of stretch wrap (low-density polyethylene) used to protect parts/machines from weather. The estimated annual material savings from implementation of this project is 1.9 MT, or 238,000 linear meters of stretch wrap.

- The qualification and implementation of high-recycled-content polyethylene cushions used for IBM z Systems,® Power, and storage products. These efforts have reduced the use of virgin packaging materials by 60%. The estimated annual material savings from implementation of this project is 90 MT.

2021 product end-of-life processing methods



Product reuse and recycling

For many decades, IBM has developed products with consideration for ease of their servicing and upgradability, and for the reuse, recyclability and recoverability of materials used in the products. We also have a long-standing goal to reuse or recycle end-of-life products such that the amount of product waste sent by our operations to landfills or for incineration does not exceed a combined 3% (by weight) of the total amount processed. In 2021, IBM processed more than 18,000 MT of end-of-life products and product waste, with 97.7% (by weight) reused, resold, or sent for recycling, 2.0% sent to waste-to-energy for final disposition, and 0.3% sent to landfills or for incineration. Since we began reporting on product disposal in 1995, IBM has processed 1.12 million MT (2.46 billion pounds) of products and product waste worldwide.

Supplier environmental goals

Since 2010, IBM has required all first-tier suppliers to establish their own social and environmental management systems as well as set quantifiable goals and publicly disclose progress toward those goals in the areas of energy management, GHG emissions reduction, and waste management. This is an important aspect of IBM's deployment of the RBA code with its suppliers of hardware, software, and services.

In 2021, IBM established three goals to help accelerate GHG emissions reductions in our supply chain and to encourage suppliers to take ownership and build their capabilities across a broad range of sustainability topics. These goals:

- Require key suppliers in emissions-intensive business sectors to set an emissions reduction goal by 2022, addressing their Scope 1 and Scope 2 GHG emissions, that is aligned with scientific recommendations from the UN IPCC to limit Earth's warming to 1.5 degrees Celsius above pre-industrial levels.
  + During 2021, we worked with logistics, airline, and hotel suppliers (representing 28% of suppliers covered by the scope of our goal) to collect information about their emissions reduction goals, and we have started an assessment to determine their alignment with the UN IPCC recommendations. In 2022, we will contact the remaining in-scope suppliers, complete an assessment of their targets, and work with any suppliers not yet meeting the goal to establish action plans.

- Establish, by year-end 2021, individual baselines for fleet carbon intensity with each key carrier and shipment supplier involved with IBM's product distribution globally. Starting in 2022, convene with each supplier to set a fleet carbon intensity reduction target covering the services they provide to IBM.
  + In 2021, we engaged our top five logistics suppliers and established a fleet carbon intensity baseline for their logistics operations. In 2022, we will continue to work with these suppliers to obtain more insights into the carbon intensity of their fleets and set carbon intensity reduction goals.

- Convene an annual Sustainability Leadership Symposium to recognize progress and achievement among suppliers in emissions-intensive business sectors across applicable areas of environmental stewardship.
  + Our first Supplier Sustainability Leadership Symposium is planned for the second half of 2022.

Remediation

At IBM, we take swift action to clean up any environmental contamination found at former and current sites, and we are committed to taking proactive measures to prevent future contamination. When groundwater contamination was first discovered at one of IBM's sites in 1977, we voluntarily initiated groundwater monitoring at our manufacturing and development locations worldwide. Today, IBM has more than 2,000 monitoring wells in place at its current and former locations.

In 2021, IBM operated remediation systems that removed approximately 10,200 pounds of solvents from groundwater and soil vapor at three currently operating IBM locations and 12 former IBM locations. IBM also has financial responsibility for remediation at one additional former location.

Under the US Superfund law, IBM is also involved in remediation activities at some third-party 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. Currently, IBM is participating in remediation activities or bears some financial responsibility at 19 Superfund sites.

Using technology and expertise to help clients and the world

IBM continues to apply technologies and expertise to help clients become more environmentally sustainable and accelerate solutions to address environmental challenges.

Using AI to help reduce landfill waste

As Italy's largest waste management and recycling company and a leading multi-utility, Hera is on the front lines working to reduce waste and minimize environmental impacts. Hera personnel manually analyze the waste unloaded at their plants and help direct recoverable materials for downstream sorting. It's an onerous job, and consider it at scale: 1,400 spotters across 89 plants treating 6.3 million tons of waste every year. Hera worked with IBM to explore how AI-powered automation could improve efficiency and help channel more material to new use. By engaging IBM Garage™ and incorporating IBM Watson® Studio and IBM Watson Machine Learning technology, Hera and IBM co-created and released a minimum viable product (MVP) in just eight weeks that captures video of trash at individual collection points and uses AI to recognize plastic waste that would qualify for recovery and reuse. The teams continue their work to train AI to find recoverable waste and scale their MVP. Learn more here.

Harnessing data and AI to operationalize insights

Companies increasingly recognize the expectations to demonstrate their progress toward sustainability in a quantifiable way. IBM has a growing portfolio of AI-enabled software to help companies assess the impacts of the environment on business and of business on the environment, including its recently acquired Envizi. Using Envizi with IBM's broader software portfolio, companies will now be able to automate the feedback generated between their environmental initiatives and the operational endpoints being used in daily business activities—a crucial step in making sustainability efforts more scalable. For example, Envizi will integrate with IBM Maximo® asset management solutions, IBM Sterling® supply chain solutions, and IBM Environmental Intelligence Suite, which helps companies increase resiliency by assessing and planning for the impact of environmental conditions on their operations. Learn more here.

Supporting renewable electricity market growth

The state of Maine is encouraging greater use of renewable resources. This has resulted in significant changes to the electric distribution business to connect distributed generation facilities with electric consumers. IBM helped Versant Power, one of Maine's largest utilities, define new business processes and upgrade its systems to support renewable electricity market growth. Since these modified systems were deployed in mid-2021, 11 new renewable generation facilities have been added to Maine's electricity supply and 17.4 megawatt (MW) capacity has been brought online. Another 342.7 MW are expected to be added within the next two years.

Accelerated discovery of more sustainable materials

IBM researchers are using AI, hybrid cloud, and quantum computing to find novel and more sustainable materials faster. In the field of materials discovery, identifying a new material may take 10 years of research and can cost $10 million to $100 million to develop. The AI-boosted Accelerated Discovery approach, developed at IBM Research, uses a combination of advanced computing technologies to enable researchers to rapidly design new materials with specific properties that can be used to develop more sustainable products, mitigate climate change, and more. Some recent successes of this approach:

Computer chips: Photoacid generators (PAGs) play a vital role in the manufacturing of computer chips, but they are one of several classes of chemical compounds used in semiconductor manufacturing that have recently come under enhanced scrutiny from global environmental regulators. IBM researchers were able to accelerate the process of designing and synthesizing new PAGs with improved environmental properties**.** Learn more here.

Carbon capture: Invisible and difficult to capture, CO_2 is a great challenge in tackling climate change. Capturing it at the point of origin is thought to be one of the most effective ways to limit its release into the environment. IBM researchers identified several hundred molecular structures that could enable more efficient and cheaper alternatives to existing separation membranes for capturing CO_2 emitted in industrial processes. Researchers are now evaluating these candidate molecules. Learn more here.