2025 Environmental Sustainability Report

Accelerating progress to 2030

Reporting on our 2024 fiscal year

Microsoft

In this report

This year, we reflect on our progress towards our ambitious 2030 goals: to be carbon negative, water positive, and zero waste, while protecting ecosystems. Since we announced our goals in 2020, we have made meaningful progress and we remain resolute in our commitment not only to meeting our climate goals but to empowering others with the technology they need to build a more sustainable future.

Reporting disclosure

A key principle of our work is transparency. This report, published annually, includes our strategy, progress against our goals, and key challenges and trends we see in this work. We also publish our environmental data, which is included in the separate Environmental Data Fact Sheet. Deloitte & Touche LLP performed a review relating to specified information within Section 1 of the Environmental Data Fact Sheet. Read about how we report in Appendix A.

Explore more

www.microsoft.com/corporate-responsibility/sustainability/progress

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Overview

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Foreword

Accelerating progress to 2030

Brad Smith
Vice Chair and President

Melanie Nakagawa
Chief Sustainability Officer

As Microsoft continues to grow and innovate, our commitment to environmental sustainability remains a core value. This year, we reflect on our progress towards our ambitious 2030 goals: to be carbon negative, water positive, and zero waste, while protecting ecosystems. As we enter the second half of the decade, Microsoft remains steadfast in our dedication to achieving the company's 2030 environmental sustainability commitments.

Since we announced our goals in 2020, we have made meaningful progress while seeing major changes in both the technology sector and in our understanding of what it will take to meet our goals. We are learning as we go, and we are proactively working to address sustainability challenges and accelerate solutions. We remain resolute in our commitment not only to meeting our climate goals but also to empowering others with the technology they need to build a more sustainable future.

> "Microsoft remains steadfast in our dedication to achieving the company's 2030 environmental sustainability commitments."

At the heart of our approach is an understanding that sustainability is not simply a set of isolated initiatives, but a fundamental principle that must be integrated into every aspect of our business. Our cross-company Climate Council brings together leaders from across Microsoft to drive innovation, accelerate progress, and identify ways to build sustainability into our operations, products, and partnerships.

We remain pragmatically optimistic because of the promise of new sustainability technologies, innovations in AI, and market solutions that are emerging which can accelerate progress across challenging sectors like steel, concrete, and energy transitions. This annual report is our opportunity to share our learnings to help accelerate these markets, be transparent about our progress, and explore how we can ultimately scale solutions across our value chain.

We are sharing details about the progress made in each of our core commitment areas: carbon negative, water positive, zero waste, and protecting ecosystems. Our report also highlights a number of our breakthrough innovations, drawing insights from the leading edge of climate innovation.

Our progress

In 2020, Microsoft made bold sustainability commitments. At this halfway point to our 2030 goals, we are reaching key milestones and making progress that includes:

- **Ecosystems.** In 2022, we met our target of protecting more land than we use by 2025, a target we've since exceeded by more than 30%. AI innovation is now driving biodiversity conservation through research efforts led by the AI for Good Lab and tools like the Microsoft Planetary Computer.
- **Zero waste.** We exceeded our annual target to divert 75% of construction and demolition waste six years early by diverting 85% of this waste in FY24. We have also surpassed our target for our reuse and recycling rate for servers and components, reaching 90.9%. The Surface Copilot+ PCs now feature our most sustainable packaging design yet. Packaging from over 30,000 server racks was processed through recycling programs in FY24—diverting over 2,500 metric tons of waste from landfills.
- **Water positive.** We met our target to provide more than 1.5 million people with clean water and sanitation solutions. We are also on track to replenish more water than we consume across global operations and improve datacenter water use efficiency, including through a new innovative datacenter design that optimizes AI workloads and consumes zero water for cooling to avoid the use of an estimated 125,000 cubic meters annually per facility.
- **Carbon negative.** To date, we have contracted 34 gigawatts (GW) of carbon-free electricity (CFE) across 24 countries, about an eighteenfold increase since 2020. We have also entered long-term agreements to procure nearly 30 million metric tons of carbon removal since the start of this program.

Carbon negative: a marathon, not a sprint

As we remain focused on sustained progress towards our 2030 goals, it has become clear that our journey towards being carbon negative is a marathon, not a sprint. While our total emissions (Scope 1, 2, and 3) have increased by 23.4% compared to our 2020 baseline due to growth-related factors such as AI and cloud expansion, we are encouraged by the fact that this increase has been modest compared to the 168% increase in energy use and 71% revenue growth that has taken place over the same period.

For Microsoft to be carbon negative by 2030, we will need to reduce our value chain emissions. Starting with our direct operational emissions, as we shared earlier this year, since 2012 our carbon strategy has included a combination of procuring environmental attributes leveraging our corporate carbon fee and overall carbon emissions reduction efforts. This enabled us to decrease our Scope 1 and 2 emissions by 29.9% from our 2020 baseline in FY24. At the same time, as we shift away from procuring non-additional environmental attribute certificates, we recognize that we must also bring more carbon-free electricity onto the grids where we operate.

We are also implementing strategies to reduce our Scope 3 emissions by 2030, which increased in FY24 by 26% from our 2020 baseline. We are prioritizing addressing these emissions through supplier engagement programs including establishing standards via our Supplier Code of Conduct. Through the latter, select large-scale Microsoft suppliers are required to transition to 100% carbon-free electricity for their delivered goods and services as well as forthcoming guidance, launching in July, to target usage of sustainable aviation fuel, where possible, for Microsoft business-related air travel by 2030. We also remain committed to developing and supporting innovative solutions to reduce emissions from key datacenter and operational inputs including building materials, chips, and fuels, focusing on long-term solutions over short-term stopgaps. To do this, we have been adapting our strategies to use new sustainability technologies and address the challenges of expanding energy demand.

We see significant progress in several key areas, demonstrating potential for global impact:

Powering operations with carbon-free electricity (CFE): In 2024, Microsoft contracted 19 GW of new renewable energy across 16 countries through power purchase agreements (PPAs) which are central to our carbon reduction strategy, driving down our Scope 2 emissions. Microsoft has taken a first-mover approach to making long-term investments to bring more CFE online.

We continue to advocate for expanding clean energy solutions globally to support not only our power needs but also those of our supply chain. We are addressing challenges with permitting, interconnection delays, and fluctuating interest rates by innovating through circularity and contracting. For example, we signed groundbreaking PPAs with Engie requiring that 100% of photovoltaic modules will be reused or recycled.

Transforming datacenters and campuses: In FY24, we launched our first datacenters constructed with mass timber, a strong, ultra-lightweight wood in a hybrid construction model. This approach is projected to reduce the embodied carbon footprint of these new datacenters by up to 65% compared to typical precast concrete. We also doubled our rate of power savings and are transitioning from traditional air-cooled datacenters to chip-level liquid cooling designs at all owned datacenters. As the World Economic Forum highlighted in Innovation and Adaptation in the Climate Crisis, "Data-driven and digital technologies are uniquely suited to build adaptive capacity."[1]

We believe technology can be a powerful tool to address some of society's toughest challenges, including environmental sustainability. As demand for AI and cloud services grows, we are advancing how we design, build, and operate our datacenters and campuses. Decarbonizing the built environment is a crucial element in this process.

Accelerating carbon removal initiatives: In FY24, Microsoft signed long-term agreements to procure more carbon removal than all previous years combined, achieving nearly 22 million metric tons in contracts for carbon removal. We are committed to helping build the markets we buy from, translating leading science into commercial innovation and regularly updating our Criteria for High-Quality Carbon Dioxide Removal. We also know we cannot accelerate this market alone, which is why we co-founded the Symbiosis Coalition with industry partners. The Symbiosis Coalition is targeting up to 20 million metric tons of high-quality, nature-based carbon removal credits by 2030.

Improving operational efficiency and logistics: In FY24, among facilities that manufacture devices for Microsoft, we saw a tenfold increase over the previous year in transitions to 100% CFE. This was accomplished, in part, by partnering with 3Degrees to launch the Supplier REach portal to support suppliers making their CFE transition. Our drive to reduce datacenter emissions extends to transforming the logistics operations of these facilities.

Through strategic partnerships and targeted initiatives, Microsoft continues to reduce emissions across transportation, warehousing, and the broader logistics supply chain, setting new benchmarks for operational efficiency and environmental impact. We adopted alternative fuels and electric vehicles to reduce emissions, collaborating with several leading logistics service providers (LSPs).

Foreword continued

Renewable diesel is now in use in our road freight operations in Europe and California, cutting emissions by 50% for these shipments while keeping existing equipment in use. We also have partnered with airlines and shipping lines to expand the use of sustainable aviation and marine fuels. These efforts have reduced emissions by over 17,000 metric tons of CO_2 emissions, comparable to avoiding the combustion of nearly 40,000 barrels of oil.[2]

Accelerating global solutions

At Microsoft, we understand that driving meaningful sustainability progress goes beyond our own practices and requires global collaboration, investment, and innovation. Across our operations, we are working to empower customers, build impactful partnerships, and invest in breakthrough solutions that drive progress worldwide.

- **Investing in innovation:** A hallmark of this effort has been our Climate Innovation Fund (CIF)—our $1 billion commitment set in 2020 to advance innovation beyond Microsoft's four walls. To date, CIF has made significant investments in innovative climate technologies including commercial direct air capture technologies, sustainable aviation fuel, industrial decarbonization, and more. CIF has invested over $793 million in capital in new climate technologies, expanding to 63 investments across CFE, sustainable fuels, carbon removal, and advanced building materials.
- **Empowering customers:** We help customers and organizations centralize, analyze, and act on their data with AI-powered platforms for advanced analytics and reporting insights. For example, the Howden Resilience Laboratory supported by Microsoft and our Planetary Computer uses technology and data platforms to help investors understand climate risks to critical infrastructure, improve resilience, and contribute to better-informed investment decisions.
- **Partnering for impact:** Partnering to scale our impact is a critical component of our sustainability efforts. Today GitHub fosters a thriving community that is home to over 150 million developers and 60,000 climate-focused open-source projects, advancing climate technology, greener software, and device sustainability. Xbox has made significant investments not only to reduce the environmental footprint associated with the production of our devices, accessories, and console packaging, but also to reduce the energy usage of the console itself. For example, Xbox became the first console to release a dedicated energy consumption and carbon emissions measurement tool designed for game creators.

> "We are building an efficient, sustainable engine that drives us closer to our commitments."

- **Accelerating AI for sustainability:** Our AI for Good Lab, sustainability science, and research teams collaborate globally to accelerate solutions and develop climate resilience with AI. For example, we have partnered with the United Nations to apply AI to climate challenges through programs like the Early Warning for All initiative, which seeks to better understand which populations may be at risk of extreme weather events and other threats. By sharing our progress, tools, and learnings with the world, we aim to accelerate the pace of innovation, improve overall operational efficiency, reduce energy consumption, and find new solutions with long-term results.

Sustained momentum and future impact

There is no issue today that connects everyone on the planet more than climate change. As we strive to build a more sustainable future, we remain inspired by the dedication of our employees and partners and committed to transparency, accountability, and collaboration.

While the road to a sustainable future is challenging and not linear, we are encouraged by the progress we have made in FY24. By strategically focusing on CFE, carbon removal, water stewardship, waste reduction, and ecosystem protection, we are building an efficient, sustainable engine that drives us closer to our commitments.

We encourage you to read further to learn more about our progress and learnings across all of these areas, and we look forward to engaging in continued dialogue as we learn and develop new ways to help us meet our goals. We will continue to adapt our strategies, utilize emerging sustainability markets, and scale innovative technologies for even greater impact.

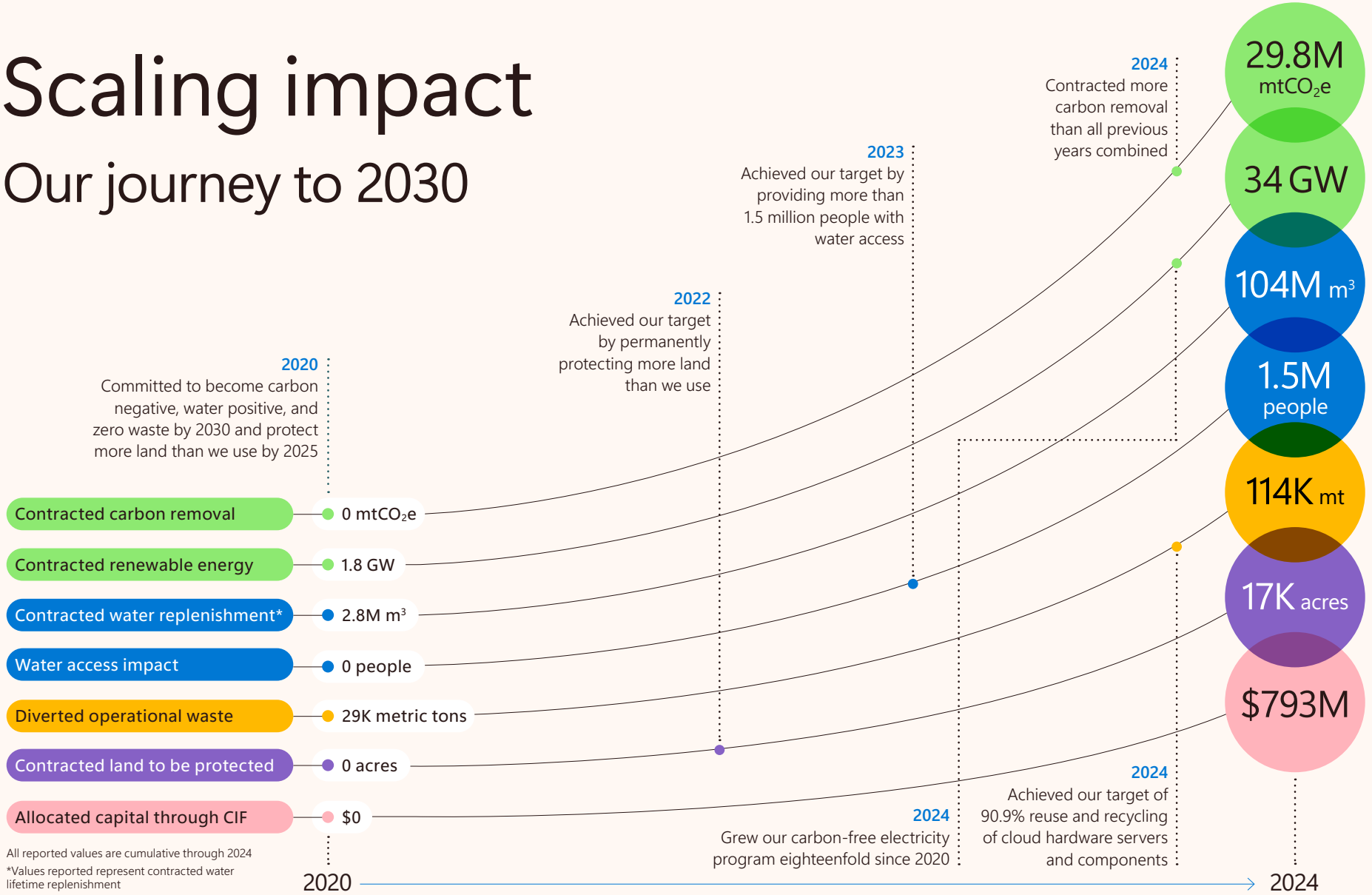
We recognize that achieving our ambitious goals requires sustained momentum, and we are dedicated to driving that momentum forward.

Brad Smith
Vice Chair and President

Melanie Nakagawa
Chief Sustainability Officer

Scaling impact

Our journey to 2030



All reported values are cumulative through 2024

*Values reported represent contracted water lifetime replenishment

How are we progressing to 2030?

- Advancing more energy-efficient datacenter design technologies.
- Optimizing power efficiency and expanding carbon-free electricity.
- Collaborating to scale sustainable practices and decarbonize key sectors.
- Launching datacenters that minimize water, energy, and environmental impacts.
- Improving water use efficiency across our global operations.
- Supporting water-positive solutions and innovative technologies.
- Advocating for effective water policy and sustainable water management.
- Reducing the amount of materials we use.
- Replacing materials with more sustainable alternatives.
- Scaling circularity for our products, packaging, and devices.
- Applying AI and data platforms to accelerate ecosystem protection.
- Partnering to support biodiversity and habitat protection.
- Continuing to integrate biodiversity in how we plan, build, and operate.

How we work

Our sustainability journey starts with getting our own house in order. In 2020, we set ambitious targets to be a carbon-negative, water-positive, zero-waste company that protects ecosystems by 2030. We are committed to sharing our progress, challenges, and learnings through our annual Environmental Sustainability Report to help accelerate global progress.

We recognize that our actions alone will not solve the climate crisis. As a global technology provider, we also believe we have a role to play in supporting the thousands of customers and partners who look to Microsoft to provide the innovation and solutions to help them on their own sustainability journey. We think about Microsoft's role in sustainability across three pillars: Microsoft sustainability, customer sustainability, and global sustainability.

Microsoft sustainability

Taking care of our own environmental footprint

Our sustainability work starts with taking account of our operational footprint. This means reducing and even eliminating emissions related to our operational footprint across our campuses, datacenters, devices, software, and value chain. We conduct life cycle assessments across our operations, assets, and products, from design to building, usage, and end of life. We are committed to sharing our learnings, accelerating markets, scaling solutions across our value chain, and being transparent about our progress.

Global sustainability

Catalyzing global impact

Microsoft's actions alone cannot solve the climate crisis. As a global technology leader, we are also committed to helping develop the market conditions and standards and launch solutions that will support a net zero economy. We're focused on accelerating the availability of new climate technologies, strengthening our climate policy agenda, helping to develop a more reliable and interoperable carbon accounting system, advocating for skilling programs to expand the green workforce, and working to help enable a just energy transition.

Customer sustainability

Accelerating progress through technology

Microsoft is committed to providing innovative technology to help build a more sustainable world. We're working to empower our customers and partners across industries with Microsoft for Sustainability, by continuously innovating AI solutions that help accelerate climate technologies. We're also advancing greener software and reducing carbon intensity to improve device sustainability, and helping organizations to measure and manage the health of the planet's natural ecosystems with the Microsoft Planetary Computer.

Microsoft sustainability

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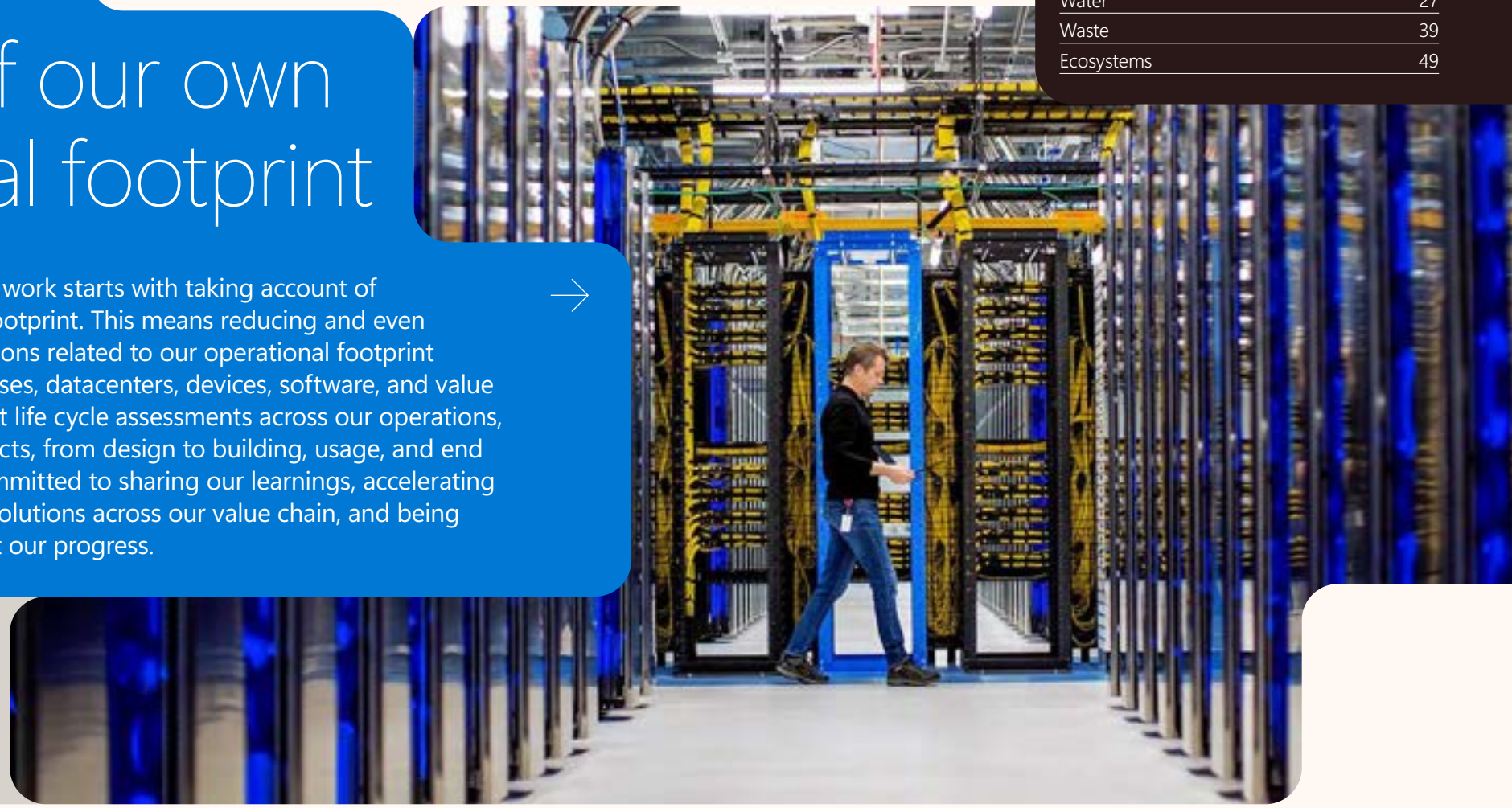

In this section

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Getting to carbon negative

We are working to build markets, scale solutions, and improve access to sustainability solutions to support our Microsoft sustainability journey and others working to achieve their own carbon goals.

As we reach the halfway point in our journey to becoming carbon negative, we reflect on the progress made, as well as the opportunities and challenges that lie ahead. This journey requires a comprehensive and collaborative approach, addressing all necessary components simultaneously and laying a foundation that enables future scale and impact.

Our approach

In our 2024 Sustainability Report, we highlighted the establishment of the Microsoft Climate Council, an internal leadership body with representatives from nearly every business organization at Microsoft. This council works to track and accelerate progress, review new reduction measures, and help the company achieve our environmental sustainability commitments.

This unique structure drives progress on our carbon reduction roadmap across all business groups. As part of the roadmap process, each business group assesses its emissions forecasts to 2030. From there, existing and new reduction interventions are evaluated to drive down emissions against Microsoft's 2020 baseline, emission reduction projections are revised, and lessons learned are shared with the Council, highlighting where further investments and interventions are needed.

This annual process drives accountability and progress throughout the company amid exciting new innovations and continued business growth. As part of this cross-company effort, we have unlocked new opportunities to reduce emissions which help us progress closer to our 2030 commitments.

Through this process, we identified three critical focus areas as we look to 2030:

1. **Efficiency:** Many of the products and technologies, such as AI, which can accelerate climate solutions also pose a resource challenge. We are continuously improving our processes and identifying solutions to do more with less—reducing carbon emissions and resource use while ensuring our infrastructure aligns with business growth.
2. **Availability:** Many of the products and technologies required to reduce emissions, such as carbon-free electricity, are not currently available in sufficient quantities or in all necessary locations. We are working to build markets, scale solutions, and improve access to sustainability solutions to support our Microsoft sustainability journey and others working to achieve their own carbon commitments.
3. **Measurement and adoption:** For the low-carbon products available today, we must ensure our teams have the systems and processes needed to integrate sustainability solutions into our design, construction, and operations. We also need systems that provide accurate measurement and insights, allowing us to demonstrate progress in our emissions reporting.

These focus areas are central to our strategy today. At Microsoft, we are continuously reassessing and adjusting our strategy to drive the highest impact toward our 2030 commitments and beyond.

Our approach continued

Our targets and progress

Carbon negative

By 2030, Microsoft will cut its emissions by more than half compared to 2020 and remove more carbon than it emits. By 2050, we will remove the same amount of carbon we have emitted operationally since our founding in 1975.

Target

Reducing direct and indirect emissions

We will reduce our Scope 1 and 2 emissions to near zero against a 2020 baseline by increasing energy efficiency, decarbonization of our operations, and reaching 100% renewable energy by 2025.

Reducing value chain emissions

By 2030, we will reduce our Scope 3 emissions by more than half from a 2020 baseline.

Expanding carbon-free electricity

By 2030, 100% of our electricity consumption will be matched by zero carbon electricity purchases 100% of the time.

Removing the rest of our emissions

By 2030, Microsoft will remove more carbon than it emits. By 2050, we will remove an amount of carbon equivalent to all our historical operational emissions.

Progress — In progress — Achieved

Scope 1 and 2 emissions

Our Scope 1 and 2 emissions decreased by 30% from the 2020 base year. This result is driven by our ongoing work to advance clean energy procurement, green tariff programs, and use of unbundled renewable energy certificates.

Scope 3 emissions

Our value chain or Scope 3 emissions increased by 26% from our 2020 baseline. Microsoft continues to work to scale carbon-free electricity markets across our supply chain and invest to decarbonize need-to abate sectors, including steel, concrete, and other building materials used in our datacenters, as well as fuels.

Expanding carbon-free electricity with renewable and nuclear energy

In 2024, we contracted an additional 19 GW of new renewable energy across 16 countries, further diversifying our energy portfolio. Microsoft also expanded into nuclear energy with the signing of our first large-scale nuclear energy PPA with the Crane Clean Energy Center in September 2024. This agreement will enable the restart of an 835-MW nuclear facility in Pennsylvania, retired in 2019, providing a significant supply of new, reliable, CFE to the PJM power grid—a critical energy region for Microsoft's datacenters.

Contracted carbon removal

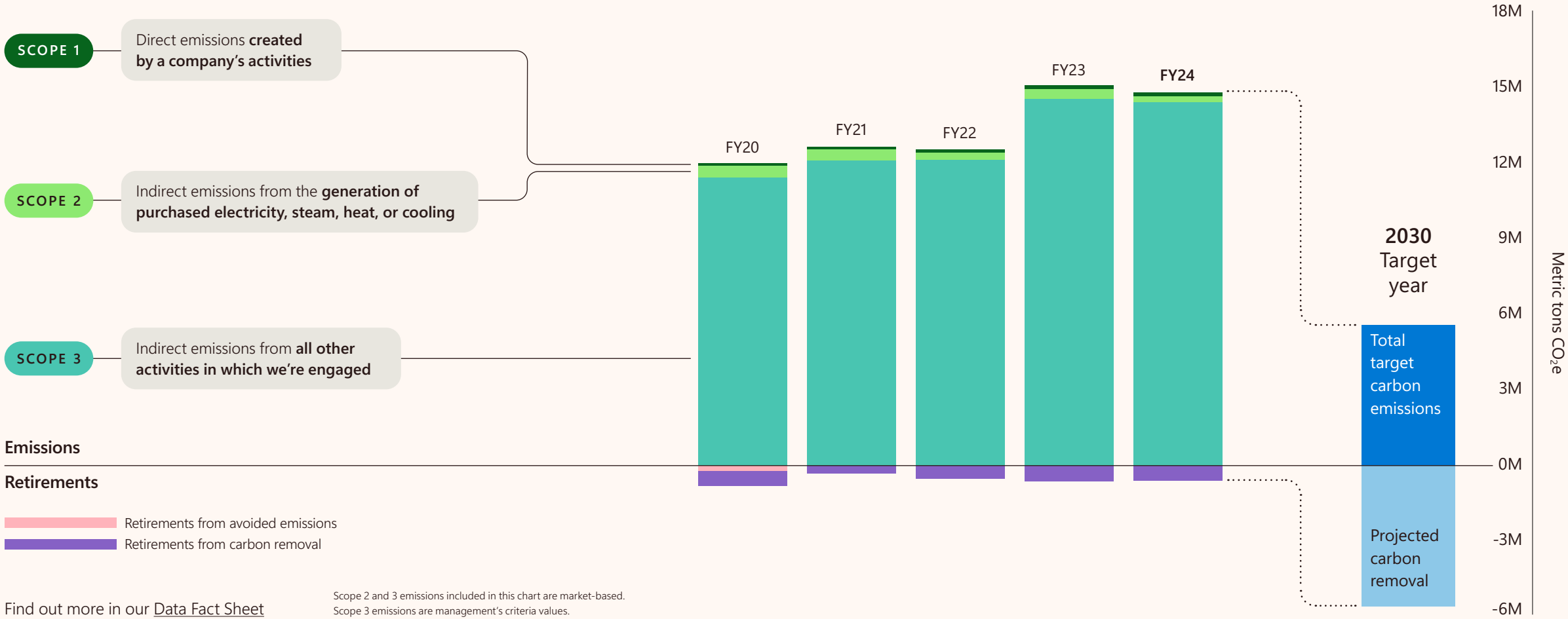
In FY24, we contracted an additional 2.8 million metric tons of carbon removal expected to be delivered toward FY30.[3] In addition, we contracted 17.4 million metric tons that we expect to apply toward carbon negative goals after 2030 and/or our 2050 goal.

Our approach continued

Carbon Table 1

Tracking progress toward carbon negative by 2030

Microsoft's overall emissions increased by 23.4% in FY24, in relation to our base year.
Additionally, we retired 595,922 metric tons of carbon removal as part of achieving our FY24 target to be carbon neutral.



Find out more in our Data Fact Sheet

Scope 2 and 3 emissions included in this chart are market-based.
Scope 3 emissions are management's criteria values.

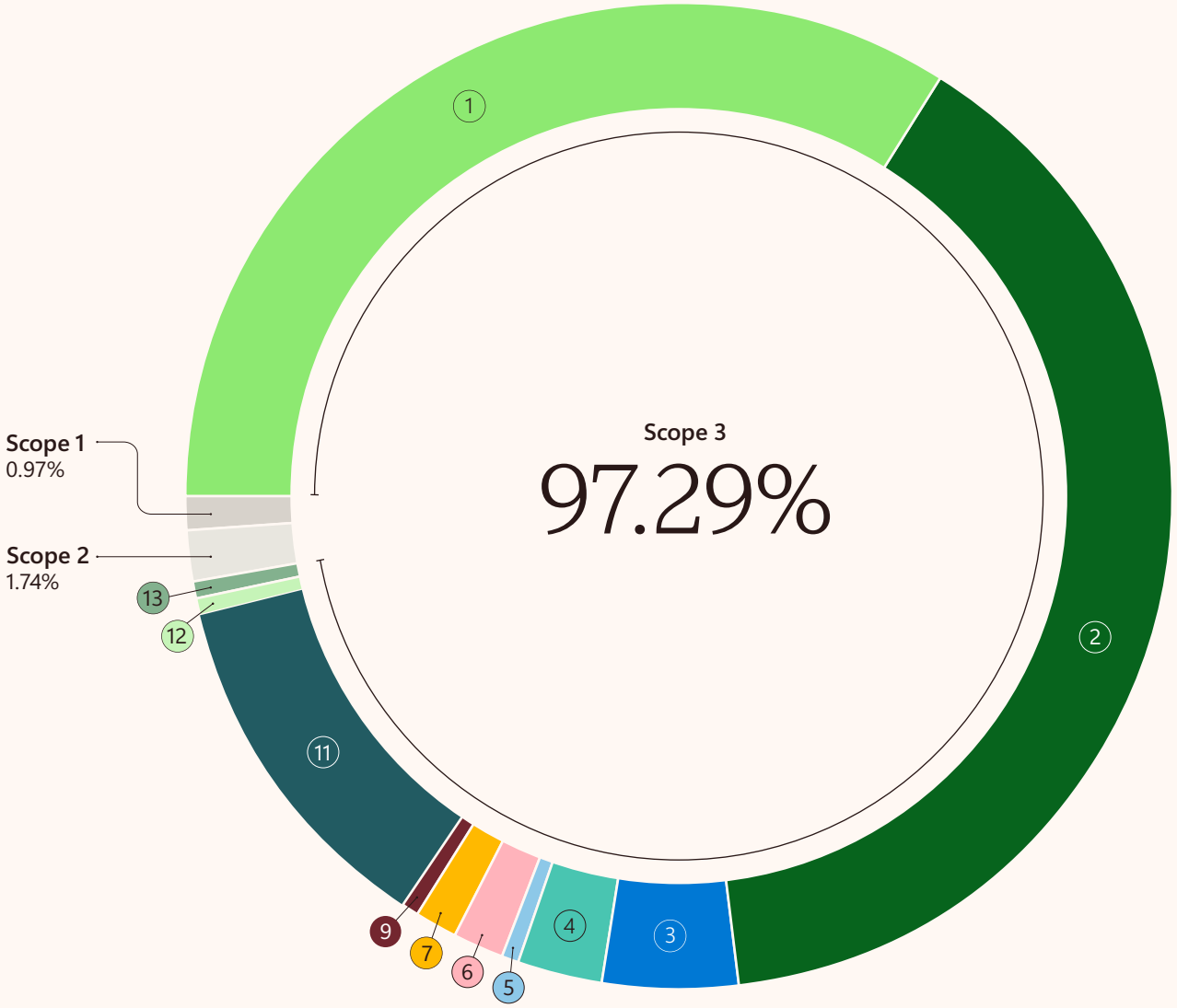
Our approach continued

Carbon Table 2

Breaking down our FY24 Scope 3 emissions by source

Microsoft's Scope 3 emissions continue to account for more than 97% of our total emissions. Tackling Scope 3 means decarbonizing industrial processes such as steel, concrete, and other building material production for use in our campus and datacenter construction, as well as jet fuel for business travel and logistics, with the vast majority of these emissions coming from two categories upstream, Purchased Goods and Services (Category 1) and Capital Goods (Category 2), and one downstream, Use of Sold Products (Category 11).

Scope 3 Categories	
1 Purchased Goods and Services	34.04%
2 Capital Goods	40.83%
3 Fuel- and Energy-Related Activities (Market-Based)	4.40%
4 Upstream Transportation and Distribution	2.69%
5 Waste Generated in Operations	0.05%
6 Business Travel	1.70%
7 Employee Commuting	1.40%
9 Downstream Transportation and Distribution	0.29%
11 Use of Sold Products	11.83%
12 End-of-Life Treatment of Sold Products	0.02%
13 Downstream Leased Assets	0.04%



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Scope 3 emissions are management's criteria values.

Efficiency: Transforming datacenters and campuses

At Microsoft, we believe technology can be a powerful tool to address some of societies' toughest challenges, including environmental sustainability. And we have already begun to see how the application of AI can be used to help accelerate climate progress, from new material discovery to ecosystem measurement and monitoring at scale. As demand for AI and cloud services grows, we are advancing how we design, build, and operate our datacenters and campuses. By further optimizing systems and adopting innovative solutions, we are working to reduce the carbon intensity of our operations while supporting continued infrastructure growth and technology adoption.

Datacenters

Datacenters make AI and cloud computing possible. Addressing the resource intensity of our datacenters is critical in this new era of AI.

At Microsoft, we are redefining datacenter construction and operations to meet the challenge. By integrating advanced building materials, renewable energy solutions, and innovative technologies such as power optimization, thermal efficiency, and waste heat recovery, we are setting a new benchmark for a more sustainable and resilient datacenter infrastructure.

Decarbonizing the built environment

At Microsoft, we are advancing the use of low-carbon building materials[4] at our datacenters. As a sector, building materials such as steel and cement are currently some of the highest contributors globally to the carbon cost of new construction, together producing an estimated 13.5% of global carbon emissions.[5]

In 2024, we launched our first mass timber datacenters, using strong, ultra-lightweight wood in a hybrid construction model that incorporates cross-laminated timber (CLT), steel, and concrete. This approach is projected to reduce the embodied carbon footprint of these new datacenters by 35% compared to conventional steel construction, and by 65% compared to typical precast concrete, by drastically reducing the reliance on traditional carbon-intensive materials.

To further accelerate decarbonization in our datacenter operations, Microsoft is dedicated to pursuing LEED Gold certification on all new datacenters. This certification requires advanced energy-saving technologies and practices to lower energy consumption and associated carbon emissions.

In addition to these efforts, we are:

- **Advancing low-carbon materials** with investments in companies like Stegra, which is pioneering near-zero-carbon steel products that can be used in multiple applications, including datacenter supply chains. Stegra is building the world's first commercial scale near-zero-carbon steel plant with up to 95% reduced carbon emissions compared to conventional steel.
- **Reducing Scope 3 emissions in hot aisle containment (HAC) units**. Novel materials like polyethylene terephthalate (PET) film and fiber-reinforced plastic (FRP) are being tested to reduce the weight and volume of HAC panels and replace steel in support structures, cutting material mass by up to 75%, thereby reducing embodied carbon.

Efficiency continued

Collaborating for industry-wide impact

Since launching our sustainability commitments, we have embedded low-carbon materials and equipment requirements into supplier contracts, while also collaborating with industry leaders to scale sustainable construction practices.

As a member of the Infrastructure Masons (iMasons) and the iMasons Accord (ICA)—a nonprofit professional association dedicated to reducing carbon in digital infrastructure materials, products, and power, Microsoft is working alongside AWS, Google, Meta, and over 200 leading digital infrastructure providers, product companies, and investment firms to address climate change.

Decarbonizing datacenter operations

Optimizing power efficiency in datacenters

At Microsoft, we are continually refining our approach to energy efficiency across our datacenter operations, working to ensure that energy is used as effectively as possible without compromising performance or reliability. One key initiative, power harvesting, maximizes the use of our available power by reallocating unused power from workloads that do not consume their full power allocation. Despite increased demands from AI workloads over the past year, Microsoft has doubled our rate of power savings, scaling this approach across our datacenters.

In parallel, Microsoft is reducing server energy consumption through methods like low-power server states, which lowers energy usage on unallocated servers by up to 35%. This initiative has rapidly expanded from deployment on a few thousand servers in 2022 to nearly 2 million by the end of 2024. Additionally, in a similar initiative, servers awaiting maintenance are placed in power-saving modes, reducing energy usage by hundreds of megawatt-hours monthly. Microsoft is also increasing server utilization by selectively oversubscribing CPU cores for internal workloads with low utilization. This targeted approach has reduced datacenter hardware needs for the Microsoft Azure platform by approximately 1.5% since 2020—representing a threefold improvement compared to reductions achieved by 2022—while also cutting embodied carbon.

-35%

Microsoft is reducing server energy consumption through methods like low power server states, which lowers energy usage on unallocated servers by up to 35%.

INNOVATION IN ACTION

Datacenter innovation

Advancing cooling technologies

The GPU server hardware that supports AI in datacenters can be heat intensive. New, more resource-efficient cooling technologies are needed to address this challenge and help keep infrastructure in use longer. Microsoft is transitioning from traditional air-cooled datacenters to chip-level liquid cooling designs at all owned datacenters. This cutting-edge technology supports significantly greater rack capacity, reducing the need for new datacenter construction—and the related embodied carbon emissions—while eliminating the need for evaporation to align with Microsoft's water positive 2030 commitment.

One of the key innovations that makes these advancements possible is the use of our life cycle assessment (LCA) tool to evaluate the environmental impacts of cooling and server infrastructure technologies.

By comparing carbon emissions and water consumption across various technologies, LCA enables informed decision-making to optimize sustainable technology choices for each location.

At the Open Compute Project (OCP) Global Summit in October 2024, Microsoft presented a detailed comparison of greenhouse gas emissions, water usage, and energy demand of advanced cooling technologies in datacenters. By making these insights and tools available in open-source venues like OCP, Microsoft is enabling LCA-informed decision-making across the cloud industry and advancing more collaborative sustainability efforts.

Efficiency continued

Transitioning to renewable diesel

Backup generators play a critical role in providing power to our datacenters during outages and grid instability. While rarely used, these generators are essential to maintaining uninterrupted service for customers, but the carbon footprint of traditional diesel generators underscores the importance of transitioning to alternative fuels. Microsoft is transitioning its datacenter generators to use alternative fuels including renewable diesel, which offers significantly lower life cycle emissions compared to conventional diesel. This transition includes:

- **Equipment modifications and local permitting**. Making progress towards full conversion, many sites have already completed the retrofitting process to transition to renewable diesel, with special attention given to generators in cold climates, ensuring they have adequate heaters to mitigate cold temperature impacts to renewable fuel.
- **Sustainable fuel standards**. We work closely with suppliers to responsibly procure hydrogenated vegetable oil and other renewable diesel variations, reinforcing our commitment to reducing emissions from fuel.

Partnering with suppliers to reduce operational emissions

Microsoft's goal to reduce emissions extends beyond our internal operations, and we continue to partner with suppliers to reduce emissions across our supply chain. The Microsoft Supplier Engagement Program uses in-depth analysis to identify the most impactful carbon reduction opportunities across Scope 1, 2, and 3 emissions.

In 2024, Microsoft introduced a new target in the Microsoft Supplier Code of Conduct requiring suppliers to transition to 100% carbon-free electricity (CFE)[6] for goods and services delivered to Microsoft by 2030. This milestone has inspired several suppliers to adopt even more ambitious targets, such as procuring 100% renewable energy under RE100 standards and implementing Scope 3 programs modeled on the Microsoft Cloud Supply Chain. These efforts help to ensure sustainability is embedded throughout the supply chain. In support of these targets for our suppliers, Microsoft is working in countries with a significant supply chain footprint to identify and solve for specific policy, technology, and finance barriers to carbon-free electricity access, prioritizing impact by 2030.

Improving operational efficiency and logistics

Our drive to reduce datacenter emissions extends to transforming the logistics operations of these facilities. Through strategic partnerships and targeted initiatives, Microsoft is reducing emissions across transportation, warehousing, and the broader logistics supply chain, setting new benchmarks for operational efficiency and environmental impact.

One key achievement is the completion of the North American SuperHub, developed in partnership with our logistics service provider DB Schenker. This LEED Platinum-certified warehouse, the fourth in North America, serves as a model for sustainable supply chain infrastructure. With features like rooftop solar, advanced heating and cooling systems, and ecosystem-conscious stormwater management, the SuperHub demonstrates how physical infrastructure can align with environmental sustainability commitments.

In transportation, Microsoft has adopted alternative fuels and electric vehicles to reduce emissions, collaborating with several leading logistics service providers (LSPs). Renewable diesel is now in use in Microsoft's road freight operations in Europe and California, cutting emissions by 50% for these shipments while keeping existing equipment in use.

Microsoft is also advancing aviation decarbonization by integrating sustainable aviation fuel (SAF) into shipments of cloud hardware through multiyear agreements designed to reduce air freight emissions and scale the adoption of SAF. By prioritizing credible, long-term partnerships, Microsoft is driving innovation in sustainable logistics and helping to accelerate the global energy transition. Through our LSPs, we've partnered with airlines and shipping lines to expand the use of SAF and sustainable marine fuels, a switch that reduces emissions by over 17,000 metric tons of carbon dioxide equivalents ($mtCO_2e$) compared to conventional transportation fuels—equivalent to avoiding the combustion of nearly 40,000 barrels of oil.[2]

100%

In 2024, Microsoft introduced a new target in the Microsoft Supplier Code of Conduct requiring suppliers to transition to 100% carbon-free electricity (CFE) for goods and services delivered to Microsoft by 2030.

Efficiency continued

At the same time, the deployment of electric vehicle (EV) trucking in the United States, Asia, and Europe is enabling more sustainable logistics operations. We are expanding the use of these EVs within our supply chain, serving both longer routes and datacenter deliveries. This transition brings significant benefits to the local communities where we operate by eliminating tailpipe emissions affecting local air quality.

Beyond vehicle innovation, Microsoft's logistics teams have achieved significant reductions in shipment carbon intensity through network optimization, mode shifting to lower-carbon transportation, and consolidation. These efforts have reduced the relative carbon intensity across the cloud logistics supply chain by 73% since 2022. For these achievements, our cloud logistics team earned the Coupa Inspire Award for Purpose and Impact and the SEAL Award for Sustainability, reinforcing Microsoft's leadership in sustainable logistics.

Through these combined efforts, Microsoft is building a supply chain operation to support datacenter operations while advancing progress to meet our commitments, proving that environmental responsibility and logistical efficiency can —and do—go hand in hand.

Campuses

We are deeply invested in enhancing the sustainability of our campuses. We've implemented more sustainable construction practices, such as reducing our carbon footprint and using local materials within the East Campus Modernization Project. Both at our Microsoft and LinkedIn campuses, we are dedicated to reducing our environmental impact and promoting sustainable practices among our employees.

INNOVATION IN ACTION

East Campus Modernization Project

Harnessing geothermal energy

In 2024, we opened the first seven buildings from the East Campus Modernization Project at our Puget Sound headquarters, all of which achieved LEED Platinum certification—a designation earned by less than 1% of buildings globally. These buildings are supported by Microsoft's Thermal Energy Center, a groundbreaking facility using geothermal energy to provide carbon-free heating and cooling. The East Campus Modernization Project serves as a proving ground for sustainable construction, facility design, and operations practices, significantly reducing operational and embodied carbon, while also minimizing water consumption.

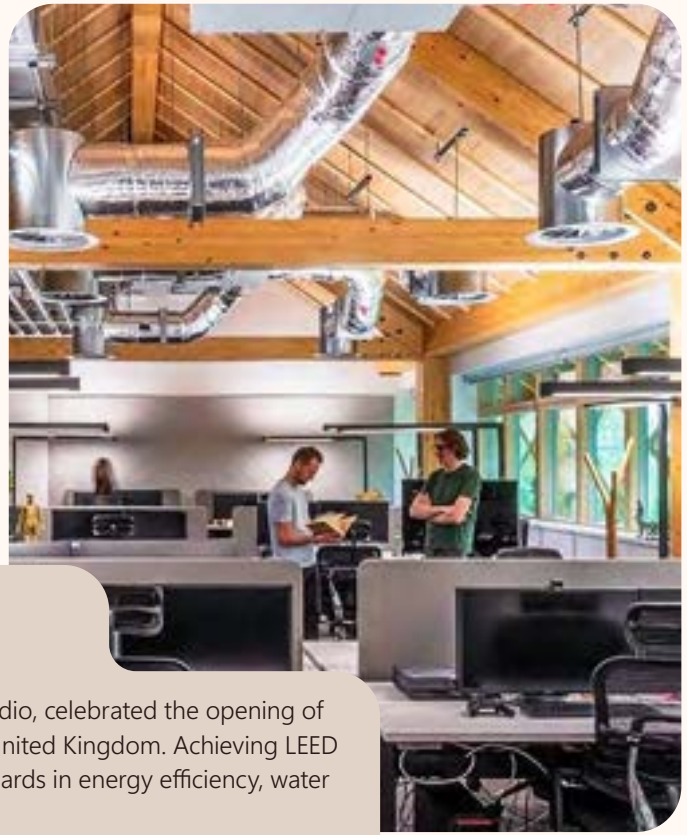
Transforming how we work

During East Campus Modernization Project construction, Microsoft prioritized vessel, rail, and truck transportation over air freight, while incorporating more locally sourced materials to help reduce the environmental impact associated with transporting goods. In addition, renewable diesel and electric construction equipment were piloted and have been incorporated into our Global Sustainability Standards as examples of opportunities to reduce emissions during construction.

Across our global portfolio, we continue to implement energy efficiency measures. Our North American campuses optimized lighting, adjusted operational setpoints, and incorporated energy solutions like heat pumps to reduce energy consumption. Facilities in Bogotá and Medellín, Colombia; Quito, Ecuador; and Montevideo, Uruguay optimized their heating, ventilation and air conditioning (HVAC) systems, cutting year-over-year energy consumption for these systems by 20%. In Europe and the Middle East, lighting upgrades further reduced electricity usage.
To guide future improvements, we are conducting comprehensive facility audits across our portfolio, prioritizing locations with the highest energy use, to discover areas where we can further enhance energy efficiency.

Efficiency continued

INNOVATION IN ACTION



BarnX

LEED Gold Certified

In 2024, Rare, a Microsoft-owned game studio, celebrated the opening of BarnX at its Twycross headquarters in the United Kingdom. Achieving LEED Gold certification, BarnX reflects high standards in energy efficiency, water conservation, and environmental design.

BarnX incorporates innovative sustainability features, including a rainwater harvesting system, solar panels, and advanced HVAC technology, which significantly reduce carbon emissions and energy consumption. Locally sourced, sustainable building materials were prioritized throughout the construction process, further reducing embodied carbon and environmental impact. The design also enhances local biodiversity with native wildflower meadows and pollinator-friendly gardens.

Driving change with electrification projects

Inspired by the success of our first 100% electric food hall in Puget Sound, which opened in 2022, Microsoft has expanded kitchen electrification around the world. In 2024, new all-electric food halls opened in Puget Sound and kitchen electrification efforts began in India.

We also achieved new milestones for fleet electrification in 2024. Our sites in Shanghai and Suzhou, China; Dublin, Ireland; and Paris, France have fully electrified fleets, while Microsoft India launched its first phase of electric vehicle adoption. In the United States, over 15% of the Puget Sound fleet is electric, supporting commuting and facility operations. Fleet right-sizing efforts are further optimizing resources to better match demand. As the EV industry evolves, Microsoft is adopting emerging technologies, ensuring that efficiency, safety, and sustainability remain a central focus for operations.

LinkedIn

LinkedIn is integrating sustainability into every step of real estate decision-making, from selecting new properties to renewing leases. By aligning strategies to help us to achieve a more than 50% Scope 3 reduction by 2030, we're ensuring effective planning and progress toward our environmental sustainability commitments.

- At our LinkedIn South Bay campus in California, the transportation team launched an onsite bike maintenance and repair program, reducing waste from new products and encouraging sustainable commuting among employees.
- In support of the Climate Council process, LinkedIn created a comprehensive carbon reduction roadmap, aligning cross-functional teams to advance toward our carbon negative commitment. This roadmap has become a foundational tool for accelerating project timelines, improving decision-making, and tracking progress across departments.

Availability: Scaling access to tools for decarbonization

As we plan for 2030, we are working to ensure that the materials, technologies, and solutions required for decarbonization are available at the scale and locations needed—not just for Microsoft, but also for our partners, suppliers, customers, and the world.

Advancing renewable energy markets

At Microsoft, we believe we have a responsibility to support the communities and grids where we build and operate our datacenters. Microsoft has taken a first-mover approach to making long-term investments to bring more carbon-free electricity online. Power purchase agreements (PPAs) are central to this strategy, and we continue to advocate for expanding clean energy solutions globally to support not only our power needs but also those of our supply chain.

Advancing energy markets

Since 2020, the renewable energy sector has transformed significantly. However, challenges with permitting, interconnection delays, and fluctuating interest rates have added complexity to scaling these technologies. These dynamics have reshaped strategies across the industry as we work toward grid decarbonization by 2030 and beyond.

Microsoft has taken bold steps to address these challenges and expand access to carbon-free electricity. Our carbon-free electricity program has grown eighteenfold since 2020, with contracted renewables increasing from 1.8 gigawatts (GW) to over 34 GW across 24 countries. This growth reflects our leadership in advancing clean energy markets and has us on track to achieve our 2025 target of procuring enough renewable energy to cover 100% of our energy consumption.

PROGRESS TOWARDS TARGETS

Renewable energy

Expanding global procurement and deployment

In 2024, we contracted an additional 19 GW of new renewable energy across 16 countries, further diversifying our energy portfolio. Notable market expansions include:

- **Brookfield Renewable Energy Framework**—a framework to deliver more than 10.5 GW in the United States and Europe over the next five years.
- **Wisconsin PPA with National Grid Renewables**—a 250-megawatt (MW) agreement to support this growing datacenter region, including a $15 million community benefit fund for environmental resilience initiatives.

Microsoft also brought 45 carbon-free electricity projects online across 15 different countries through PPAs, including our first operational projects in Canada, Chile, France, Germany, Japan, and Poland. Key projects include:

- **Silux Solar Facility, Germany**—a 415-MW solar project built on a former coal mine, the largest solar facility in Europe at the time.
- **Drumlins Park, Ireland**—a 48.8-MW wind project, the first to achieve commercial operations under a strategic framework agreement signed with Energia Group.
- **Kotun Solar Project, Poland**—a 36-MW facility advancing one of Europe's most carbon-intensive grids.

Availability continued

Advancing carbon-free electricity with nuclear energy

Microsoft also expanded into nuclear energy with the signing of our first large-scale nuclear energy PPA with Constellation for the Crane Clean Energy Center in September 2024. This agreement will enable the restart of an 835-MW nuclear facility in Pennsylvania, retired in 2019, providing a significant supply of new, reliable, CFE to the PJM power grid—a critical energy region for Microsoft's datacenters.

The project will also generate substantial community and economic benefits, including an estimated 3,400 direct and indirect jobs and $3 billion in state and federal taxes. This agreement underscores Microsoft's dedication to investing in diverse, high-impact solutions to accelerate decarbonization.

Innovating through circularity and contracting

Microsoft is also leading efforts to integrate circular economy principles into renewable energy projects. In 2024, we signed four groundbreaking PPAs with Engie requiring that 100% of photovoltaic modules—from construction through end of life—will be reused or recycled.

Innovative contracting structures also continue to advance decarbonization. In January 2024, we announced a partnership with Qcells to supply Microsoft projects with up to 12 GW of solar modules and engineering, procurement, and construction services over an eight-year period. This agreement bolsters large-scale, sustainable US solar manufacturing and supports a resilient clean energy economy.

Collaborating for industry transformation

Beyond procurement, Microsoft is collaborating with industry leaders to address barriers to scaling carbon-free electricity technologies. In March 2024, we announced an advanced clean energy buyers' consortium with Google and Nucor to aggregate demand and accelerate deployment of first-of-a-kind technologies. This consortium aims to unify customer voices to policymakers and regulators, and collaborate with key stakeholders on enabling business models, with project deals expected in early 2025.

Advancing community vitality with energy procurement

Microsoft is supporting community development in energy procurement. The rapid growth of AI and its supporting infrastructure has created an unprecedented opportunity to foster problem-solving and shared responsibility in growing datacenter markets while driving meaningful community impact and supporting local prosperity and well-being.

In 2024, we announced our Datacenter Community Pledge, reinforcing our role as a responsible corporate citizen and ensuring that local communities experience meaningful benefits from clean energy projects including significant economic, social, and environmental benefits.

Key examples from the past year include:

- **Pivot Energy agreement**—a five-year framework agreement to develop a 500-MW portfolio of community-scale solar energy projects, enabling approximately 150 projects in 100 US communities between 2025 and 2029. As Microsoft's first large-scale distributed generation portfolio, this agreement uses an innovative contracting structure to prioritize benefits for low-income and rural communities, including workforce development, energy burden relief, and advancing community investment funds. It also supports Microsoft's target of reducing Scope 3 emissions by more than 50% by 2030.
- **ReNew agreement in India**—a 437-MW hybrid wind and solar project in Maharashtra that includes a community benefit fund managed by the ReNew Foundation. This fund supports initiatives focused on women's economic empowerment, energy access, water quality improvements, and rural electrification for communities disproportionately affected by climate change and pollution.

Scaling carbon removal

So far on our journey, carbon reduction and removal have all played an important role on our path to net zero.

Microsoft's commitment to carbon removal began in 2020 when we shifted our avoided carbon emissions credit procurement to focus exclusively on removing carbon dioxide from the atmosphere. Since then, we have significantly scaled our efforts, learning from early purchases of one-year carbon removal offtakes from existing projects. In 2022, we signed our first long-term agreement, purchasing 10,000 tons from Climeworks' first direct air capture (DAC) facilities in Iceland over 10 years. This required adapting the PPA contract model, working through the intricacies of how to structure agreements to account for carbon registries, reversals, and more.

In 2023, we expanded on this model of advance procurement, signing our first contracts for millions of tons of carbon removal, with developers that were able to design and structure much larger projects. In 2024, we built on this progress by advancing commercial offtake structures, refining methodologies, and expanding a platform that enables further progress and supports industry growth. These efforts included Mombak, a Brazilian reforestation company, unlocking new natural capital-oriented financial tools in the form of a $225 million outcome bond issued by the World Bank to help reforest the Brazilian Amazon.

Availability continued

In FY24, Microsoft entered long-term agreements to procure more carbon removal than all previous years combined—22 million metric tons. That's the equivalent of taking 4 million cars off the road for a year.[7] Our diversified portfolio spans multiple pathways, including: afforestation, reforestation, and revegetation (ARR); bioenergy with carbon capture and storage (BECCS); and DAC. Eight of the projects signed last year will start delivering over 100,000 metric tons annually by 2030, supporting our carbon negative milestone year.

Building first-of-a-kind technology and planting millions of trees each present common and distinct challenges, and we seek to drive development of projects that can come online quickly to deliver at scale. Key examples include:

- **Stockholm Exergi (BECCS)**—a 10-year agreement to purchase over 3 million metric tons of carbon removal from the planned BECCS facility in Vartan, Sweden. Using sustainably sourced forest biomass, Stockholm Exergi captures carbon dioxide from flue gas and stores it for thousands of years under strict measurement, monitoring, reporting, and verification (MMRV) standards.
- **re.green (ARR)**—a 15-year agreement supporting the planting of over 10 million seedlings across 16,000 hectares in Brazil, encouraging natural regeneration across the Atlantic and Amazon Forests. Microsoft will purchase 3 million metric tons of carbon removal, with all restoration activities using native species and building on the foundational work of previous scientific studies in the region.

Strengthening carbon removal markets

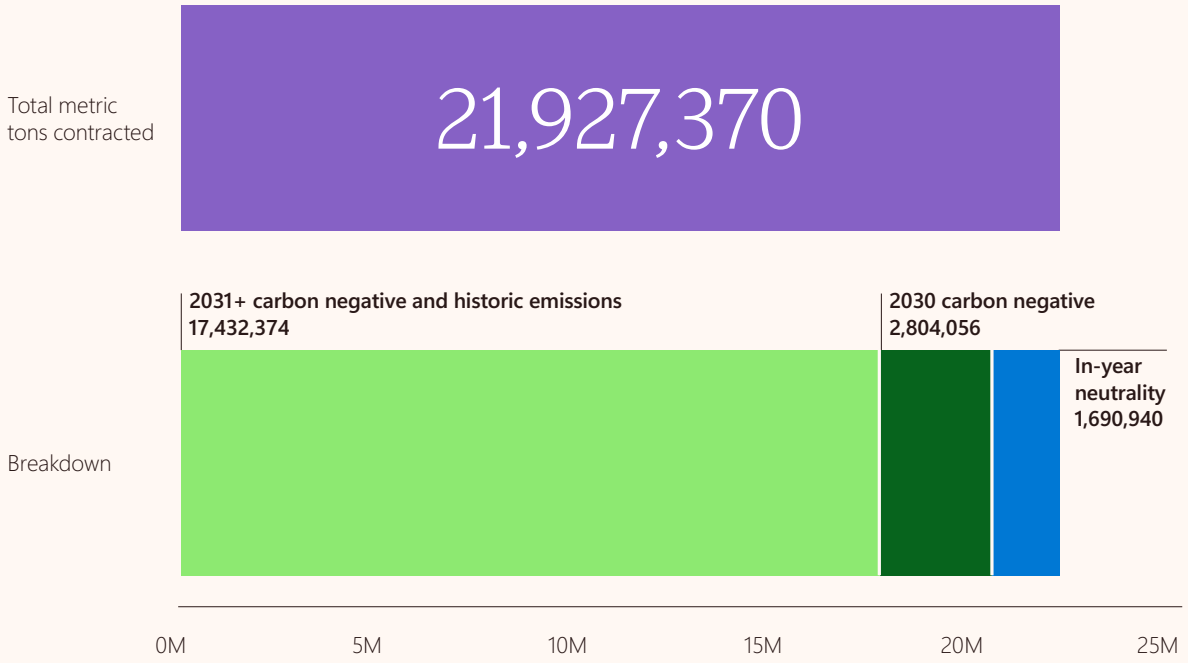
Microsoft is committed to building the markets we buy from, translating leading science into commercial innovation and regularly updating our Criteria for High-Quality Carbon Dioxide Removal. In FY24, thousands of hours of third-party due diligence for our portfolio further informed which project design and operational characteristics are high integrity.

In Panama, Microsoft collaborated with Ponterra to structure an innovative offtake agreement that aligns buyers, developers, and financiers early in the project life cycle. By ensuring clear investment pathways from the outset, this agreement created confidence among stakeholders and accelerated the development of impactful carbon removal projects.

Carbon Table 3

Tracking progress toward carbon negative by 2030

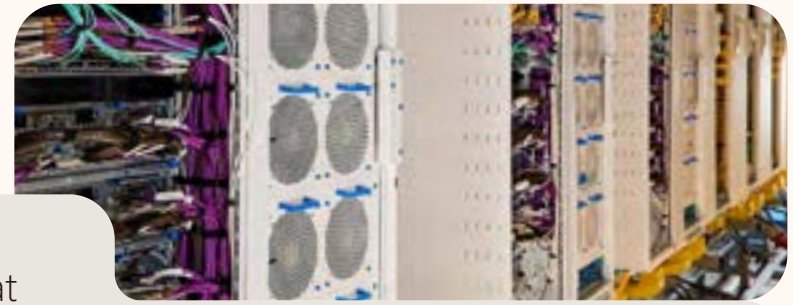
In FY24, we contracted nearly 22 million metric tons of carbon removals to be delivered at various points over the next 15+ years. This includes 2.8 million metric tons that we expect to be delivered in our FY30 goal year for carbon negativity and many more tons toward carbon negativity for FY31 and beyond.



Find out more in our Data Fact Sheet

Availability continued

INNOVATION IN ACTION



Innovation in carbon removal

Harnessing waste heat

Microsoft's datacenter operations present a unique opportunity to integrate direct air capture (DAC) technology into our infrastructure, using existing resources to support carbon removal. Waste heat recovery has emerged as a pivotal innovation in this effort, accelerating progress by utilizing excess heat generated by computing workloads.

Traditional waste heat reuse requires a physically close heat consumer and could have economic, seasonal, and geographic constraints. Building on insights shared at the OCP Global Summit, Microsoft showcased how excess heat from datacenters can be repurposed to power DAC systems. This approach has shown promise in not only enhancing the efficiency of DAC solutions but also offsetting the carbon footprint of AI workloads.

The Microsoft DACinDC program integrates DAC technology directly into datacenter infrastructure, utilizing waste heat generated by computing workloads, and uses AI models to develop optimized materials which can improve performance and system efficiency. In 2024, the program advanced customized solutions to the prototype stage while exploring additional opportunities to reuse waste heat, airflow, and water from datacenters. Our investments in internal research, partnerships with leading companies, and collaborations with research institutions have been crucial in assessing the feasibility and scalability of this technology.

While waste heat recovery holds significant promise, its effectiveness depends on having the right infrastructure, such as a district heating system capable of utilizing this energy. With such systems, 70% to 85% of energy reuse could be achieved. This journey towards commercialization and scaling markets for DAC technology in datacenters is a testament to our pledge to sustainability and innovation.

In May 2024, Microsoft co-founded the Symbiosis Coalition—a collaboration with Google, Meta, and Salesforce—establishing an advance market agreement to contract for 20 million metric tons of high-integrity nature-based carbon removal credits by 2030. With this agreement and an open request for proposals launched in December 2024, Symbiosis is sending a strong demand signal to project developers, encouraging the production and financing of high-quality removals while creating a platform to increase the speed and scale of climate impact.

Quality is the foundation of Microsoft's carbon removal efforts. We perform extensive due diligence to ensure that our projects demonstrate additionality, measurability, and permanence, and promote resilient and healthy communities. Our diligence seeks to ensure local communities have meaningful participation throughout project life cycles, and that projects advance effective community engagement plans that prioritize responsible sourcing practices.

Innovating for greater impact

We view our carbon removal program as a living laboratory, designed to inspire action and demonstrate what's possible. By advancing new technologies and engaging the broader carbon removal ecosystem, we aim to create opportunities for buyers, investors, and developers, while making sustainability progress at Microsoft and beyond.

While prioritizing projects ready to scale by 2030, we are investing in emerging technologies to accelerate learning and technology development. In 2024, we supported carbon dioxide removal pathways such as enhanced rock weathering (ERW), soil organic carbon, carbon dioxide mineralization, and biochar, constructing tailored portfolios within promising pathways to advance scientific discovery and evaluate scalability.

Our contracts with ERW companies—Eion, Lithos, and Undo—are deploying groundbreaking science to explore ERW's potential as a major contributor to high-durability carbon removal. These efforts highlight the importance of collaboration across suppliers, financiers, and other stakeholders to align investment and accelerate development of scalable solutions.

Measurement and adoption: Supporting accurate data and industry-wide change

Accurate measurement and the adoption of best practices are critical to achieving our carbon negative commitment and driving progress across industries. By implementing advanced methodologies like life cycle assessments (LCAs), improving supplier collaboration, and supporting the adoption of sustainable solutions, Microsoft is creating systems that enable insight-driven action. These efforts help us to quantify progress, identify areas for improvement, and empower suppliers and partners to make meaningful contributions to a collective future.

Measurement: Evolving data systems for greater impact

Data is at the heart of Microsoft's cloud logistics decarbonization strategy. In 2024, Microsoft was recognized as a Gartner Power of the Profession™ finalist for using data to identify emissions reduction opportunities from logistics.

Our data systems help to:

- Evaluate impacts of business decisions to balance cost, carbon, and cycle time.
- Identify opportunities for process or network improvements across the supply chain.
- Differentiate suppliers based on emissions performance.

AI in action: Streamlining assessments

Microsoft is using AI-powered tools like Makersite to transform LCAs, reducing the time and effort required while significantly improving the accuracy and representativeness of results. By automating the analysis of bills of material (BOMs) and material compositions along with manufacturing processes, Makersite enables Microsoft to quickly and effectively model its supply chain to inform data-driven decisions and track carbon reductions.

For example, Surface and Xbox devices now benefit from faster, automated modeling of the manufacturing phase supply chain, with Makersite reducing the LCA modeling process by more than 80% per device. This efficiency allows sustainability teams to spend less time on manual data processing and more time on ecodesign and circularity.

In Azure hardware, Makersite supported our successful transition from spend-based to activity based carbon accounting in 2024—a critical milestone in precisely measuring Scope 3 emissions. By automating the analysis of BOMs across the global datacenter fleet, Makersite provides detailed cradle-to-gate insights for material extraction, manufacturing, and assembly. These insights empower engineering teams to make more informed decisions to support Microsoft's efforts to align with its 2030 carbon negative commitment.

Measurement and adoption continued

INNOVATION IN ACTION

Advancing LCA methodologies

Improving data collection for better decision-making

In FY24, Microsoft's Devices team launched a fully automated data collection process to facilitate seamless sustainability data exchanges with suppliers. We are also advancing our data assurance processes through independent third-party external audits, including the use of onsite audits. In 2025, we are exploring opportunities to standardize supplier sustainability surveys and data collection across the industry to ease the reporting obligations on suppliers.

We've incorporated both the CFE data from our suppliers and the semiconductor manufacturing data from IMEC into customized Microsoft supplier-specific information.

By integrating this primary data into product environmental LCAs, Microsoft has increased the representativeness of assessments, with 70% of the carbon footprint for devices informed by primary data—a significant improvement over the typical 20% of primary data use in LCAs for laptops and tablets. These insights are driving actionable opportunities to reduce carbon in our supply chain. For example, supplier data has enabled Microsoft to better quantify and track the environmental impacts of individual hardware components, identify carbon hotspots, and prioritize reduction strategies across our global operations.

Advancing LCA tools

Microsoft continues to enhance its LCA tools to quantify environmental impacts across datacenter, device, and cloud infrastructure operations. Beyond datacenter insights, such as assessing carbon emissions versus water trade-offs in cooling technologies, LCAs facilitate informed decision-making and help redistribute costs to prioritize regions most adversely affected. By applying these principles to devices and Azure hardware, and sharing tools through open-source platforms like the Open Compute Project, Microsoft aims to drive industry-wide adoption of LCA-informed practices that scale sustainable innovation.

Microsoft participates in the Interuniversity Microelectronics Centre (IMEC) Sustainable Semiconductor Technologies and Systems program, which assesses and works to reduce the environmental impacts of semiconductor manufacturing. Through customized life cycle inventories for over 400 chip configurations, we can track chip generations, forecast emissions, and differentiate environmental impacts across device and Azure hardware configurations with greater precision. However, LCAs can be time-consuming and labor-intensive, requiring detailed analysis of complex supply chains and product components. To address this, Microsoft is using AI to accelerate and enhance the LCA process, improving accuracy while significantly reducing the time required.

Embedding measurement to decarbonize the built environment

Accurate measurement is essential for advancing low-carbon construction and reducing embodied carbon. By integrating tools like environmental product declarations (EPDs) and Building Transparency's Embodied Carbon in Construction Calculator (EC3), Microsoft enables trade partners to quantify impacts, track progress, and make data-driven decisions. These efforts create a scalable model for low-carbon construction, setting a new standard for sustainability across the industry.

EPDs are essential for reducing embodied carbon because they provide detailed, standardized data on the environmental impacts of materials throughout their life cycle. This transparency helps project teams to compare materials and prioritize low-carbon alternatives. However, many trade partners are unfamiliar with EPDs, unsure of how to gather necessary information from suppliers and manufacturers, or hesitant to adopt low-carbon materials due to perceived risks.

To address these barriers, Microsoft has invested in educating contractors and suppliers through training and webinars. These sessions demystify EPDs, demonstrating their role in identifying low-carbon materials and integrating them into construction projects. By fostering confidence in EPD adoption, Microsoft is empowering partners to align with shared decarbonization goals and embed measurement into decision-making processes.

Measurement and adoption continued

EC3 builds on the insights provided by EPDs, serving as a cornerstone of Microsoft's building material carbon measurement practices by enabling precise, product-level accounting of materials' embodied carbon impacts. By using EC3, contractors can evaluate materials using detailed carbon data, moving beyond traditional broad estimates to make more informed, data-driven decisions.

Microsoft's process begins with early engagement of contractors, ideally during the request for proposal stage. By involving contractors in material sourcing, procurement, and fabrication, Microsoft uses their expertise to identify low-carbon materials and optimize project design. EC3 enhances this process by enabling precise material comparisons, transforming embodied carbon accounting from broad, spend-based estimates into actionable data. In 2024, Microsoft utilized a version of the Impact Accounting Methodology to refine carbon accounting in two datacenter construction projects. These pilots demonstrated measurable reductions in embodied carbon, increased supplier awareness of EPDs, and enabled greater integration of low-carbon materials into construction workflows.

HVAC systems represent a significant percentage of a datacenter's embodied carbon footprint, but embodied carbon information about these systems is often unavailable. However, Microsoft continues to work with a dedicated team that collaborates with actors throughout our supply chain to ensure that more equipment EPDs become available.

This effort will enable not just Microsoft but our entire industry to make better-informed whole-life carbon decisions when selecting these critical systems.

PROGRESS TOWARDS TARGETS

Strengthening engagement

Measuring impact across our supplier network

At Microsoft, 97% of our emissions are in the Scope 3 category, with the majority originating in our supply chain. To accelerate decarbonization, we strengthened supplier engagement by requiring suppliers to transition to 100% carbon-free electricity by 2030 under the Supplier Code of Conduct. Updated electricity estimates within our supply chain now enable more targeted policy engagement in key operational regions.

To further support supplier decarbonization efforts, Microsoft Indirect Procurement teams have enhanced data collection and processing through the ESG Value Chain Solution within Microsoft Sustainability Manager. Initially focused on emissions disclosure, their use of the platform has evolved into a central hub for sustainability engagement, offering resources such as webinar recordings and program content to suppliers. AI-powered innovations have streamlined processes, including:

- **Automated survey processing**—supplier assurance letters are reviewed, values are extracted directly into disclosures, and compliance determination is automated with detailed feedback provided in a new Actions tab, resulting in a 94% reduction in time for our team to process supplier survey submissions, from 35 minutes per survey to two minutes per survey.
- **Streamlined support desk**—supplier support tickets are integrated into Microsoft Dynamics, where Copilot drafts responses for human agents based on program knowledge articles, improving customer satisfaction and response times.

Adoption

Microsoft is driving the adoption of best practices by setting ambitious standards for suppliers, providing tools that support implementation, and fostering industry-wide collaboration. By aligning supplier goals with our own, piloting innovative materials, and enhancing access to resources like CFE and SAF, we aim to create a ripple effect that extends well beyond our operations. These efforts are critical for scaling decarbonization across our value chain, supporting meaningful progress toward our 2030 commitments.

Elevating supplier standards to accelerate decarbonization

Since 2022, Microsoft's Devices Supplier Decarbonization program has built policies, procedures, data systems, and educational tools to align suppliers with our sustainability commitments. Over the past three years, this program has evolved to address the growing urgency of decarbonization, amplified by the introduction of the new Supplier Code of Conduct requirement to transition to 100% CFE by 2030.

Measurement and adoption continued

Progress has been significant. As of FY24, 89 devices manufacturing facilities transitioned to 100% CFE for Microsoft production, marking a more than tenfold increase over the previous year. These efforts expanded CFE use and avoided nearly 232,000 $mtCO_2e$ in emissions.

Many suppliers have gone beyond meeting minimum requirements, with several committing to the RE100 standard, ensuring the use of high-quality renewable energy resources. This effort underscores the importance of maintaining credible, impactful renewable energy standards across the supply chain.

Microsoft's approach has also inspired several suppliers to adopt similar sustainability practices. Many have modeled their Scope 3 emissions programs after Microsoft's Cloud Supply Chain efforts, demonstrating how collaborative partnerships can create ripple effects across industries. These changes not only amplify the impact of Microsoft's program but also contribute to an industry-wide shift toward decarbonization.

As the program continues to expand, Microsoft is focused on codifying best practices into supplier requirements while providing tools like the Supplier REach Portal to make decarbonization solutions more accessible. These efforts are accelerating the global transition to CFE and strengthening the resilience of Microsoft's supply chain.

Enhancing access through tools and partnerships

Recognizing that access to CFE and decarbonization solutions varies by region, Microsoft has launched several initiatives to support suppliers in overcoming these challenges.

Key initiatives include:

- **Supplier REach portal**—launched in 2023, we partnered with global climate solutions expert 3Degrees to develop a portal that provides suppliers with streamlined access and a guided experience to procure CFE, helping them align with Microsoft's environmental sustainability commitments.
- **SAF purchasing pilot**—in 2024, Microsoft partnered with Chooose to make SAF more accessible to our suppliers. Aviation-related emissions from business travel are a significant contributor to supplier carbon footprints. This partnership enables Microsoft suppliers to act on these emissions by supporting smaller-scale SAF purchases.

Recognizing progress and aligning expectations

As we reach the midpoint of our journey to 2030, we are celebrating the progress made with our suppliers while setting clear expectations for the path ahead. In October 2024, Microsoft hosted a supplier summit, bringing together suppliers across our supply chain.

The summit focused on advancing sustainability across the supply base, aligning suppliers with decarbonization goals, and sharing best practices for achieving impact at scale. This moment marked more than just a milestone—it highlighted the collective power of collaboration driving meaningful change.

By building strong partnerships and fostering transparency, Microsoft and its suppliers are accelerating progress toward a decarbonized future, reinforcing the idea that shared success is the foundation for industry-wide transformation.

LEARNINGS AND WHAT'S NEXT

Advancing carbon market mechanisms. As part of our efforts to reduce Scope 3 emissions, we are building on our experience with book-and-claim systems for sustainable fuels to contract for sustainable building materials certificates. By collaborating with multi-stakeholder groups, we aim to develop market infrastructure to scale these approaches, driving greater adoption and impact.

Building a robust carbon removal portfolio. We continue to refine our carbon removal strategy by signing bankable, multiyear agreements across high, medium, and low durability pathways. These efforts will broaden our supplier base and geographic footprint, while accelerating financing for critical infrastructure and afforestation projects to deliver meaningful carbon removal credits by 2030.

Scaling community-focused sustainability infrastructure. Through energy procurement efforts like Pivot and ReNew, we have learned a lot about the importance of leading with partnership, trusting the expertise of local communities, and authentically shifting power and decision-making such that new projects are fairly developed and enhance the health, safety, and overall well-being of the communities in which we operate. We are using these lessons learned and embedding these practices to enable a more sustainable future for all.

Driving datacenter innovation. With rapid cloud business growth, we are advancing datacenter sustainability by developing strategies to integrate novel low-carbon materials into HVAC units, incorporating low-carbon requirements for materials and equipment in datacenter construction into our contracts, and identifying opportunities to improve operational efficiency.

Getting to water positive

Microsoft is leading efforts to develop and scale the water replenishment market while driving innovation in water solutions.

Read more about our learnings on the journey to water positive in our white paper.

Water is essential to life and an important part of our sustainability journey. In 2020, we set the ambitious commitment of becoming water positive by 2030. To achieve this commitment, we are taking action to reduce water use, replenish water in critical regions, improve global water access and sanitation, drive innovation in water management, and advocate for effective water policy. Our approach is designed to mitigate water stress, safeguard critical watersheds, and support global resilience.

Our approach

As we continue our work to be water positive by 2030, we are focusing on progress in three core areas:

- **Increasing efficiency.** Microsoft's newest datacenters feature advanced direct-to-chip liquid cooling systems that recycle water in a closed-loop design, eliminating the need for evaporation. By adopting these innovations, each datacenter saves over 125,000 cubic meters of water annually, reducing freshwater reliance even as AI workloads drive increased compute resource needs.
- **Reducing dependence on freshwater.** As an ongoing effort across our global operations, we are continually investing in improving the design and operation of our datacenters to minimize water use, including implementing water recycling projects and rainwater harvesting.
- **Increasing restoration and reuse.** We continue to fund projects that restore, reuse, and reduce freshwater consumption in water-stressed locations where we operate. Across approximately 40 priority locations worldwide, we invest in solutions such as rainwater harvesting, groundwater replenishment, and irrigation modernization, delivering measurable social and environmental benefits while addressing local water challenges.

As we progress, our water positive strategy is evolving—integrating new ideas, technologies, and approaches to address global water challenges. Microsoft is leading efforts to develop and scale the water replenishment market while driving innovation in water solutions. A key challenge since setting our replenishment target in 2020 has been the limited availability of initiatives ready for investment and implementation in priority locations. To overcome this, we are building and scaling replenishment efforts by supporting projects through non-governmental organizations (NGOs) and pioneering first-of-their-kind initiatives with private sector partners. As of 2024, private sector projects accounted for 17% of our replenishment portfolio, reflecting our resolve to foster a diverse, collaborative ecosystem to achieve water sustainability.

Today, four principles guide our replenishment work:

1. Prioritize investments in areas with high water stress and high operational water consumption.
2. Don't just count drops; invest in locally relevant projects that offer co-benefits.
3. Keep community needs and impact at the forefront.
4. Focus on innovation with an aim to build project supply and scale.

Our approach continued

Our targets and progress

Water positive

As we work to be water positive, we continue to scale our efforts to reduce water use across our operations, while increasing procurement from alternative sources and investing in innovative replenishment and access projects.

Target	Progress
Replenishing more water than we use by 2030 We will replenish more water than we consume across our global operations, with a focus on water-stressed regions where we work.	**Over 100 million cubic meters of water replenishment volume** (In progress) In FY24, we increased the number of projects we have funded by over 50%, funding 27 replenishment projects that are estimated to provide more than 50 million cubic meters in volumetric water benefit over the lifetime of these projects. Since the inception of this program, projects contracted are estimated to provide more than 100 million cubic meters of replenishment volume over their lifetime.
Increasing access to water We will provide 1.5 million people with access to clean water and sanitation services by 2030.	**Over 1.5 million people with water access** (Achieved) In FY24, we added seven new projects, bringing our portfolio to 13 initiatives that when fully implemented will serve over 1.6 million people across Brazil, India, Indonesia, Mexico, Chile, the United States, Malaysia, Kenya, and Nigeria.
Reducing our water intensity We will make progress against our target to improve water use efficiency by 40% across our global, owned datacenter operations by 2030, from a 2022 baseline.	**Improving water efficiency** (In progress) Since our baseline year of 2022, operational datacenters have achieved an 18% reduction in water intensity progressing towards our 2030 target to reduce water use intensity by 40%.

Advancing water replenishment

Delivering support in an emerging field

Water replenishment encompasses a broad range of interventions aimed at improving watershed health. These activities focus on enhancing water quantity and quality through measures such as reducing water use, recharging local aquifers, restoring aquatic ecosystems, and conserving critical land resources. By driving these efforts, we aim to not only meet our own environmental sustainability commitments but also catalyze progress across industries and communities worldwide.

Water replenishment remains an emerging field with limited historical guidance and data to inform corporate investment strategies. This nascence translates to a limited supply of projects and a reliance on new or early-stage organizations entering the space. As corporate demand for replenishment investments grows, there is a pressing need to build supply and scale efforts.

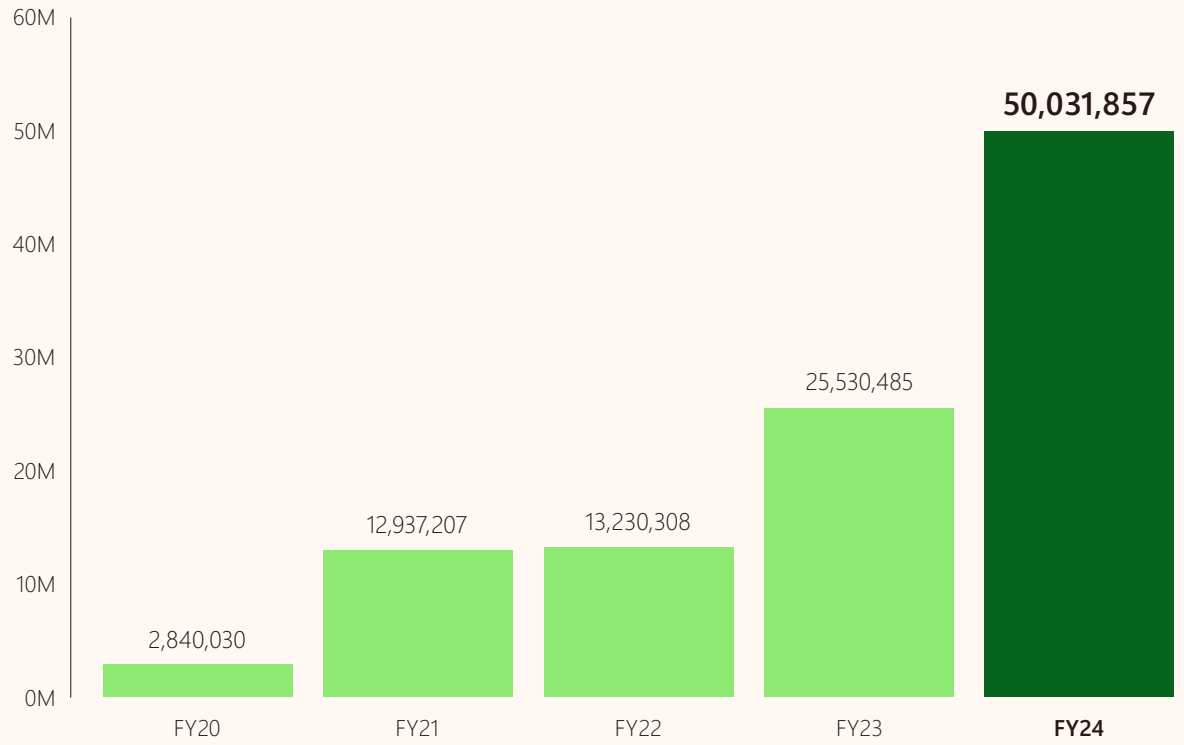
To address this gap, Microsoft is working to empower new project implementers and help scale the water replenishment market through collaborative partnerships with NGOs and private sector entities. While implementers may not initially specialize in replenishment, their expertise in water management or related solutions can be adapted to align with replenishment objectives, driving innovation and creating scalable models for success.

Water Table 1

Replenishing more water than we consume

Since the program's inception, we have contracted 76 replenishment programs in water-stressed basins, which are expected to deliver more than 100 million cubic meters of replenishment volume over their lifetime.

Total contracted volume water replenishment
Water m^3



Find out more in our Data Fact Sheet

All historic values reported have been adjusted to exclude projects that are considered no longer viable. Projects become no longer viable due to a range of different factors such as unexpected changes in the conditions of the project site.

Advancing water replenishment continued

Building a robust and effective portfolio

The outcomes of projects tied to natural systems can be inherently unpredictable. Volumetric water benefits, for instance, may fluctuate due to changing weather patterns—rainwater harvesting projects, for example, might yield less water than anticipated during droughts or unexpectedly exceed expectations in periods of heavy rainfall. To address these challenges, Microsoft has implemented a proactive and strategic approach for our water portfolio:

1. **Build a diverse portfolio**. We mitigate risk by diversifying across a variety of locations, project types, and partners, ensuring resilience against variability.
2. **Invest early**. By building a robust portfolio early, we create the runway needed to achieve our replenishment target by 2030.
3. **Use data-driven forecasts**. We collaborate with partners to use conservative, realistic estimates in forecasting project outcomes.
4. **Evaluate progress continuously**. Annual progress reports from partners help us verify project health, address challenges, and support timely resolutions.

Learn more about our water access and replenishment projects here

In FY24, we significantly expanded our replenishment efforts, contracting 27 new projects and increasing our total portfolio by more than 50% to 76 projects. This represents a cumulative investment of more than $34 million, with 62% of these projects using nature-based solutions and 47% providing critical biodiversity co-benefits. For example, we are supporting a project with Conservation International to conserve and restore the Lake Xochimilco wetlands in Mexico City, Mexico. This wetland is home to 5% of Mexico's described species, including the critically endangered axolotl salamander.

+50%

We increased our water replenishment portfolio by more than 50% in FY24.

Water Table 2

Replenishment activities

Our water replenishment portfolio works to improve watershed health through a broad range of activities that are not limited to nature-based solutions. The following table shows replenishment activities by percentage of our total portfolio which enable us to not only meet our own environmental sustainability commitments but also catalyze progress for people and nature.

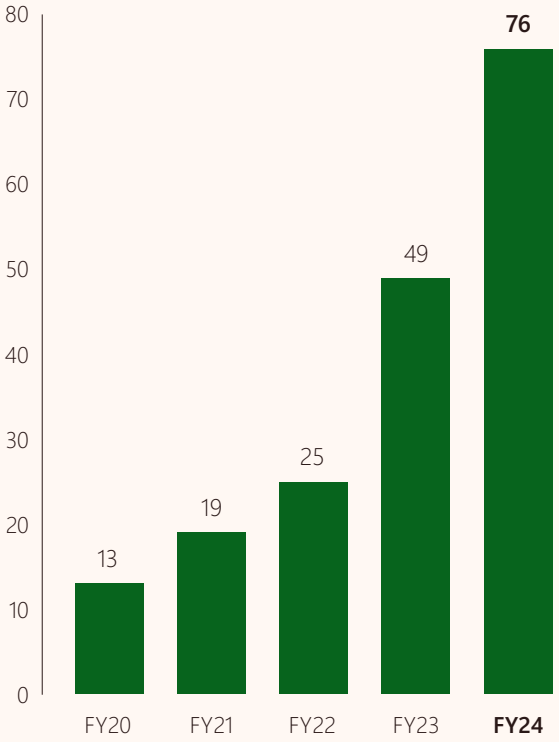
Wetland restoration and creation	29%
Agricultural water demand reduction measures	17%
Land cover restoration	9%
Operational efficiency measures	8%
Leak repair	8%
Rainwater harvesting	7%
Legal transactions to keep water in-stream	4%
Agricultural best management practices	4%
Water reuse	3%
Constructed wetland treatment systems	3%
Land conservation	3%
In-stream barrier removal	3%
Floodplain inundation / reestablish hydrologic connection	3%
New water supply for crop irrigation	1%

Water Table 3

Replenishment projects

Our project portfolio continues to grow. We are supporting 76 water replenishment projects—working with partners, communities, and innovators to drive lasting impact in water-stressed areas where we operate.

Cumulative total of projects contracted



Advancing water replenishment continued

At Microsoft, water volumes are only counted toward our replenishment target if they are implemented beyond our operational needs and directly benefit the local community and environment. For example, rainwater captured for use in our datacenters or campuses contributes to reducing our own water use but does not count toward our replenishment target.

Accelerating water progress with AI

AI is revolutionizing water projects, offering untapped potential to address challenges across the replenishment life cycle. Drawing on data from satellite imagery, on-site sampling, and sensors, AI enables:

- **Monitoring and identification** at scale by using machine learning to remotely track watershed changes and identify land use patterns over time.
- **Resource planning** by creating early warning systems for droughts, floods, and water quality violations; forecasting water demand; and modeling aquifer depletion and recovery.
- **Operational efficiencies** by detecting leaks and wastewater system blockages, monitoring water quality in real time, optimizing irrigation schedules, and using water and wastewater quality data to hot spot diseases.

AI also simplifies the often-challenging task of monitoring and evaluation throughout the project life cycle, which can be prohibitively expensive for many replenishment projects. Currently, about 17% of our replenishment projects use AI to replenish, restore, or reduce water use, ensuring real-time tracking and more actionable insights.

Reducing water loss in cities

In 2023, Microsoft began supporting leak detection projects that utilize AI-enabled technology to combat water loss in collaboration with Aganova, FIDO, FluxGen, and Orbia. These projects use AI to analyze data, precisely identifying the size and location of leaks faster and more accurately than traditional methods. With leaking pipes accounting for an estimated 30% of global water losses, these technologies offer significant potential to reduce waste.

Our portfolio now includes seven leak detection projects in cities such as London (England), Querétaro (Mexico), Phoenix (Arizona), Las Vegas (Nevada), Madrid (Spain), Campinas (Brazil), and Bengaluru (India). For example, in Madrid, Microsoft is funding Aganova to deploy advanced AI across more than 160 kilometers of pipes in the water distribution network of the Mancomunidad de Aguas del Sorbe (MAS) water utility. MAS plans to repair identified leaks within three months, helping reduce overall water withdrawals, alleviate regional water stress, and lower costs and carbon emissions by decreasing the energy required for water treatment and distribution. Projects like this strengthen the region's resilience to drought and exemplify the transformative impact of AI-powered water management.

PARTNERING FOR IMPACT

AI water management

Optimizing water use in hospitals

In India, FluxGen Sustainable Technologies is using funding from Microsoft to help two charitable hospitals in Bengaluru improve their water use efficiency and reduce their dependence on groundwater supplies. Using the AquaGen System, an end-to-end AI and IoT-based water management solution, the project monitors real-time water usage, infrastructure inefficiencies, and energy consumption. By addressing leaks and reducing water waste in laundry facilities, residential areas, and cooling towers, the hospitals aim to cut water consumption by 50%. The system also enhances the performance of existing rainwater harvesting and wastewater treatment structures, providing a scalable model for other high-demand facilities.

AI-powered precision irrigation

Helping farmers save water

In Chile, one of the world's most water-stressed regions, Microsoft partnered with Kilimo to deploy AI-powered precision irrigation systems. By integrating crop soil moisture tests, satellite data, local weather data, and agronomy advisory, Kilimo provides farmers with tailored irrigation schedules. To date, this technology has been implemented across 440 hectares of farmland in Chile's Maipo Basin, saving an estimated 1.5 million cubic meters over three years, benefitting 11 farmers. These efforts also reduce agricultural runoff and carbon emissions while improving natural pest control and crop yields.

Advancing water replenishment continued

Protecting watersheds and increasing efficiency in irrigation

In addition to using AI, we continue to invest in nature-based water projects, such as beaver dam analogs, and agricultural water management systems, such as climate-smart irrigation practices, to ensure holistic and scalable solutions. These efforts demonstrate how together, technology and nature can help scale water replenishment progress.

Protecting watersheds with beaver dam analogs

Beavers have been hunted extensively—not only for their fur but also to eliminate them as perceived pests. However, these industrious animals play a vital role in protecting watersheds. By building dams, they help control runoff, replenish groundwater, and create important reservoirs. Through a partnership with Trout Unlimited, Microsoft supports aquatic habitat restoration projects that use beaver dam analogs (human-made structures mimicking natural beaver dams) to enhance water quality and flow.

To date, we have funded the creation of 190 beaver dam analogs in key areas, including the Columbia River Basin and Rock Island Creek in Washington state, as well as the Little Snake River watershed in Cheyenne, Wyoming. These projects will help mitigate the destructive effects of flooding, drought, and wildfire, while increasing wetland areas, enhancing groundwater infiltration, and improving riparian health. They also provide critical habitat for native fish, wildlife, and vegetation, while reducing downstream sedimentation and nutrient runoff. Such efforts demonstrate the value of nature-based solutions in bolstering ecosystems and building resilience.

Supporting climate-smart irrigation practices

The agriculture sector is one of the largest consumers of water, and inefficient irrigation systems can put a significant strain on water resources. To address this, Microsoft invests in agriculture and irrigation efficiency projects that transition outdated systems—such as flood irrigation—to more efficient alternatives. These solutions conserve water, reduce fertilizer and pesticide use, and improve climate resilience.

Our projects span key locations, including the Verde Valley and the lower Colorado River in Arizona, the mid-Columbia Basin in Washington state, the Edwards Aquifer in San Antonio, Texas, the Tagus River Basin in Madrid, Spain, and the Rio Lerma in the state of Guanajuato, Mexico. Collectively, these initiatives are projected to save 20 million cubic meters of water over their lifetimes. Technologies employed include:

- **Mobile drip irrigation systems**, which directly water plants to minimize evaporation and reduce overapplication of fertilizers and pesticides.
- **Advanced soil moisture and climate monitoring systems**, which provide data to optimize irrigation schedules.
- **Land-leveling of agricultural fields**, which improves irrigation efficiency, increases crop yields, and reduces crop disease risk.
- **Center pivot sprinklers and subsurface drip irrigation systems**, which reduce consumptive water use while maintaining crop productivity.

These sustainable, climate-smart practices not only conserve water but also strengthen community resilience, ensuring a more sustainable future for both farmers and ecosystems.

Read our water replenishment project portfolio overview to learn more about the projects that we are funding through our replenishment program.

PARTNERING FOR IMPACT

Improved resilience

Supporting sustainable agriculture

Luis Enrique Guerrero, a grain producer growing crops like corn, beans, and sorghum in Guanajuato, says, "We have experienced very severe and intense droughts. We need water to produce… We have a well that provides about 42 liters per second. However, with that amount of water and our current flood irrigation system, and due to the droughts, we only manage to use about half of it."

Luis has already realized water savings after starting to use irrigation gates and tubing systems through the project. The adoption of these types of technologies supports sustainable, climate-smart agricultural practices that enhance community water supply resilience.

Expanding clean water access

Access to clean water is a fundamental human right and a cornerstone of the United Nations (UN) Sustainable Development Goal (SDG) 6. In support of Microsoft's water positive commitment, we set a target to provide 1.5 million people with access to clean water and sanitation services—a target we proudly achieved in 2023.

Building on this accomplishment, we continue to expand our impact through replenishment projects that also improve access to safe water. In FY24, we added seven new projects, bringing our portfolio to 13 initiatives that when fully implemented will serve over 1.6 million people across Brazil, India, Indonesia, Mexico, Chile, the United States, Malaysia, Kenya, and Nigeria. These projects range from core solutions, such as piped connections that reduce collection time for women and girls and deeper wells to replace polluted sources, to innovative approaches like air-to-water generation and condensate capture from fruit and vegetable manufacturing. Each initiative is tailored to meet the unique needs of local communities.

Where possible, we are prioritizing approaches that do not pull from groundwater sources. Instead, we focus on sourcing from alternative sources, like rainwater harvesting and capturing condensate from fruit and vegetable manufacturing, to help ensure long-term water security for the communities we serve.

Harvesting rainwater for schools and communities

In areas prone to water shortages or extreme weather, rainwater harvesting serves as a critical, sustainable solution. It ensures access to clean water for schools and communities and enhances climate resilience. Through our access and replenishment portfolios, Microsoft has funded 250 rainwater harvesting projects globally.

1.6 million people

In FY24, we added seven new projects, bringing our access portfolio to 13 initiatives that when fully implemented will serve over 1.6 million people.

In Malaysia, for example, a project in partnership with Clean International is installing rainwater harvesting systems at 50 schools. These systems utilize a three-tier filtration process that removes 99.99% of bacteria, providing safe drinking water for 30,000 people. Additionally, completed schools in the region act as flood relief centers during the monsoon season. The newly installed systems will provide clean water for up to 500 displaced community members, offering a vital lifeline in the face of natural disasters.

Capturing potable water in sugarcane manufacturing

In the villages around Nagpur, India, thousands of people face persistent challenges in accessing clean drinking water. To address this, Microsoft is funding an innovative project that utilizes condensate generated during sugarcane processing at a local sugar mill. Through a partnership with Botanical Water Technologies, water harvesting units will be deployed to capture and purify condensate into safe drinking water to be distributed to water-scarce local communities.

This process is estimated to produce 60,000 cubic meters of clean water annually over the next three years, which will then be transported and distributed to the surrounding villages, providing more than 16,000 people with access to safe clean water. This project represents a sustainable and impactful solution to improve water access in a region that is heavily reliant on limited and stressed water resources.

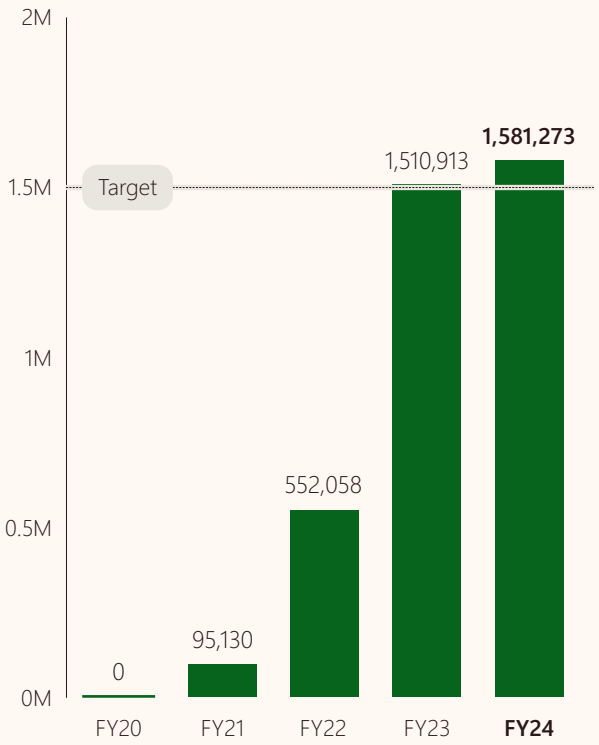
Expanding clean water access continued

Water Table 4

Access projects

After meeting our access target in 2023, we funded seven additional projects in 2024, which will enable us to expand our reach to more than 1.6 million people across the globe.

Number of people reached



INNOVATION IN ACTION

Climate-resilient impact

Funding water and sanitation services

In last year's sustainability report, we announced a partnership with WaterEquity to establish a water and climate resilience investment fund. Through our Climate Innovation Fund, Microsoft provided a $25 million anchor equity investment in this new impact fund, which focuses on climate-resilient water and sanitation services. In September 2024, WaterEquity announced that it had raised more than $100 million for the fund. Other key investors include Starbucks, Xylem, Ecolab, Reckitt, and Gap Inc. The fund aims to reach 15 million people in low-income populations across South and Southeast Asia, sub-Saharan Africa, and Latin America, providing access to safe water and sanitation.

Drilling a new well for cleaner water and sanitation services

Sometimes, the simplest, time-tested solutions are the most effective. This was the case for the Cerrillos community in Curacaví, Chile, where residents were concerned about nitrate contamination in their local shallow well. To address these concerns, Microsoft provided Agua Segura with the support needed to drill a new well, repurpose an existing filtration system, and establish a water quality monitoring program aligned with local regulations. This initiative has brought peace of mind and tangible improvements to the community, ensuring reliable access to safe drinking water.

"Today, the community lives with the assurance that the water we consume is of good quality, complies with regulations, and that our children and elderly can consume it without fear of getting sick. Additionally, we have better service, pricing, and sufficient supply."

Local resident of Curacaví

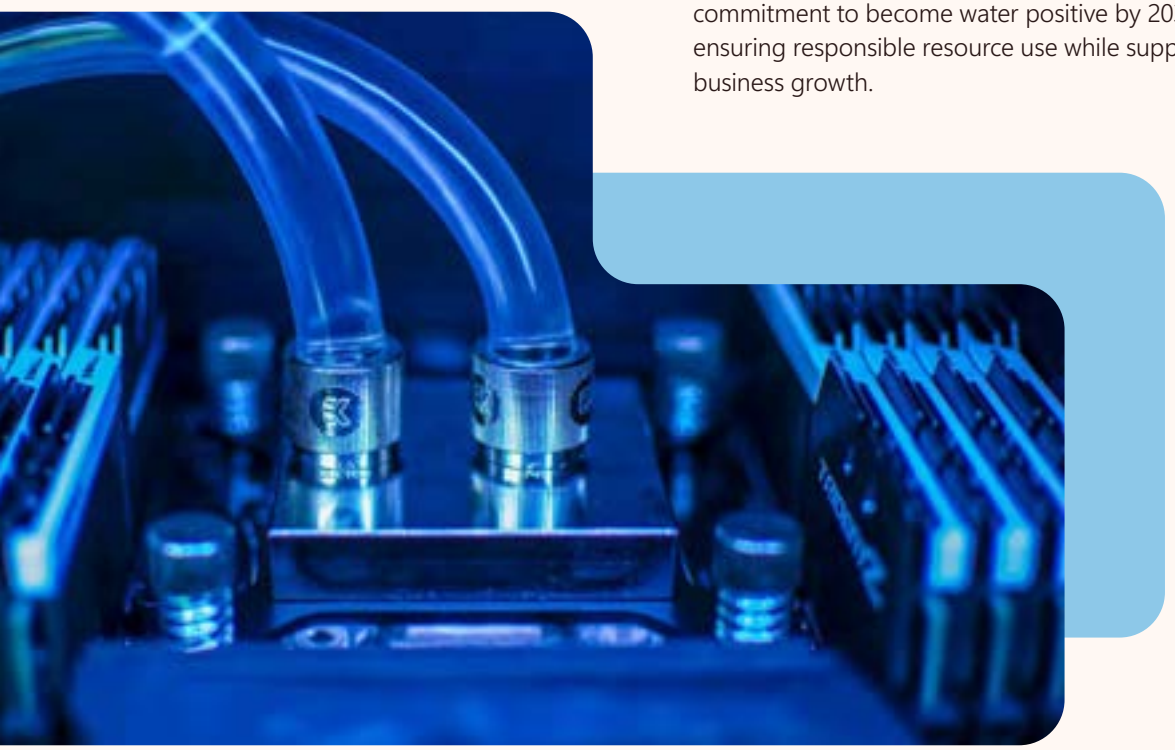
Partnering with local Microsoft employees

In 2024, we organized three employee volunteer events in India, Mexico, and Chile to support the launch of critical water projects and raise awareness about global water challenges. In Pune, India, and Queretaro, Mexico, Microsoft employees actively contributed by constructing water towers at four schools involved in the project. This initiative is providing clean water and improved hygiene for 7,200 students and their families. These events not only advanced our water access target but also engaged our employees in meaningful, hands-on efforts to drive positive change in underserved communities. In the words of one of the schools, "Because of this plant, we can take care of the children's health. And we can improve their attendance."

Learn more about our water access and replenishment projects here

Improving efficiency and reducing water use

Complementing our work in replenishment and access, Microsoft is rethinking how water is used across our datacenters and campuses to minimize our operational footprint while meeting the growing demand for cloud and AI services. Through innovative designs like liquid cooling systems and water reuse technologies, we are reducing water consumption in our newest datacenters and campus buildings, as well as retrofitting existing facilities for enhanced efficiency. Together, these initiatives align with our commitment to become water positive by 2030, ensuring responsible resource use while supporting business growth.



Eliminating water for cooling in new datacenters

Understanding Microsoft's approach to reducing water usage intensity starts with recognizing how water is traditionally used in datacenters. Historically, most ongoing water usage has been for cooling servers to prevent overheating as they deliver cloud and AI services. In this process, water is "used" by being evaporated into incoming outdoor air to reduce the air temperature during warmer months.

Early datacenter designs relied on cooling entire buildings, similar to turning on an air conditioner for your whole house to cool a single room. Over time, we have improved operational water efficiency by constructing newer datacenters with more effective and targeted cooling infrastructure—such as our air-cooled CPU datacenters, which typically require water for cooling only during the hottest portions of the year.

Our newest datacenter designs go even further by targeting cooling directly to the source of heat —the silicon itself. This method, known as direct-to-chip liquid cooling, applies cooling liquid directly to the chips in servers. Unlike traditional systems, it does not rely on evaporating the liquid and recycles water through a closed loop. Once filled during construction, the system continuously circulates water between the servers and chillers, dissipating heat without requiring additional water.

Applying liquid cooling to AI-enabling GPUs has spurred innovations in our newest datacenter designs and aligns with our target to reduce the water intensity of our operations and to evaporate no municipal water for cooling in our newest AI datacenters. Historically, water has played a key role in datacenter cooling and humidification, but our new designs aim to eliminate this need for ongoing municipal water for cooling. In 2024, Microsoft launched a new datacenter design that optimizes AI workloads and uses zero water for cooling. By adopting chip-level cooling solutions, we deliver precise temperature control without water evaporation, saving over 125,000 cubic meters of water annually per datacenter, based on our FY24 global average withdrawal water usage effectiveness (WUE) of 0.30 L/kWh. While water is still used for administrative purposes like restrooms and kitchens, this shift is a substantial leap forward. These innovations in our newest datacenter designs align with our target to reduce the water intensity of our operations and to require no water for cooling in our newest AI datacenters.

Improving efficiency and reducing water use continued

Traditionally, water has been evaporated onsite to reduce the power demand of the cooling systems. Replacement of evaporative systems with mechanical cooling will increase our power usage effectiveness (PUE); however, our latest chip-level cooling solutions will allow us to utilize warmer temperatures for cooling than previous generations of IT hardware.

This enables us to mitigate the power use with high-efficiency economizing chillers with elevated water temperatures. The result is a nominal increase in our annual energy usage compared to our evaporative datacenter designs across the global fleet. Additional innovations to provide more targeted cooling are in development and are expected to continue to reduce power consumption.

Improving datacenter water efficiency

These advancements have improved water usage effectiveness (WUE), a metric that divides the total annual water consumption for humidification and cooling by the total IT equipment energy consumption. Since our baseline year of 2022, operational datacenters have achieved an 18% reduction in water intensity, progressing towards our 2030 target of a 40% reduction.

Our efforts to reduce water usage began well before 2022. In our last fiscal year, our datacenters operated with an average WUE of 0.30 L/kWh, a 39% improvement compared to the global average of 0.49 L/kWh in 2021. Next-generation datacenter designs are expected to further reduce WUE across our owned fleet.

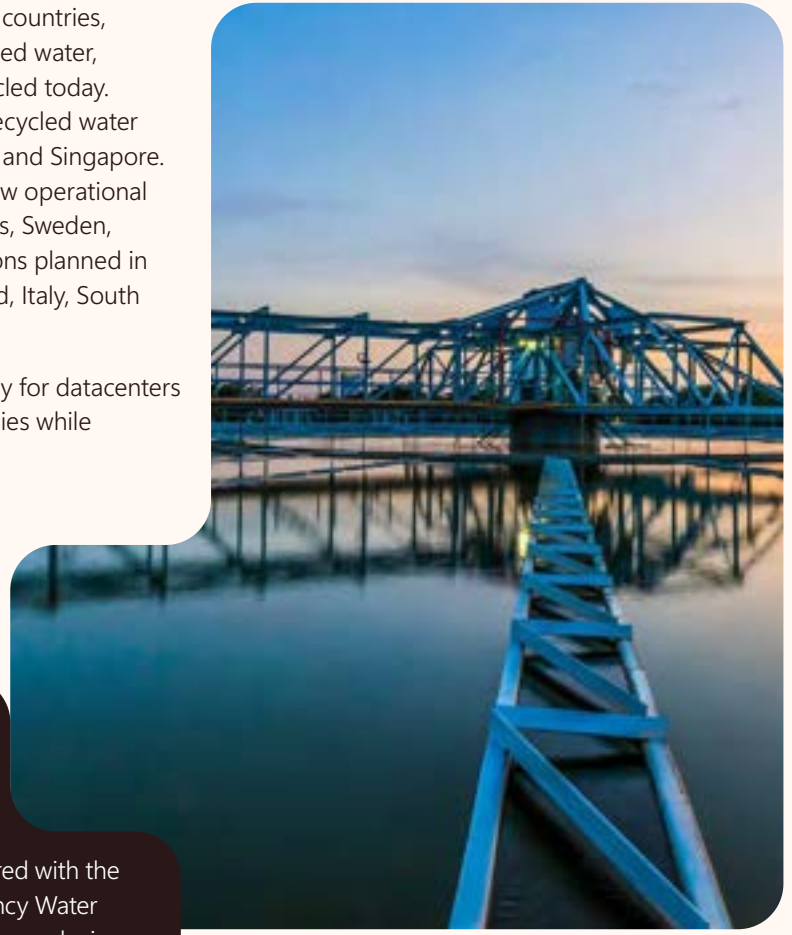
This progress is driven by ongoing efforts to reduce water wastage, expand our operating temperature ranges, and audit our datacenter operations. Regular audits help identify inefficiencies, such as excess water use, with improvements surfaced in our 2022 audit eliminating 90% of such instances. Looking ahead, we are developing advanced predictive models that anticipate water needs based on real-time weather and operational data to ensure continued progress.

Recycling and reuse initiatives

To minimize reliance on freshwater from municipal water systems, Microsoft employs water recycling and reuse strategies tailored to the needs of the individual datacenter regions.

In the United States and many other countries, there is a limited availability of recycled water, with less than 1% of water used recycled today. By 2023, we expanded sourcing of recycled water use in Texas, Washington, California, and Singapore. Rainwater harvesting systems are now operational in datacenters within the Netherlands, Sweden, and Ireland with additional installations planned in Canada, the United Kingdom, Finland, Italy, South Africa, and Austria.

Increasing water reuse is a critical way for datacenters to alleviate stress on municipal supplies while supporting operational efficiency.



PARTNERING FOR IMPACT

Quincy, Washington

Reducing potable water use

In Quincy, Washington, we partnered with the local municipality to build the Quincy Water Reuse Utility, recycling cooling water, reducing Microsoft's potable water use in the region by 97%, and providing 1.5 million cubic meters of water annually for community drinking water needs.

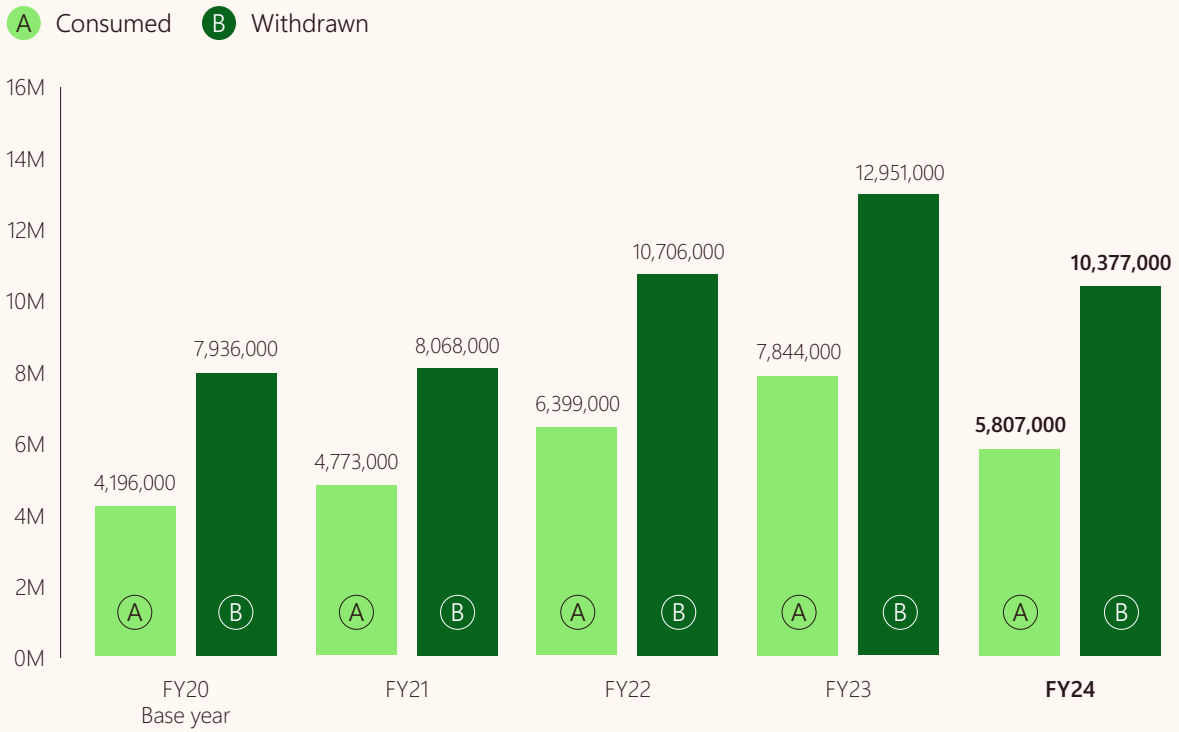
Improving efficiency and reducing water use continued

Water Table 5

Measuring our annual water consumption informs our replenishment targets

Our water consumption and withdrawal trend has shown an increase over the years, in alignment with our business growth. The consumption data from our operations informs the amount of water we need to replenish.

Total water consumption and withdrawal
Water m^3



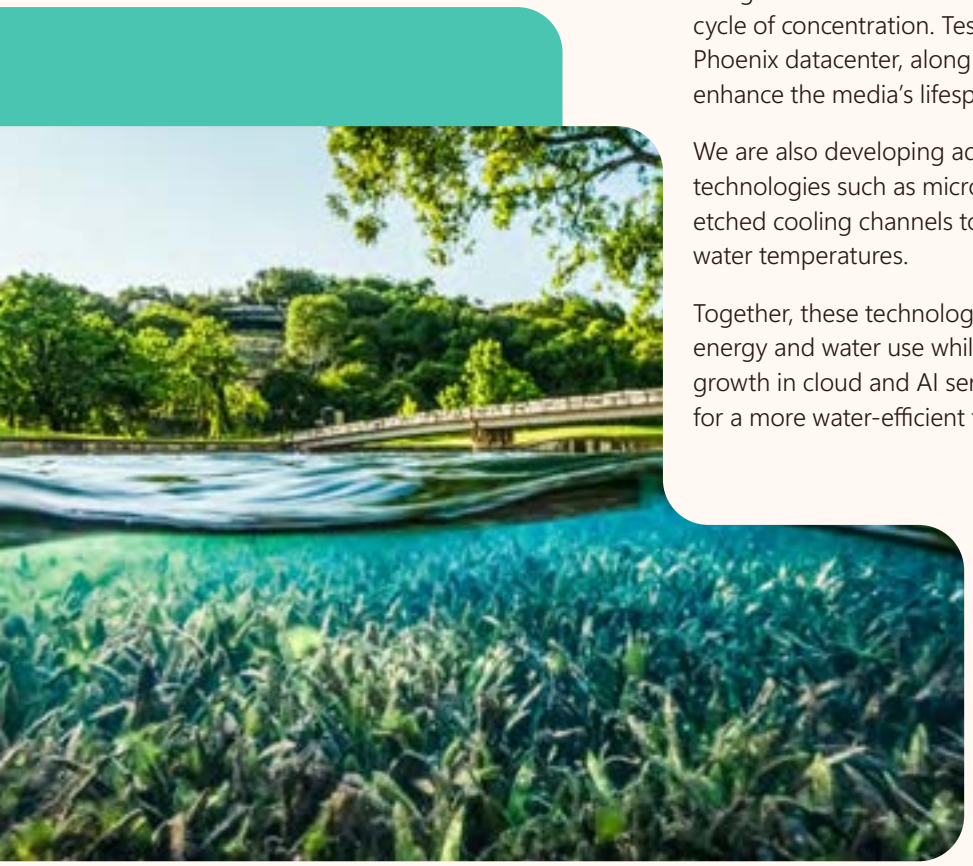
We use primary data to calculate water withdrawal and consumption volumes. We use estimates where primary data is not available. Starting in FY24, reported values incorporate an updated approach based on water use efficiency metrics to estimate how much we withdraw and consume for datacenter locations where data actuals are not available, as outlined in the methodology section of our Data Fact Sheet. Prior years were not adjusted to reflect this change due to data availability limitations. Find out more in our Data Fact Sheet.

Water efficiency across campuses

Efforts to improve water efficiency extend beyond our datacenters to our campuses, where a range of water-saving projects are underway. These include installing low-flow fixtures, dual-flush toilets, and smart irrigation systems; capturing rainwater; and reusing treated water. At our Beijing, China campus, collaborative conservation efforts with dining services partners—including purchasing fresh products to reduce water needed for thawing frozen goods—led to a 15% reduction in kitchen water use in 2024. Similarly, our India campuses are treating water to a tertiary level, enabling reuse for restrooms, landscaping, and chiller equipment.

At sites in water-constrained regions, Microsoft is also exploring new ways to source water without placing additional strain on local supply. In 2024, we installed an air-to-water system at our Hyderabad, India, campus. Powered by sunlight, the system extracts water vapor from the air and converts it into clean, drinkable water. With plans to install approximately 300 panels, the campus anticipates generating over 1,600 liters of water per day.

Innovating for greater water efficiency



Microsoft is continually exploring new technologies to further reduce water usage. As part of this effort, we are assessing ways of improving water efficiency in adiabatic cooling systems (a process where no heat transfer takes place). Early testing of a new microporous evaporative media showed promising results, with up to a 30% reduction in water usage, along with a 42% decrease in wastewater via higher cycle of concentration. Testing continues at our Phoenix datacenter, along with collaboration to enhance the media's lifespan and performance.

We are also developing advanced liquid cooling technologies such as microfluidics, which use silicon-etched cooling channels to operate at higher facility water temperatures.

Together, these technologies will help optimize energy and water use while enabling sustainable growth in cloud and AI services and paving the way for a more water-efficient future.

LEARNINGS AND WHAT'S NEXT

Improving monitoring and evaluation. As we continue our journey to become water positive, advancing monitoring, data, and insights will allow us to take more precise action and adjust our approaches to meet our targets. If we face scenarios where water volume cannot be confirmed or if there is a project that experienced delays or other challenges, these insights will allow us to respond appropriately. We are in the process of building an in-depth asset management strategy to map short- and longer-term monitoring opportunities that we can use to ensure the projects we fund are achieving the objectives set.

Using AI to protect freshwater in high stress priority basins. We continue to look for opportunities to use AI to mitigate water challenges across the globe. This includes funding replenishment projects that use AI, assisting the organizations leading this work, and directly supporting groups using AI to drive meaningful impact.

Innovate and scale as we approach the halfway mark of our water positive goal. When we first set our water positive goal in 2020, we started by assessing our water-related risks and impacts that would inform our strategy. This is a critical first step at the beginning of any company's water journey. Once we understood more about our water footprint, we started to build the program from the ground up. We launched programs to maximize efficiency across our datacenters, provided over 1.5 million people with access to clean water and sanitation solutions, and established processes and thought leadership pieces to guide the development of our growing replenishment portfolio. As we approach 2030, we are now laser focused on innovation and scale for our water program. We will launch datacenters that will require zero water for cooling to minimize impacts on freshwater resources as we grow, increase procurement of alternative sources of water to reduce our dependence on freshwater resources, and continue partnering with organizations to develop, pilot, and scale first of their kind replenishment projects in high stress priority locations across the globe.

Getting to zero waste

Surpassing our targets

90.9%

This past year, through our Circular Centers, we achieved 90.9% reuse and recycling of servers and components in FY24, surpassing our 90% target a year early.

Surpassing our targets

85.3%

At the same time, we diverted 85.3% of construction and demolition waste from landfills and incinerators, exceeding our annual 75% target six years ahead of schedule.

In 2020, we made a commitment to be zero waste by 2030—an effort to support the global transition out of the traditional "take, make, waste" linear economic model to a circular economy. Our zero waste commitment applies across our building construction and operations, products, and packaging. We use a circular economy strategy, grounded in the prioritization of reduction and reuse, to extend the life of the materials we use, and reduce waste and carbon emissions as a result. This effort begins upstream by reducing the quantity of materials wherever possible, keeps products in use longer through reuse and repair, and recovers materials downstream to our recycling and composting programs.

Our approach

This commitment reflects our belief that our planet and its resources are precious and underscores our responsibility to minimize environmental impacts and reduce carbon emissions throughout the life cycle of our materials.

We are proud of the progress we have made towards a circular economy over the past five years. This includes deploying six Circular Centers—facilities that recover parts and components from our cloud hardware for reuse and recycling; pursuing the elimination of single-use plastics from our product packaging; improving data collection and management systems across our operations; achieving zero waste validation for five offices; and increasing the rates of recycled content and repairability of our devices.

The results of these efforts are clear. Through our Circular Centers, we achieved 90.9% reuse and recycling of servers and components in FY24, surpassing our 90% target a year early. At the same time, we diverted 85.3% of construction and demolition waste from landfills and incinerators, exceeding our annual 75% target six years ahead of schedule. These milestones, driven by a culture of innovation and cross-functional collaboration, reflect not only our own advancements but also the growing momentum to integrate zero waste and circularity practices across the technology industry. Our zero waste strategy centers on circular solutions that reduce waste, pollution, and carbon emissions while improving water quality, ecosystems, and human health. This approach prioritizes waste prevention, robust reuse operations, and transparent reporting to ensure our efforts are measurable and impactful.

As we reflect on the learnings since launching the zero waste program in 2020, we've come to understand that a circular economy is not a choice but a necessity to address the triple planetary crisis of climate change, biodiversity loss, and pollution. Moving forward, we will continue to prioritize solutions and materials that continue to increase circularity and further reduce waste and emissions.

Our approach continued

Our targets and progress

Zero waste

As we work to achieve zero waste, we are taking an increasingly circular approach to materials management to reduce waste and carbon emissions.

Target	Progress
Driving to zero waste building and operations We will achieve 90% diversion of operational waste at owned datacenters and campuses, and 75% diversion for all construction and demolition projects, by 2030.	**25,603 metric tons of operational waste diverted** In FY24, we diverted 25,603 metric tons, or 88.1%, of operational waste from landfills and incinerators across our owned datacenters and campuses. **85.3% construction and demolition waste.** We also diverted 85.3% construction and demolition waste, achieving our target early.
Increasing reuse and recycling of servers and components By 2025, 90% of servers and components for all cloud hardware will be reused and recycled with support from our Circular Centers.	**90.9% reuse and recycling** Our reuse and recycle rates of servers and components across all cloud hardware reached 90.9% in FY24, achieving our annual target a year early.
Sustainable product packaging By the end of 2025, we plan to eliminate single-use plastics in all Microsoft primary product packaging. Additionally, by 2030, we aim to design all Microsoft product packaging to be 100% recyclable in OECD countries.	**94.8% in product packaging recyclability** On our way to eliminating single-use plastics in Microsoft product packaging by the end of 2025, we achieved a usage rate of 4.0% single-use plastics across Microsoft's product packaging portfolio in FY24. In the same year, we used 53.8% recycled content in our product packaging and achieved a packaging recyclability rate of 94.8%.
Increasing circularity of our products We are focused on increasing use of recycled content, improving device repairability, and improving data quality of device recycling.	**Designing in recycled content and revolutionizing repairability** Our Surface Copilot+ PCs now feature 100% recycled aluminum alloy in the enclosures, and 100% recycled rare earth metals in magnets.[8] Our new devices are some of the most repairable laptops and tablets in the industry, hosting at least 11 replacement components.[9] The new Surface Pro 11th Edition and Laptop 7th Edition achieved an 8/10 repairability score from iFixit.
Innovating cloud packaging We are focused on advancing sustainable cloud packaging to minimize waste.	**Increasing circularity of cloud packaging** In 2024, we began to reduce the hard-to-recycle plastic-based expanded polyethylene (EPE) foam in cloud hardware packaging, replacing it with more recyclable paper and pulp alternatives. We also diverted over 2,500 metric tons of packaging waste from landfills.

In progress Achieved

Tracking zero waste: Building a data-driven foundation for accountability and impact

The progress we've made toward our zero waste commitments is underpinned by robust methodologies and data governance processes designed to ensure transparency and accountability.

This journey began in 2020 with an enterprise-wide waste baselining initiative to establish a clear starting point for our zero waste commitment. From there, we developed methodologies to guide our collection and extrapolation efforts, collaborating with standards organizations to define diversion and prevention calculations to guide our reporting.

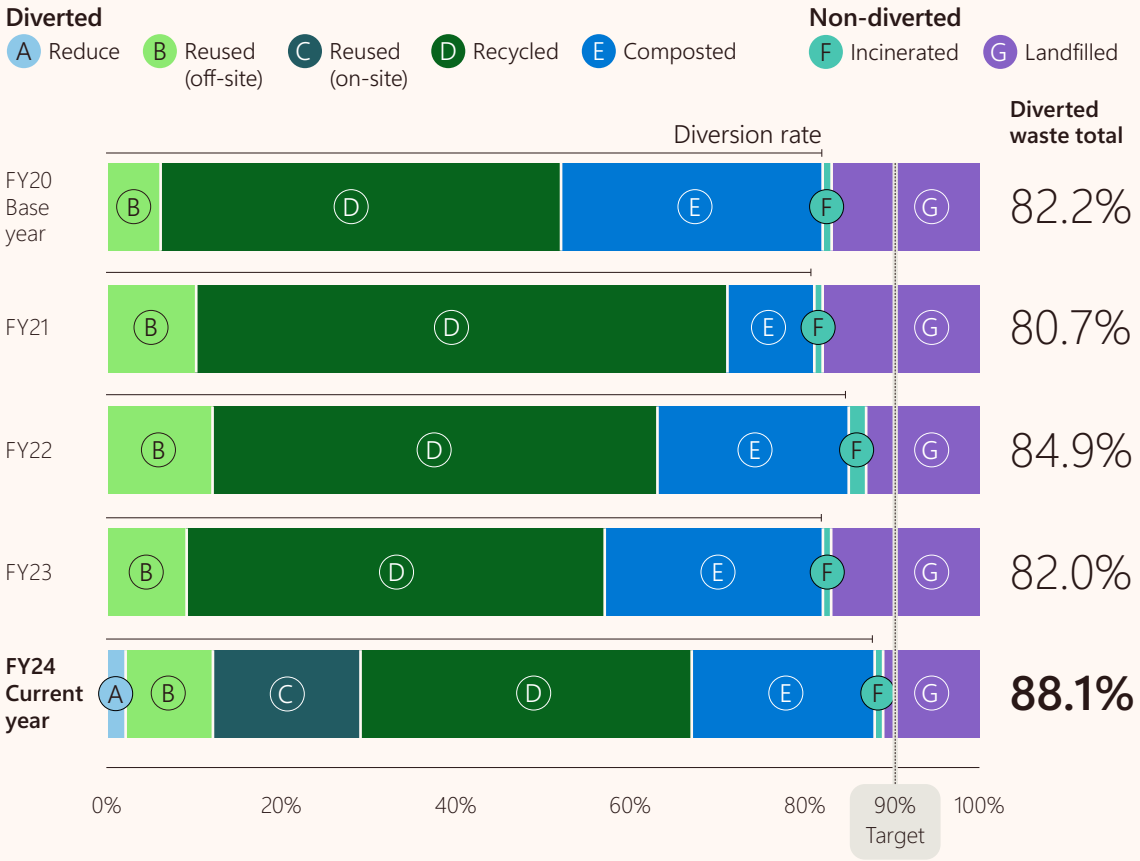
As our data capabilities expanded, including more granular insights from recycler utilization rates, we evolved our processes to better capture, track, and report on the impact of our program. These refinements enable us to identify geographical and material-specific opportunities for intervention, ensuring our strategies remain focused and effective.

Our dedication to data quality drives greater visibility into waste streams, empowering us to prioritize waste prevention efforts and enhance the integrity of our zero waste program. By continually refining our methodologies, we uphold the spirit of zero waste while laying the groundwork for long-term sustainability.

Waste Table 1

Diverting operational waste from landfills and incinerators

In FY24 we diverted approximately 26,000 metric tons of waste from being landfilled or incinerated across our owned datacenters and campuses.



Starting in FY24, the reported values now include the weight of reduction and on-site reuse in addition to off-site reuse which was reported in prior years. The weight associated to on-site reuse and reduction represents the impact from our waste prevention activities as disclosed and defined in the Data Fact Sheet. With respect to this waste diversion target, the inclusion of on-site reuse and reduction directly effects the diversion percentage alongside our off-site reuse, recycling, and compost activities. Find out more in our Data Fact Sheet.

Reducing waste at our campuses and datacenters

Microsoft has made significant strides toward achieving its zero waste commitment since 2020. From achieving zero waste validation at five offices to deploying innovative solutions for waste prevention and diversion, we are transforming our operations to minimize environmental impact. These efforts include using reusable dishware in cafes, designing datacenters for deconstruction, and implementing programs to divert materials from landfills and incinerators.

85.3%

In FY24, we reached an 85.3% waste diversion rate for construction and demolition projects, surpassing our 75% 2030 target six years ahead of schedule.

Reducing construction and demolition waste

In FY24, we reached an 85.3% waste diversion rate for construction and demolition projects, surpassing our 75% 2030 target six years ahead of schedule.

At our Puget Sound campus, the East Campus Modernization Project, a 72-acre redevelopment encompassing 3 million square feet of office spaces, dining halls, an underground garage, and a central utility plant, achieved an 85% diversion rate for construction and demolition waste.

This success was made possible by separating materials on site and working with partners to recycle early all asphalt, concrete, wood, and metals, demonstrating the effectiveness of sustainable practices on a large-scale project. Similarly, the expansion of our Belgrade, Serbia office achieved an 80% diversion rate through separation of recyclable materials, such as gypsum board, plastic, and cardboard, diverting a total of 110 metric tons of waste.

Reducing operational waste in our workplaces

In 2024, our campuses made progress toward our target of diverting 90% of our operational waste by 2030. During the year, Shanghai, Beijing, and Suzhou campuses achieved UL Platinum Zero Waste validation, and our Dublin and Hyderabad facilities achieved UL Gold Zero Waste validation. In addition to these new accomplishments, our Puget Sound headquarters, Microsoft's largest global workplace, maintained its TRUE zero waste certification for the eighth consecutive year. Looking forward, additional facilities in North America, Europe, and Asia are on track to achieve UL Zero Waste validation.

Highlights from our global efforts include:

- **Electronic reuse and recycling**. In 2024, Microsoft's hardware recycling program collected nearly 240,000 e-waste units, diverting 1,400 metric tons of waste. This included refurbishing, reusing, and recycling devices, with 1,600 used Surface devices repurposed for spares warranty reuse.
- **Food waste reduction**. Nine campuses across India, China, Ireland, the United Kingdom, and the United States are using AI to optimize food preparation, reducing over 400 metric tons of food waste.
- **Reducing waste contamination**. Our Puget Sound headquarters expanded its liquid bins pilot into a full-scale initiative and implemented a new waste conveyor belt system to increase container recycling rates and reduce contamination. These efforts have resulted in the diversion of approximately 270 metric tons of waste from landfills.
- **Reusable containers in dining operations**. Our China campuses began to shift away from single-use plastics in their kitchen operations to reusable containers, which effectively avoided over 4 metric tons of waste in 2024.

Reducing waste in our datacenter operations

Microsoft's datacenter operations are at the forefront of our zero waste initiatives. To achieve zero waste in our operations, a primary objective is to prevent waste generation from the outset. Achieving this requires a combination of practical solutions and active employee participation. One way we've prevented waste generation is by operating with durable pantry serviceware. In 2024, 100% of our new owned datacenters located in Europe and the Asia-Pacific region began operations with durable serviceware, and we're looking to expand this practice in North American datacenters in 2025.

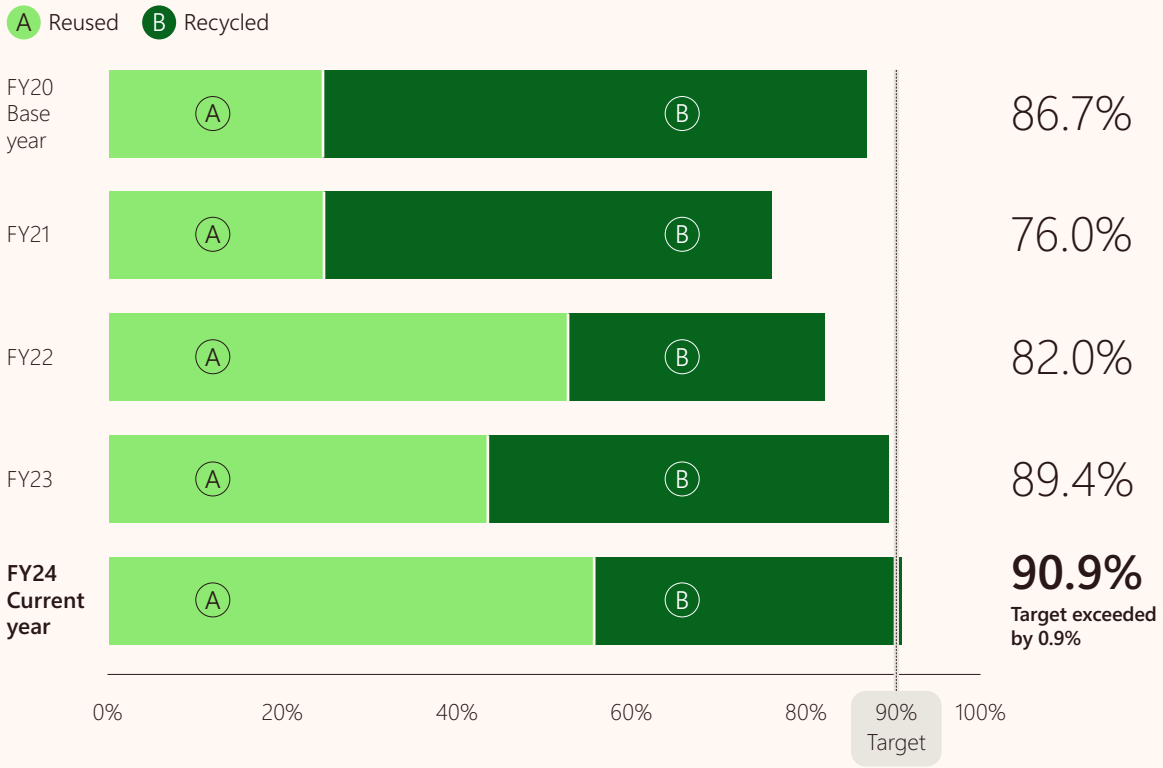
In many of our datacenters, washable pre-filters have been implemented to extend the lifespan of our primary filters. When these pre-filters accumulate sufficient particulate buildup, they are removed, washed, and redeployed in our datacenters. Each filter can be reused for multiple years, which reduces waste compared to a disposable alternative.

Reducing waste at our campuses and datacenters continued

Waste Table 2

Improving reuse and recycling of servers and components for all cloud hardware

In FY24 Microsoft increased reuse and recycling of servers and components to 90.9%, exceeding the 90% target.



Find out more in our Data Fact Sheet

We're proud to partner with organizations in the communities where we operate and work together to drive a circular economy approach locally. In FY24, we worked to improve donation pathways for our datacenters. This resulted in over 1.5 metric tons of donated items including furniture, office supplies, laptops, ladders, and fan motor control equipment. Donation recipients include a food bank in Texas, a community college in Virginia, and a primary school in Dublin, Ireland.

Recognizing that employee participation can accelerate our zero waste impact, we are engaging our workforce to play an active role in these efforts. In 2024, we introduced an online training course covering global waste issues, circular economy principles, and ways employees can drive impact in their day-to-day roles. We also coordinated local zero waste engagement events that reached hundreds of datacenter employees, fostering a culture of sustainability across datacenter operations.

PROGRESS TOWARDS TARGETS

LinkedIn

Advancing waste reduction

LinkedIn contributed to our zero waste achievements by advancing waste reduction across its offices and datacenters. In 2024, LinkedIn's San Francisco office earned UL Gold Zero Waste Certification by diverting over 97% of operational waste. Other sites engaged in partnerships to upcycle or donate 46.7 metric tons of carpet and repurpose over 600 pieces of furniture, which diverted 11.3 metric tons of waste and avoided 29.6 metric tons of carbon emissions.

Advancing circular cloud hardware and packaging

Cloud hardware and packaging are a critical component of Microsoft's zero waste commitment, and we are proud to have achieved our target for reusing and recycling cloud hardware a year ahead of our 2025 deadline. Over the last several years, we've implemented design specifications for hardware and packaging with our suppliers requiring minimum recycled content and sustainable design. These efforts, combined with the work of our Circular Centers and collaborations with suppliers, are advancing the recovery of both hardware and packaging.

Improving reuse and recycling in cloud hardware

Launched in 2020 with the opening of a first-of-its-kind facility, the Circular Centers have achieved 91% reuse and recycling in FY24—exceeding our 2025 target ahead of schedule. These centers have expanded globally, with six facilities now operating in locations including the United States, Amsterdam (Netherlands), Dublin (Ireland), and Singapore. In 2024, capabilities were further enhanced, and new Circular Centers are planned for Cardiff, Wales (2025); Sydney, Australia (2026); and San Antonio, Texas (United States) (2028).

91%

Circular Centers have achieved 91% reuse and recycling in FY24—exceeding our 2025 target ahead of schedule.

As hardware volume processed through Circular Centers increases, strategic partnerships with recyclers have improved efficiency. By harvesting and recertifying decommissioned server components no longer available on the market, we are meeting new demand while reducing waste. Collaborations with original equipment manufacturers (OEMs) are also allowing greater reuse of rare earth oxides and improving recycling processes for complex material types. Additionally, we are creating a direct channel with global recycling partners to help us to achieve best-in-class recycling efficiencies across material types and improve our collective recycling knowledgebase.

All new cloud hardware programs must meet minimum recycled content requirements for plastic and steel. In addition, we've made progress integrating sustainability into our hardware processes and requirements, including a sustainability assessment that identifies design changes to improve material and energy efficiency throughout the length of the process. These include the qualifications of materials such as 20% certified recycled steel and 50% certified recycled resins. Over the past year, efforts to improve supply chain predictability and measurement have also enabled significant sustainability advancements. In 2024, our Boydton Circular Center completed a successful pilot for internally reusing solid-state drives, paving the way for broader reuse of high-impact components in the future.

Advancing circular cloud hardware and packaging continued

Increasing circularity of cloud packaging

In addition to advancing hardware circularity, Microsoft is dedicated to reducing the environmental impact of packaging. In 2024, we began to reduce the hard-to-recycle plastic-based expanded polyethylene (EPE) foam in cloud hardware packaging, replacing it with more sustainable paper and pulp alternatives. These efforts are part of a broader strategy that includes developing a multinational recycling program for datacenter server packaging waste and transforming server rack packaging through our Sustainable Rack Packaging System.

Last year, packaging from over 30,000 server racks was processed through our recycling program, diverting over 2,500 metric tons of waste from landfills. The program has now expanded to include packaging used to transport the new generations of AI server racks, and additional datacenter geographies.

Understanding and transforming the packaging landscape

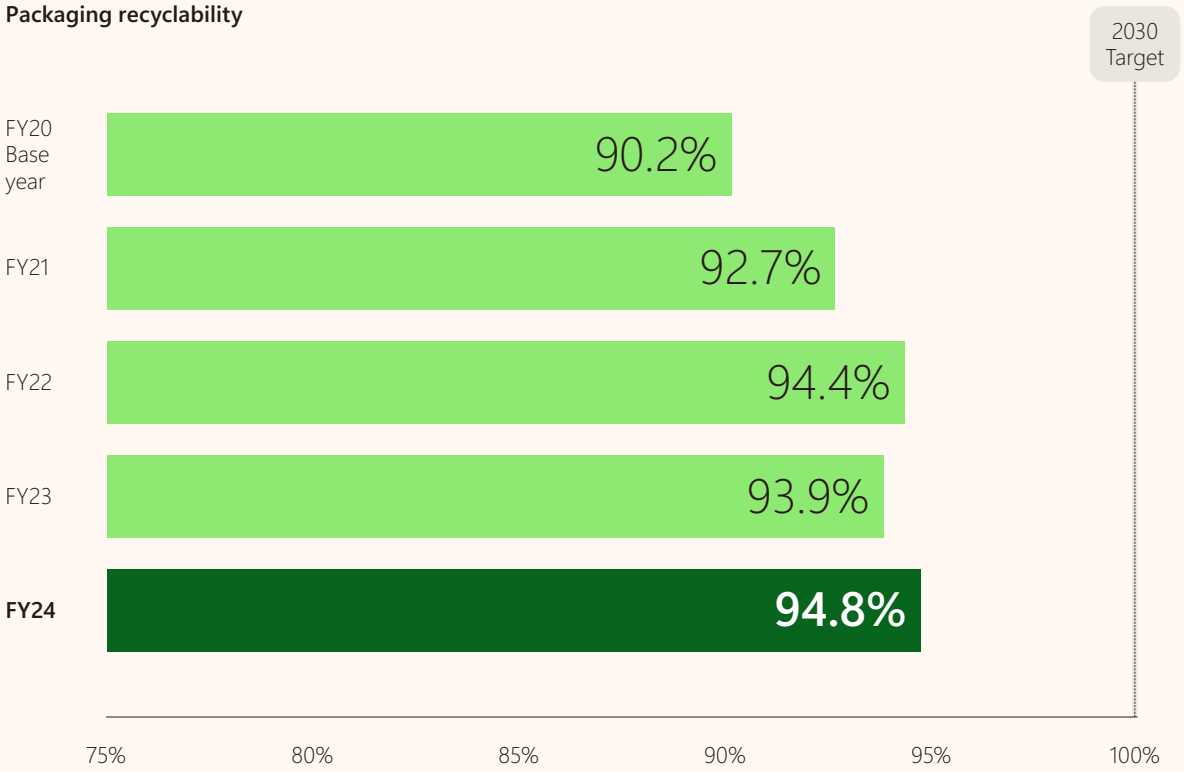
With over 150 OEMs supporting our fleet of datacenters, improving packaging sustainability requires systemic change across the supply chain. In 2024, the Sustainable Packaging Supplier Engagement Program was launched, working with high-volume suppliers, including the major hubs who ship IT hardware to our datacenters, to ensure packaging aligns with environmental sustainability goals from the earliest stages of hardware design.

Looking ahead, efforts will focus on addressing difficult-to-eliminate packaging materials such as rigid plastic trays and soft plastic foams, while continuing to develop technologies to track and transform packaging programs more effectively. Pilots are already underway with our systems integrators, who construct our racks, to provide circular applications for plastic trays. These initiatives reflect an ongoing commitment to advancing circular solutions for both hardware and packaging.

Waste Table 3

Designing our product packaging for circularity

In FY24 we achieved a rate of 94.8% recyclability across all Microsoft product packaging.



Find out more in our Data Fact Sheet

Improving device and packaging circularity

Devices and packaging are integral to Microsoft's circular economy strategy, complementing the zero waste initiatives implemented across datacenters. From improving the repairability of devices to redesigning packaging for recyclability and waste reduction, these efforts align with the principles driving progress in datacenter waste management, such as reuse, recycling, and material optimization. By applying a circular mindset, significant advancements have been made in both packaging and device design since 2020, with a focus on scaling these solutions across product lines.

Reducing waste in packaging design

Since 2020, we have been systematically phasing out single-use plastics in our packaging, and recyclability has been prioritized. In 2024, Surface Copilot+ PCs were introduced with the most sustainable device packaging to date, designed to use less material and minimize plastic content. In line with our targets, we continue to eliminate single-use plastics and improve the recyclability of packaging for all products.

Our Devices supply chain has introduced the utilization of lightweight, reusable expanded polystyrene pallets for shipments from our contract manufacturers, driving a carbon emission reduction of 1,528 $mtCO_2e$ out of our global logistics network.

For Xbox, a complete packaging redesign for all new Xbox Series S and X console models eliminated single-use plastic packaging, following a comprehensive redesign in fall of 2024. This included incorporating new paper cushioning solutions to replace plastic foam and eliminating plastic laminate films through paper-based labels and coatings. Similar improvements have been made across Xbox accessories, including adaptive controller remotes, with a focus on lower waste solutions.

Microsoft Devices supply chain has transitioned from the use of palletized containers to loose-loaded containers for shipments of Xbox consoles in ocean shipments from our contract manufacturers, driving emissions savings of 136 $mtCO_2e$ through load optimization.

INNOVATION IN ACTION

Designing for repairability

Repairability is a key priority for both Surface devices and Xbox consoles, driving efforts to extend product use and support a circular economy.

Surface devices are among the most repairable laptops and tablets in the industry, reflecting a strong dedication to circular design. Our first field-repairable product, Surface Laptop 3 in 2019, has evolved into our current portfolio featuring field replaceable units (FRUs) like the display, keyboard, solid state drive, motherboard, battery, and charging ports. Today our newest Surface devices include easily accessible options for both self-repair instructions and in-person expert repair service.[10]

Xbox console repairability also advanced in 2024 with the introduction of our first FRUs and service guides for console products, including key components such as HDMI ports, fans, and enclosures. Partnerships with in-person repair service providers, including UbreakiFix (Asurion).

Partnerships with in-person repair service providers, including UbreakiFix (Asurion) in the United States and Currys in the United Kingdom, bring repair closer to customers for both in-warranty and out-of-warranty repairs. Finally, the same FRUs available to our partners are also available to consumers and independent repair providers via iFixit.

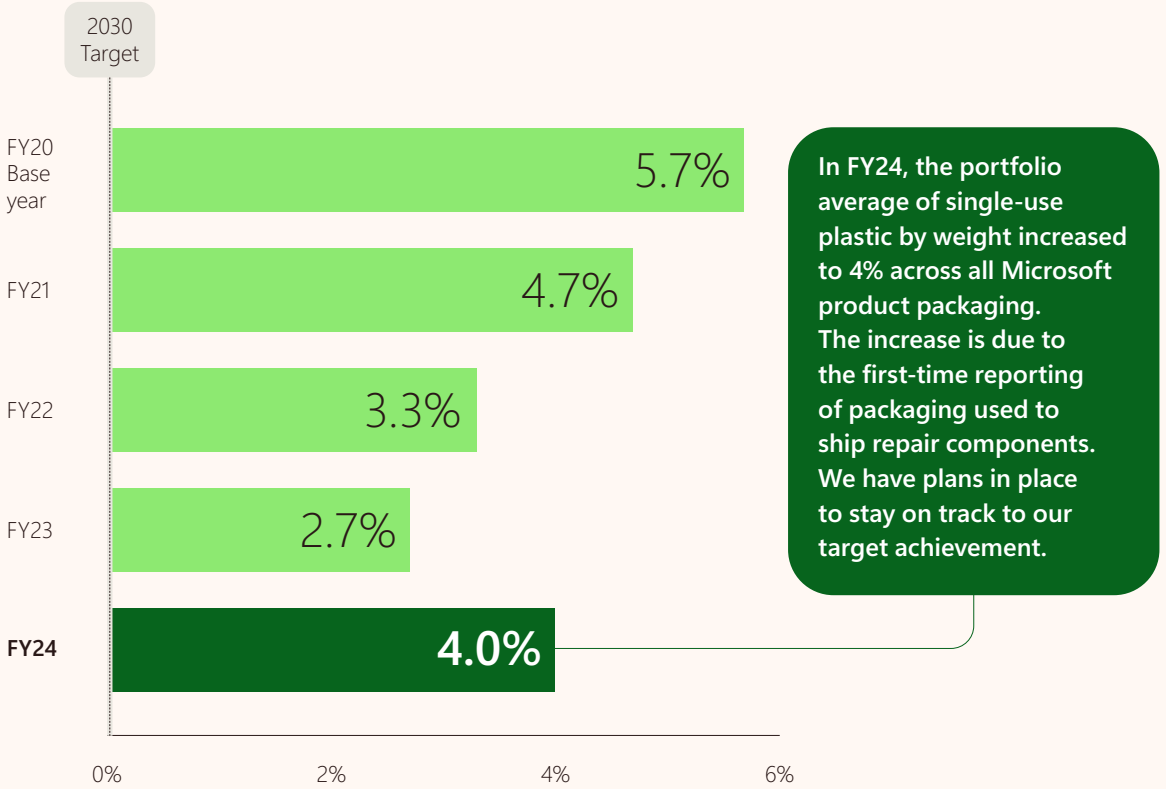
Improving device and packaging circularity continued

Waste Table 4

Reducing single-use plastics

In FY24 we achieved a rate of 4.0% single-use plastics across all Microsoft product packaging. Since FY20 we have decreased it by 1.7%.

Single use plastics



Find out more in our Data Fact Sheet

Improving data and supplier partnerships for circular design

Accurate data and strong supplier collaborations are essential to advancing circularity in devices. Microsoft has taken significant steps to improve the accuracy of recyclability calculations and promote waste reduction across the supply chain.

Since 2021, Microsoft has partnered with the United Nations Institute for Research and Development (UNITAR) to enhance recyclability assessments for materials used in electrical and electronic equipment. Over the past three years, batch tests in Italy and Germany have analyzed how recyclers handle end-of-life electronics and quantified the recycling process efficiency. These efforts, combined with Microsoft's recyclability assessment procedure, provide a more accurate method for calculating recyclability, yielding valuable insights to improve product design.

In 2024, supplier collaborations further strengthened circularity efforts. Microsoft worked with 82 supplier factories to achieve waste diversion rates of 90% or higher in the manufacturing process. Among these, 25 factories obtained UL 2799 Zero Waste to Landfill certification, and 57 factories passed the Responsible Sourcing annual waste data validation. Together, these efforts diverted more than 100,000 metric tons of waste from landfills or incineration.

Promoting responsible sourcing with device manufacturing

The collection of materials destined for recycling can have both environmental and social impacts. Our responsible sourcing criteria for recycled materials utilizes a third-party certification scheme that verifies the percentage of recycled content and assesses responsible sourcing practices at collection and processing sites. Five Surface products launched in FY24 are manufactured using recycled aluminum certified by the UL 2809 standard, which assesses labor safety, community impacts, and environmental contributions. These efforts reduce reliance on mining, minimizing its associated social and environmental impacts.

Improving device and packaging circularity continued

LEARNINGS AND WHAT'S NEXT

Microsoft has made tremendous progress towards zero waste over the past five years, including the accomplishment of two of our key targets ahead of schedule, the global deployment of our Circular Centers, and the establishment of robust methodology and governance processes. In 2025 and beyond, we're excited to accelerate our adoption of circular practices as we work to collaboratively find solutions for our most challenging materials.

Continuing prevention first. Preventing waste remains the core of our zero waste strategy. By prioritizing material reduction and reuse interventions across our enterprise, we lay a strong foundation for sustainability throughout our operations. We are also focused on reducing hard-to-recycle materials and deploying innovative circular solutions throughout the design process, ensuring that waste is minimized from the outset. By continually evaluating best practices, emerging data, and new technologies, we ensure that our investments target the highest-impact environmental solutions, further advancing our commitment to sustainability.

Expanding funding opportunities. To drive progress in circularity, Microsoft is committed to using its purchasing power to expand markets of circular initiatives. By supporting the scaling of these initiatives, we can strengthen solutions that address the most challenging materials and help accelerate broader adoption of circular practices.

Prioritizing localized solutions. Achieving true circularity requires localized infrastructure and solutions that both meet specific needs of communities and the global transition to a more circular economy. Our Circular Centers exemplify how companies can accelerate the material recapture of technical products while safeguarding intellectual property, and we look forward to expanding similar interventions and continuing to facilitate exchange of best practices. Partnerships, like those with local waste management companies and logistics service providers participating in the Cloud Logistics Rack Packaging Recycling program, demonstrate the importance of tailoring solutions to regional context.

Building on analytical insights. Data is central to the success of our waste programs and identifying opportunities for improvement. By maintaining high quality data governance and refining our methodologies, we ensure our approaches remain aligned with best business practices and regional realities. Combining quantitative data with qualitative insights from our regional operators allows us to make informed investments and advance our zero waste commitments.

Protecting ecosystems

Land protection

>30%

In 2022, we met our target of protecting more land than we use by 2025, a target we've since exceeded by more than 30%.

Healthy ecosystems are essential for life on Earth. They provide clean air, water, food, and countless other benefits that sustain communities, economies, and ecosystems globally. Yet these ecosystems face mounting threats from climate change and biodiversity loss, and require urgent and coordinated action.

Our approach

Microsoft recognizes the interconnectedness of ecosystem health with all aspects of sustainability. From supporting pollinator habitats at our campuses to integrating biodiversity into datacenter designs, we are embedding ecological considerations into our operations. Through partnerships with conservation organizations and the application of innovative technologies, we are helping to monitor, protect, and restore ecosystems, driving meaningful environmental impact at both local and global scales.

Total land protected
15,849 acres

Microsoft land use footprint
11,900 acres

Find out more in our Data Fact Sheet

Total land contracted to be protected
17,439 acres

Meeting our target of protecting more land than we use by 2025

As of FY24, Microsoft has contracted to protect 17,439 acres of land, and 15,849 acres were designated as permanently protected.

By 2025, we'll protect more land than we use.

Our target
Taking responsibility for our land footprint
We will take responsibility for the ecosystem impacts of our direct operations by protecting more land than we use by 2025.

Our progress
15,849 acres permanently protected
We have exceeded our land protection target of 11,900 by more than 30%.

Fostering biodiversity at campuses and datacenters

Microsoft is committed to advancing biodiversity through innovative approaches at our datacenters and campuses. By using data-driven tools, regenerative design principles, and sustainable practices, we are creating environments that support local ecosystems while reducing our environmental footprint.

Datacenters designed for biodiversity

Since 2020, Microsoft has been integrating biodiversity considerations into our datacenter development strategy. The introduction of the Ecosystem Intelligence tool has transformed how we assess the ecological impacts of our operations, evolving from basic environmental assessments for regulatory compliance to a comprehensive platform for measuring ecosystem service production around our datacenters. This shift allows us to take a more holistic approach to understanding and enhancing the ecosystems where we operate.

Guided by these insights, nature-based design solutions, such as native landscaping, stormwater management, and biodiversity enhancements, are reducing our environmental footprint and integrating ecological benefits into our datacenter designs.

To monitor the success of these initiatives, we have deployed Microsoft Premonition technology, an AI-driven ecological monitoring tool that provides real-time insights into species populations and ecosystem health. This approach allows us to track the impact of our biodiversity efforts and refine them for greater global scalability. As these efforts expand, we are committed to aligning our datacenter development with regenerative design principles that prioritize resilience.

Supporting biodiversity at campuses

Our campuses also play a vital role in supporting biodiversity. At our Puget Sound campus, native Washington species such as red-twig dogwood, vine maple, and huckleberry have been planted to reduce irrigation needs and enhance local habitats. Pollinator gardens and strategically placed beehives and bee hotels are bolstering the honeybee population, contributing to pollination and ecological health in the area. In 2024, more than 40 pounds of honey were harvested from eight frames—a direct result of thriving bee activity.

To further enhance biodiversity, we updated our Global Sustainability Standards to incorporate ecologically conscious practices in our campuses. These updates include:

- Requiring the use of native and adaptive plants in landscaping to support local ecosystems and reduce water use.
- Meeting LEED bird collision standards by installing bird-safe glass and limiting nighttime lighting to protect migratory birds.

These initiatives reflect our dedication to sustainable design and achieving our goal of supporting the ecosystems around our facilities.

PARTNERING FOR IMPACT

Project Positive

Pioneering nature-inspired design solutions

Through a collaboration with Biomimicry 3.8 and its Project Positive CoLab, Microsoft is pioneering nature-inspired design solutions that align with regenerative principles. By applying biomimicry, we aim to improve ecosystem health, reduce environmental impacts, and create long-term positive contributions to biodiversity and resilience at our datacenter campuses.

In North Holland, our datacenter ecosystem restoration project has entered its next phase, focusing on soil remediation and the introduction of diverse plant species to foster year-round biodiversity. These efforts are creating thriving habitats for birds, insects, and other wildlife, demonstrating how datacenters can actively contribute to ecological health.

Collaborating to protect ecosystems community-wide

Microsoft is taking action to support the communities that host datacenters and where employees live and work by advancing projects that protect and restore natural environments. Through the Microsoft Community Environmental Sustainability program, launched in 2020, 123 programs have been implemented across 39 global cities hosting Microsoft datacenters. Initially focused on hyper-local efforts, the program has evolved into a principle-based initiative deploying scalable, community-focused environmental projects aligned with datacenter growth. Its guiding principles include addressing local needs, integrating technical knowledge, and prioritizing partnerships with local organizations.

Between July 2023 and October 2024, community investment efforts focused on ecological restoration, urban forestry, grassroots engagement, and community development. This work included planting 77,657 trees, benefiting native species and creating over 2.7 million square meters of improved green spaces—equivalent to approximately 378 standard soccer fields.[11]

+39 cities

Since 2020, we have implemented 123 programs across 39 global cities to support communities that host datacenters by protecting and restoring natural environments.

Restoration projects near datacenters

Microsoft's collaboration with the Root-Pike Watershed Initiative Network (Root-Pike WIN) in southeastern Wisconsin demonstrates how ecosystem restoration can address local environmental challenges while fostering community resilience.

The flagship Lamparek Creek Restoration project addresses decades of degradation caused by urban development and agricultural runoff. Restoration measures such as stabilizing streambanks, reintroducing native vegetation, and implementing stormwater management practices are enhancing water quality, flood control, and biodiversity. This work creates critical habitats for fish, birds, and pollinators while improving recreational opportunities for residents.

In addition to Lamparek Creek, broader urban habitat restoration efforts in Racine County focus on creating green corridors, revitalizing degraded land, and increasing access to natural spaces. Education and outreach initiatives empower residents to sustain these benefits over time, connecting communities to restored ecosystems and fostering long-term stewardship. Together, these projects reflect Microsoft's holistic approach to ecological restoration, aligning local priorities with broader sustainability goals.

Collaborating to protect ecosystems community-wide continued

Collaborating to restore urban forests

Urban forestry projects have been a cornerstone of Microsoft's environmental sustainability efforts over the past five years, particularly in cities hosting datacenters. These initiatives improve local ecosystems, and prioritize underserved neighborhoods and vulnerable populations.

Through multiyear partnerships with organizations like One Tree Planted and American Forests, Microsoft has expanded urban forestry efforts to enhance green spaces, mitigate urban heat islands, and improve stormwater management. One Tree Planted has supported the planting of 87,000 trees across nine projects in eight countries, delivering tangible environmental benefits while engaging local communities to sustain these efforts.

The collaboration with American Forests focuses on advancing Tree Equity in underserved neighborhoods, ensuring that tree canopy coverage provides cooling, improved air quality, and public health benefits. This work has included over 15 targeted projects and incorporates workforce training programs that create economic opportunities by equipping residents with urban forestry skills.

Together, these initiatives showcase the interconnected benefits of urban forestry, including biodiversity enhancement, mental well-being, and opportunities for environmental education. Microsoft's efforts demonstrate the role trees play in creating healthier, more resilient urban environments while fostering community resilience.

PARTNERING FOR IMPACT

ChangeX

Scaling grassroots impact

With funding and partnership from Microsoft, the ChangeX platform empowers communities to take localized action by providing resources, guidance, and tools to launch impactful sustainability projects. ChangeX simplifies community initiatives through step-by-step guides, practical frameworks, and financial assistance, enabling residents to implement projects that address local environmental and social challenges.

ChangeX helps communities:

Access actionable ideas. Communities can select from pre-vetted project ideas tailored to local needs, such as urban tree-planting, pollinator gardens, and environmental education.

Implement projects with confidence. Once a project is chosen, ChangeX offers seed funding and actionable frameworks to accelerate planning and implementation.

Measure and share results. Participants document progress and share outcomes through the platform, enabling replication and scalability in new locations.

Since partnering with Microsoft, ChangeX has supported over 140 community funds worldwide, creating scalable models for grassroots-led environmental restoration and community engagement. By equipping local leaders with the tools to address their unique challenges, this partnership extends the reach of Microsoft's sustainability efforts while fostering localized, community-driven impact.

Collaborating to protect ecosystems community-wide continued

Advancing community vitality through ecosystem restoration

The Datacenter Community Environmental Sustainability program prioritizes local needs and long-term benefits that promote ecosystems, community health, and well-paying jobs.

Key initiatives include:

- **Workforce development.** Programs like the Arizona Clean Energy Workforce Development Program provide job training opportunities, equipping residents with skills for careers in clean energy and environmental restoration. These initiatives create pathways for economic mobility and sustainable community growth.
- **Urban habitat restoration.** Projects in Racine County, Wisconsin, connect communities to green spaces, reduce environmental risks, and foster long-term stewardship through education and engagement.

Microsoft supports enhanced biodiversity, mental and physical well-being, and opportunities for community-led sustainability.

Advancing standards-based restoration globally

As part of our work to protect and restore ecosystems, Microsoft is collaborating with the Society for Ecological Restoration (SER) to implement standards-based projects in communities hosting datacenters worldwide. This partnership stands out for its focus on aligning local restoration efforts with global restoration standards, ensuring projects deliver measurable, long-term benefits for biodiversity and climate resilience.

Since the partnership's inception in 2022, 26 restoration projects have been completed. These initiatives span diverse ecosystems, including wetlands, grasslands, and urban green spaces, addressing critical challenges such as biodiversity loss, habitat degradation, and climate adaptation.

Other key efforts include:

- **Wetland restoration**—enhancing water filtration, flood resilience, and habitats for native wildlife.
- **Grassland rehabilitation**—revitalizing pollinator habitats and improving soil stability.
- **Urban ecosystem connectivity**—establishing green corridors that restore biodiversity while enhancing quality of life for local communities.

By partnering with SER, Microsoft ensures that restoration projects near datacenters adhere to science-informed methodologies, contributing to a global framework for ecological health. This collaboration complements broader efforts like urban forestry and reforestation, underscoring Microsoft's holistic approach to ecosystem restoration across all areas of operation.

PARTNERING FOR IMPACT

White stork restoration

Restoring vital wetland habitats

Microsoft is collaborating with the Society for Ecological Restoration to promote white stork wetland restoration in southern Sweden. Once nearly extinct in the region, the white stork is now thriving thanks to a collaborative effort that restored vital wetland habitats. These wetlands not only provide essential breeding grounds for the stork but also support a wide range of species, improve water filtration, and enhance flood resilience.

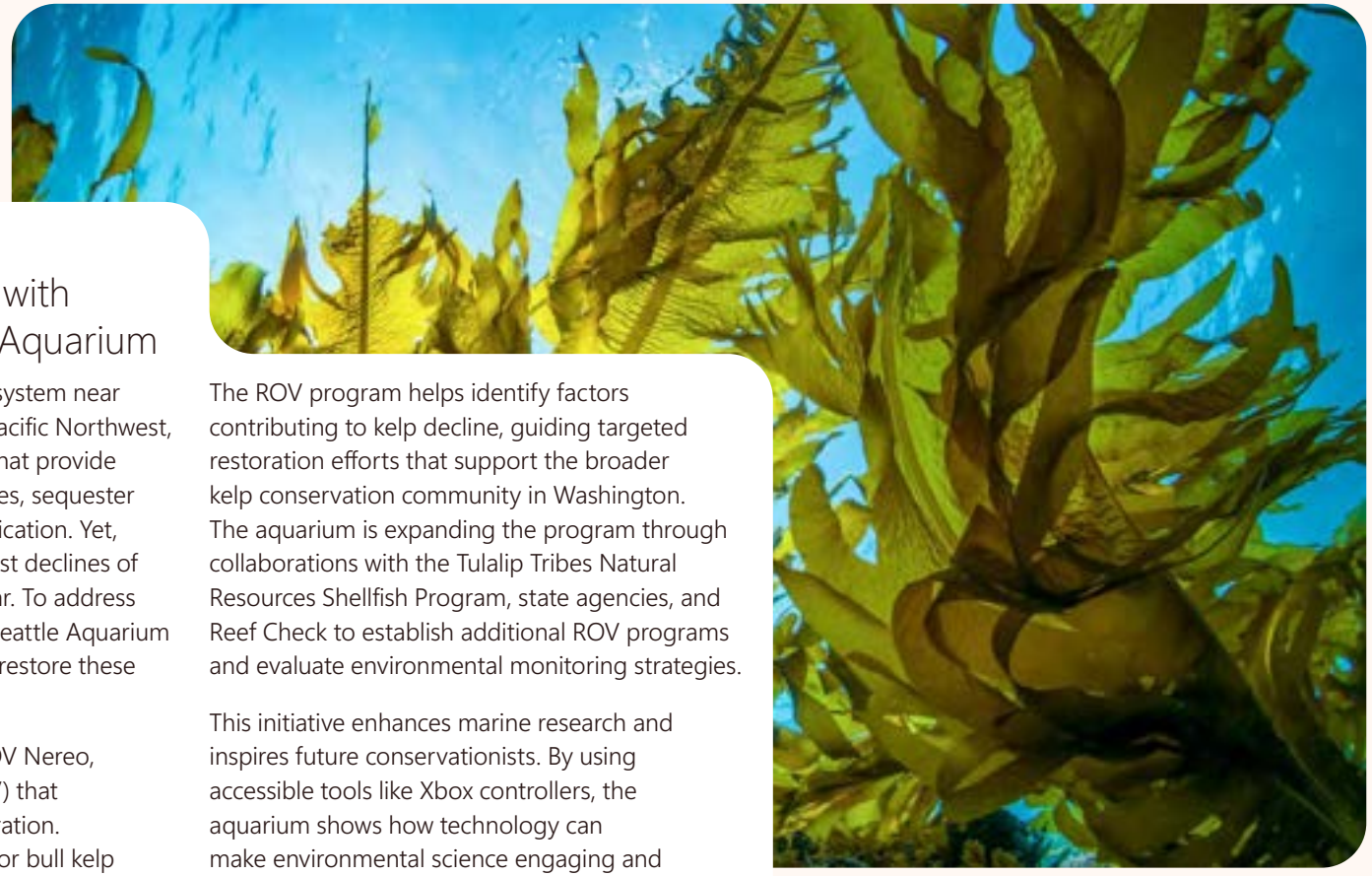
Advancing conservation through technology

Technology is revolutionizing environmental conservation, enabling researchers, communities, and organizations to better understand and protect fragile ecosystems.

In 2020, as part of Microsoft's commitment to protect and preserve ecosystems, we announced the development of the Planetary Computer—a platform designed to aggregate global environmental data and enable data-driven decision-making for sustainability. By April 2021, the Planetary Computer was launched as a full-fledged offering, combining petabytes of data with advanced spatial analysis tools to support global-scale environmental monitoring and accelerate sustainability applications.

The Planetary Computer represents a cornerstone of Microsoft's approach to using technology for biodiversity restoration, ecosystem health monitoring, and climate resilience. Its capabilities complement other initiatives driven by Microsoft and its partners, from localized innovations to global-scale applications, unlocking new possibilities for conservation and restoration worldwide.

PARTNERING FOR IMPACT



Salish Sea

Restoring kelp forests with Xbox and the Seattle Aquarium

The Salish Sea, a vast marine ecosystem near Microsoft's headquarters in the Pacific Northwest, is home to dynamic kelp forests that provide food and shelter for marine species, sequester carbon, and mitigate ocean acidification. Yet, some regions have seen kelp forest declines of up to 95%, with causes still unclear. To address this, Xbox is partnering with the Seattle Aquarium on a groundbreaking initiative to restore these critical habitats.

At the heart of this efort is the ROV Nereo, a remotely operated vehicle (ROV) that gathers data to inform kelp restoration. Named after the scientific name for bull kelp (Nereocystis luetkeana), the ROV Nereo is a small, maneuverable device capable of diving 100 meters and transmitting live video and data. Researchers use Xbox controllers to navigate through dense kelp ecosystems in Elliott Bay, enabling precise exploration and analysis.

The ROV program helps identify factors contributing to kelp decline, guiding targeted restoration efforts that support the broader kelp conservation community in Washington. The aquarium is expanding the program through collaborations with the Tulalip Tribes Natural Resources Shellfish Program, state agencies, and Reef Check to establish additional ROV programs and evaluate environmental monitoring strategies.

This initiative enhances marine research and inspires future conservationists. By using accessible tools like Xbox controllers, the aquarium shows how technology can make environmental science engaging and approachable. Through education and outreach, the program fosters appreciation for kelp forests and the marine life they support, strengthening community connections to these ecosystems.

Advancing biodiversity monitoring with AI

Building on localized efforts like the Seattle Aquarium's ROV program, Microsoft is scaling biodiversity conservation globally with AI-driven tools that empower conservationists to tackle some of the most complex and time-intensive challenges for environmental conservation—especially biodiversity and ecosystem reporting. Traditional methods often require years of research and massive resources to analyze and document the health of ecosystems. AI has emerged as an essential tool to bridge this gap, enabling researchers, governments, and companies to scale monitoring efforts, analyze intricate datasets, and generate actionable insights with unprecedented efficiency.

At Microsoft, we are committed to advancing the application of AI to monitor and report on ecosystem health, ensuring conservation efforts are both data-driven and impactful.

INNOVATION IN ACTION

Scaling AI tools for conservation

Through the Microsoft AI for Good Lab, Microsoft is supporting researchers worldwide to address biodiversity challenges with new AI-driven tools.

Scaling AI tools for conservation

Recognizing the challenges of applying AI in real-world conservation scenarios, the AI for Good Lab developed Pytorch Wildlife, an open-source platform for creating, modifying, and sharing powerful AI conservation models. Accessible through platforms like GitHub and Hugging Face, Pytorch Wildlife is designed for users with limited technical expertise. Its modular codebase simplifies customization and enables broader adoption of AI-driven biodiversity monitoring solutions.

Protecting the Amazon

In Colombia, Project Guacamaya combines AI with satellite imagery, wildlife imagery, and bioacoustics monitoring to protect Amazonian ecosystems. The joint effort of the Microsoft AI for Good Lab, Universidad de los Andes, and Instituto Humboldt uses AI to identify bird and non-bird sounds in the rainforest, providing critical insights to combat ecological threats. By analyzing more than 100,000 sounds with over 80% reliability in species identification, the project enables rapid response to ecological shifts, improving stewardship of the Amazon.

Accelerating conservation in Tanzania

In Tanzania, the Wild Nature Institute (WNI) is using AI to protect endangered Masai giraffes by automating the labor-intensive process of sorting and labeling photographs. The Microsoft computer vision workflow isolates the giraffe in images, applies object detection to focus on the torso, and uses a matching algorithm to identify existing giraffes or assign IDs to new ones.

This AI-enabled process reduces image analysis from hours to minutes, allowing WNI to process a library of 50,000 images with timely data to monitor population efficiently. The insights generated guide conservation strategies and ensure timely interventions to protect this endangered species.

Advancing conservation through technology continued

Scaling ecosystem monitoring to energy systems

Just as AI supports biodiversity conservation, it also plays a critical role in addressing climate goals by enabling precise monitoring of renewable energy systems and their impact on ecosystems. The Global Renewables Watch (GRW), a collaboration between Microsoft, Planet Labs PBC, and The Nature Conservancy, uses AI and satellite imagery to track clean energy transitions while considering land use and environmental impacts.

The GRW is an atlas of all utility-scale wind and solar installations, covering every country from 2017 to 2024. Offering insights on land use trends and environmental impacts, GRW fills critical gaps in renewable energy monitoring. Initially launched as a regional project, it has grown into a global resource that empowers governments, businesses, and researchers to track progress toward climate goals such as the Paris Agreement and UN SDG 7.

Our work on the GRW highlights the importance of transparent, accessible data in driving sustainable change. By democratizing access to renewable energy insights, we empower decision-makers to make informed, responsible environmental choices and accelerate global clean energy adoption.

LEARNINGS AND WHAT'S NEXT

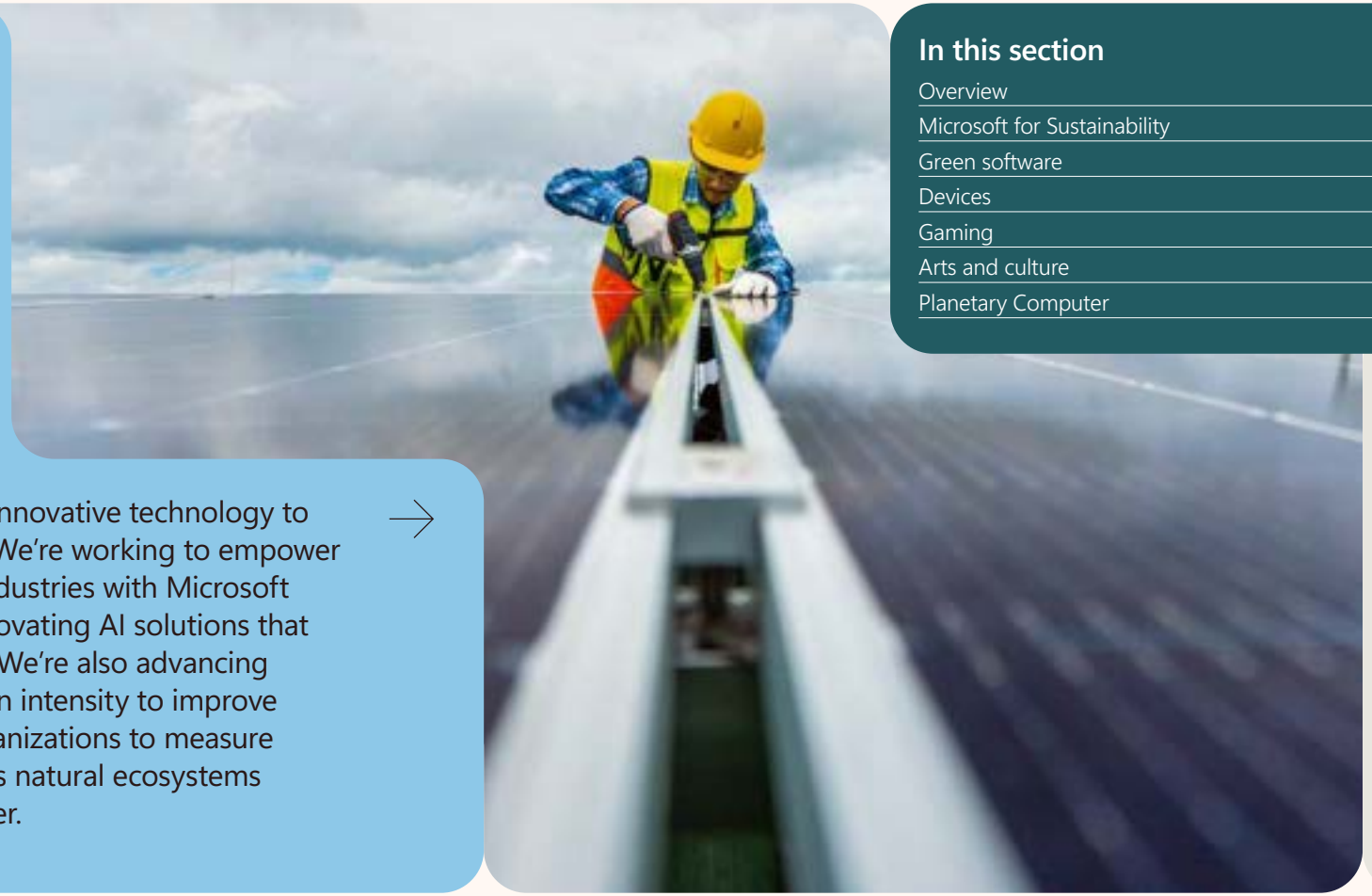
Scaling ecosystem restoration and community impact. As part of the Microsoft Datacenter Community Pledge, these efforts will continue to expand alongside datacenter growth. By focusing on restoring ecosystems, enhancing native habitats, and promoting green spaces, we aim to scale our impact while advancing sustainability globally. Innovative tools, such as AI-driven solutions, and strengthened partnerships will further optimize these efforts and measure long-term success. These efforts aim to ensure lasting benefits for the communities where we operate.

Driving innovation through technology. Investments in cutting-edge technologies, including AI and platforms like the Planetary Computer, will remain central to Microsoft's strategy for addressing emerging threats to ecosystems from climate change and biodiversity loss. By advancing tools that empower conservationists and accelerate environmental monitoring, we aim to support long-term ecosystem resilience on a global scale.

Designing datacenters and campuses to support local ecosystems. Microsoft will continue to prioritize our role as an environmental steward, fostering spaces that balance functional and environmental goals. Through a regenerative approach, we will further enhance local biodiversity by integrating sustainable design practices, such as native landscaping and water-efficient technologies, into datacenter and campus infrastructure. These efforts aim to create spaces that support thriving ecosystems while enabling technological innovation.

Customer sustainability

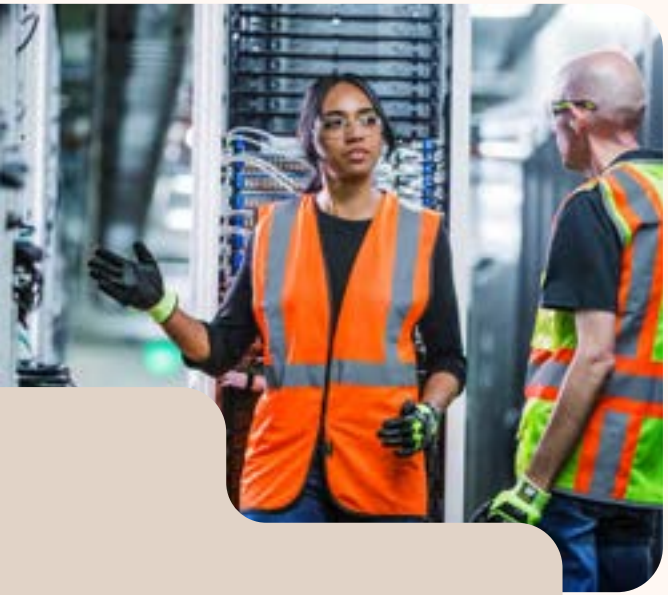
Accelerating progress through technology



In this section

Microsoft is committed to providing innovative technology to help build a more sustainable world. We're working to empower our customers and partners across industries with Microsoft for Sustainability, by continuously innovating AI solutions that help accelerate climate technologies. We're also advancing greener software and reducing carbon intensity to improve device sustainability, and helping organizations to measure and manage the health of the planet's natural ecosystems with the Microsoft Planetary Computer.

Microsoft for Sustainability: Creating impact with data and AI



Our own sustainability journey highlights the challenge of turning environmental, social, and governance (ESG) data into useful insights that drive innovation and optimization. From sourcing and structuring data to improving transparency and auditability, we bring our learnings from that journey into solutions that help organizations move from intent to impact. Microsoft for Sustainability helps organizations navigate evolving regulations, gain insights, reduce costs, and strengthen business resilience.

With centralized data and AI-powered insights, organizations can streamline ESG data collection, validation, and disclosure processes setting a foundation to advance their sustainability goals. Microsoft Sustainability Manager and Microsoft Fabric empower customers to centralize emissions and ESG data across their value chain for auditable reporting, so customers can better inform business decisions around optimizing efficiency and performance.

Accelerating progress with AI

We believe AI is essential for advancing sustainability progress at speed and scale; empowering organizations to measure, predict, and optimize complex systems; and empowering the sustainability workforce. To take advantage of this potential, we're bringing our best AI capabilities to Microsoft for Sustainability.

In Sustainability Manager, customers can now undertake deeper analysis, identifying outliers, trends, and correlations with intelligent insights and forecasting outcomes with "what-if" scenarios. Using Microsoft Copilot in Sustainability Manager, they can intelligently capture data from documents by using chat with Q&A functions, generate calculation models, and prepare for voluntary and mandatory disclosures.

In 2024, we also released sustainability data solutions in Microsoft Fabric, helping organizations to centralize their data estate for deeper ESG analysis within a single, AI-powered platform for advanced analytics and reporting insights. Fabric has AI ingrained at every level to unlock data intelligence and actionable insights for faster progress.

Organizations can now reduce their environmental footprint by optimizing their infrastructure, consolidating workloads, and leveraging energy-efficient services. Microsoft for Sustainability provides tools to measure and manage emissions, water, and waste across operations, helping teams make data-driven decisions that align with sustainability goals. This enables a shift from reactive compliance to proactive impact reduction.

Customers using Microsoft for Sustainability can embed sustainability into their core operations and decision-making, uncover new efficiencies, optimize supply chains, advance research and materials innovation, build business resilience, and differentiate in the market. Microsoft's solution ecosystem empowers customers to scale these efforts with confidence and agility.

Microsoft for Sustainability continued

Scaling progress with customers

Microsoft for Sustainability uses technologies from the Microsoft Cloud portfolio to help customers and partners through custom industry-tailored and geo-based solutions.

Envirotainer

Envirotainer, a cold chain solution provider for transporting temperature-controlled pharmaceuticals, needed to more efficiently collect and analyze emissions data across 100 airlines and 600 pharmaceutical companies as part of its ambitious sustainability goals. The company turned to Sustainability Manager to automate data collection and emissions analysis, aiming to improve data transparency and energy-efficient logistics across its global network. Now Envirotainer can measure and report across its value chain and use insights to form reduction strategies to help reach net zero by 2050. While reducing data processing from a full day to minutes, the company has reduced energy costs and waste, streamlined decision-making and alignment to science-based targets, and reinforced its endorsement of a more sustainable future.[12]

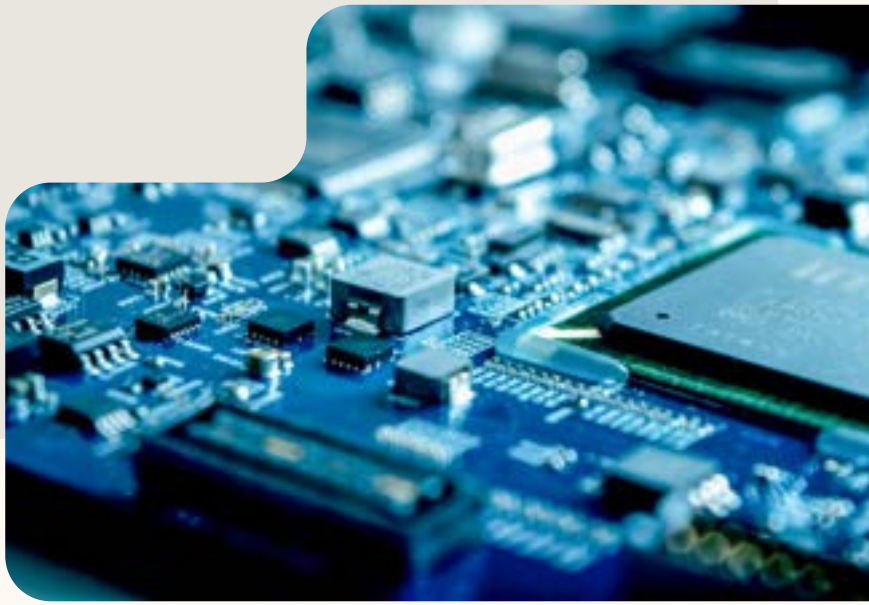
ICONICS

A pioneer in cloud-based Internet of Things (IoT) solution development for buildings and manufacturing, ICONICS was an early adopter and launch partner for Microsoft for Sustainability. This gave the company an early foothold to extend its solutions and support customers' ESG reporting needs using Sustainability Manager. ICONICS customers can publish data collected by ICONICS to Sustainability Manager for ESG reporting, and ICONICS provides ongoing operational insights and dashboards to help them improve efficiencies and meet their sustainability objectives.[12]

> "Technology can't solve every environmental issue, but it can help us manage, understand, and hold ourselves accountable for action. It enables us all to focus and align on the right aspects, those that truly impact usage, and helps us to hunt for the less obvious aspects in the data for a more positive impact."
>
> **Kyle Reissner**
> VP of Product Management, ICONICS

Esri

Effectively planning and responding to urgent environmental challenges, particularly extreme weather events, presents major challenges for cities. Esri's ArcGIS geospatial platform helps local governments and public safety staff navigate, adapt to, and mitigate the effects of an increasingly changing climate. Used alongside Microsoft Azure, organizations can model potential extreme weather scenarios and identify potential impacts to plan a more resilient community. Cities can use ArcGIS to create environmental digital twins that simulate heavy rainfall and apply hot spot analysis, and chat functionality supported by large language models lets users interact directly with digital twins.[12]



Green software: Optimizing efficiency from code to cloud

By embedding green software engineering principles into every stage of the software life cycle—from design to deployment—we can make applications more energy and hardware efficient. Collaborating with leaders like the Green Software Foundation and using tools like the Software Carbon Intensity (SCI) specification, we continue to empower developers, customers, and partners to integrate sustainable practices into their workflows and create software solutions that align with sustainability goals.

Maximizing cloud sustainability: Smarter workloads, lower carbon

As a leader in designing, building, and operating cloud computing infrastructure across the full hardware and software stack, Microsoft has a unique ability to optimize how these elements work together to maximize both performance and efficiency. From datacenters and servers to silicon, code, algorithms, and AI models, achieving efficiency in a hyperscale cloud environment requires a comprehensive approach—optimizing each individual component and considering how the system works to minimize resource demand.

One method for improving power efficiency in our datacenters is through real-time workload scheduling—maximizing hardware use to meet fluctuating demand. For instance, higher demand during peak hours in one region can be balanced by running AI training workloads during off-peak hours elsewhere, ensuring idle hardware is used efficiently and improving overall power utilization.

Carbon optimization in Azure empowers Azure developers and IT professionals with the data and insights to better optimize the carbon footprint of their cloud resources. It provides more granular emissions data, identifies underutilized resources for deletion or rightsizing, and delivers actionable recommendations to help reduce both emissions and costs. Accessible directly within the Azure Portal, this tool helps organizations to align their cloud infrastructure with their sustainability goals while driving meaningful environmental impact.

The general availability of hibernation for general-purpose virtual machines on Azure allows users to deallocate virtual machines while preserving the in-memory state, enabling energy and resource savings by pausing workloads during idle periods.

Together, these innovations can help customers align their cloud infrastructure with sustainability goals, maximizing efficiency and minimizing environmental impact.

Green software continued

Reducing the impact of greater AI intelligence

Optimizing AI applications is a critical challenge as large-scale models like generative large language models (LLMs) demand complex, power-intensive AI accelerators, raising both costs and environmental concerns. To address this, Microsoft is developing comprehensive best practices and guidelines for designers, developers, and operators to help ensure that AI applications are efficient and optimized throughout their life cycle. These guidelines will be published as part of the Azure Well-Architected Framework for AI.

The new guidance provides AI architects with best practices to help them address many key requirements for reliability, security, performance efficiency, operational excellence, and cost optimization. It offers a more complex approach, covering architectural considerations across the stack—from infrastructure and data layers to application logic—blending Well-Architected Framework principles into every level to empower teams to design smarter, more sustainable AI workloads.

Our research teams are advancing efficiency through innovative solutions that benefit not only Microsoft but also the global research community. For example, a novel approach to LLM inference splits the two phases of inference requests, prefill and decode, across separate machines using hardware optimized for each phase (even taking advantage of older generation accelerators). Compared to current designs, this technique can deliver 2.35 times more throughput under the same power and cost budgets.

Leading the charge: Advancing standards, tools, and best practices for sustainable software

Since co-founding the Green Software Foundation (GSF) in 2021, Microsoft has built a trusted ecosystem of people, standards, tooling, and best practices for creating and building green software. As a steering member, Microsoft has collaborated extensively with other industry leaders and developers on open-source projects to make key advancements, from contributions to standards like the Real Time Energy and Carbon Standard for Cloud Providers, Transforming Organizations for Sustainable Software, and the Software Carbon Efficiency Rating, to developing tools like the Impact Framework, Azure Importer, and Organizational Maturity Matrix. Microsoft also offers leadership within working groups like the Green AI Committee. Microsoft's contributions have been essential, offering expertise, use cases, and strategic applications to these projects.

In 2024, within the GSF, we particularly focused on adoption of the SCI specification as an internationally recognized ISO standard. This specification defines a methodology for calculating the rate of carbon emissions for a software system. SCI helps users and developers make informed choices about which tools, approaches, architectures, and services they use by accounting for energy efficiency, hardware efficiency, and carbon awareness of software applications.

Empowering developers with tools for a carbon-conscious future

Empowering the developer community is vital to increase the adoption of green software practices. There are over 150 million developers on GitHub, including a thriving open-source software community focused on climate technology.

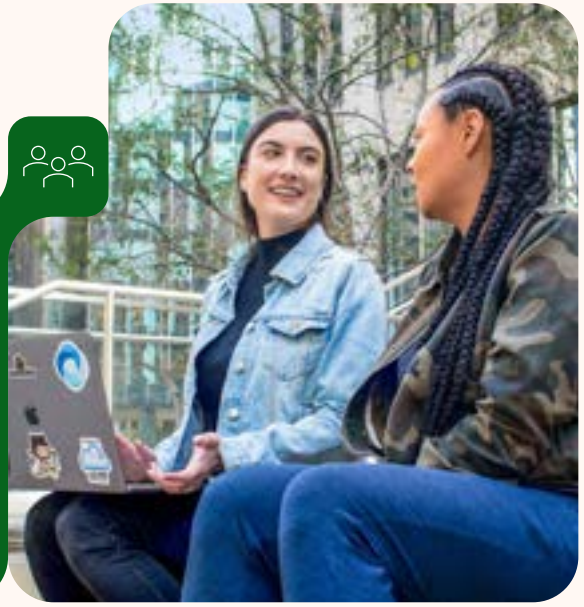
To better support developers, whether they're just starting out or seasoned professionals, we've compiled a comprehensive directory of resources built by the community, for the community: GitHub's Green Software Directory. Highlighted projects include the Carbon Aware SDK from the Green Software Foundation, Scaphandre from French organization Hubblo, and CO_2.JS from the Green Web Foundation.

There are over 60,000 climate-focused open-source software projects on GitHub, many of them listed and categorized by the community in the Open Sustainable Technology repository.

150 million

There are over 150 million developers on GitHub, including a thriving open-source software community focused on climate technology.

Check out the 10 best tools to help lower your carbon footprint.



Green software continued

Over the last year, GitHub has also begun identifying methods to help climate-focused groups scale their impact on the platform. This has included engaging with student developers by sponsoring the Climate Change AI summer school and the ClimateHack.AI machine learning competition where student developers shared models to optimize renewables for the grid in India on GitHub.

Microsoft has also focused on proofs of concepts (POCs) that help prioritize sustainability in software development. For example, one POC uses architectural drawings to measure the potential carbon in the software solution, offering actionable recommendations to reduce emissions and contextualize impact with relatable, real-world comparisons. Another POC uses GitHub Copilot to create an extension that suggests greener coding practices in the software integrated development environment (IDE). These innovations encourage developers to account for carbon costs early in the development process and foster sustainability from the outset.

Determining whether AI is truly necessary to achieve a desired outcome is another critical aspect of sustainable development. Responsible deployment of AI ensures that resources are used judiciously, avoiding unnecessary reliance on high-cost, energy-intensive solutions. By focusing on scenarios where AI creates meaningful, innovative impact, developers can balance the transformative potential of AI with its resource demands.

Accelerating progress in green software

The creation of developer enablement resources and tools for more sustainable software development aims to embed sustainable practices into the software development life cycle at Microsoft and beyond. As we collectively move forward, using AI to assist developers in making informed decisions about carbon spending will accelerate the ongoing journey to establish and improve measurement, monitoring, and progress in carbon savings through software efficiencies.

Currently, Microsoft is collaborating with GSF and its members via the Green AI Committee. Early projects include developing a white paper detailing the fundamentals of Green AI, a policy position paper for legislators and media, and supporting development of SCI for AI within the Standards Working Group.

Our research teams are advancing efficiency through innovative solutions that benefit not only Microsoft but also the global research community.

Devices: Prioritizing sustainability across the life cycle of Microsoft Surface devices

Microsoft Surface is at the forefront of advancing sustainability, reflecting a holistic drive to reduce environmental impact across product design, supply chain operations, and packaging innovations. We design products that prioritize sustainability throughout the product life cycle, embracing the principles of the circular economy, reducing carbon impact, and minimizing waste.

In the last year, we made significant progress towards lowering carbon emissions during the manufacturing process and throughout the supply chain, utilizing more recycled materials, and implementing energy efficiency features. We reduced the carbon footprints of our Spring 2024 Surface Pro and Surface Laptop products compared to previous models in those product lines while still delivering better performance for customers.

Designing in recycled content

We have reduced the life cycle carbon footprint of our devices by using more recycled materials and avoiding the mining of new materials, where feasible, to further decrease emissions related to resource extraction and processing. We focus our efforts on materials with the highest carbon impact, to reduce emissions where it counts the most.

Our Surface Copilot+ PCs now feature

100%

recycled aluminum alloy in the enclosures, and

100%

recycled rare earth metals in magnets.[8]

Devices continued

In addition to extending battery life every day,[13] enabling Energy Saver on a Surface Pro (11th Edition - Wi-Fi) can increase average energy efficiency by up to 24.2%.[14]

24.2%

Reducing the energy demands of device usage

Ongoing energy efficiency continues to be a focus for our devices. Our new Copilot+ PCs deliver higher performance while using less energy. For example, our Surface Laptop (7th Edition) uses less energy than Surface Laptop 5 and is ENERGY STAR® certified, 71% better than the ENERGY STAR® limit. Additionally, we're seeing the benefits as our own employees adopt new Copilot+ PCs. Surface Laptop (7th Edition) and Surface Pro (11th Editon) in use by our own employees are up to 42% more energy efficient than previous generations.[15]

Software is equally critical to device efficiency. Windows 11 PCs now come with ways to use less power and extend battery life. Windows 11 Energy Recommendations offer reductions in energy consumption from the adoption of more efficient screen, sleep, and power settings. Energy Saver offers a smart solution to extend your PC's battery life and reduce energy consumption without sacrificing performance. Ideal for both battery-powered and plugged-in PCs, this feature is not only optimized for laptops but also available for desktops to conserve energy continuously.

Through a combination of our use of recycled materials, more efficient manufacturing processes, and our suppliers' use of carbon-free electricity, the life cycle carbon footprint of Surface Pro (11th Edition) was reduced by 27% and the life cycle carbon footprint of Surface Laptop 15" (7th Edition) was reduced by 41% compared to baseline (no interventions).[16] This achievement is the result of collaboration between our Surface product design and development teams, Ecodesign, Sourcing, and Manufacturing teams, identifying and executing high impact interventions.

By integrating these practices, we aim to create products that not only meet the needs of our customers but also reduce our impact on the environment. In FY24 Surface reduced Scope 3 emissions by 29% from FY23. While we still have a long way to go, we are working hard to implement more innovative solutions and practices across our product development and operations.

Revolutionizing repairability: Simplifying repairs and expanding device lifespan

Over the last six years, Microsoft has developed a comprehensive portfolio of repairable devices, supported by a robust repair network. Our first field-repairable product, Surface Laptop 3, has evolved into our current portfolio featuring field replaceable units like the display, keyboard, solid state drive, motherboard, battery, and charging ports.

With repairable products, both repair instructions and the availability of spare parts are important next steps. Service guides for our Surface devices are now published and publicly available in both written and video formats. Spare parts can be obtained through commercial channels and retail outlets such as the Microsoft Store and iFixit. Additionally, we have established an Authorized Service Provider (ASP) network to bring certified Microsoft repair closer to our customers. ASPs are now available in multiple countries globally, serving both consumer and commercial channels. This transformation in repairability has allowed us to deploy same-unit repair in many countries, supporting warranty repair where previously an exchange model was used. This has reduced waste, with fewer collateral materials consumed while also extending the useful life of devices, and improved logistics needs, with decreased transportation domestically and overseas.

Our new devices are some of the most repairable laptops and tablets in the industry, hosting at least 11 replacement components.[9]

The new Surface Pro 11th Edition and Laptop 7th Edition achieved an 8/10 repairability score from iFixit.

Gaming: Playing for the planet

Powering play: Energy-saving innovations for Xbox

Xbox has made significant investments not only to reduce the environmental footprint associated with the production of our devices, accessories, and console packaging, but also to reduce the energy usage of the console itself. We've done this by building tools that include:

- **An Xbox console with advanced carbon-saving settings**, which optimizes game downloads and updates to occur during times when the console can use the most renewable energy, reducing the associated carbon footprint.
- **A shutdown (energy saving) power option**, available through a one-time update to power settings, that reduces power consumption while the console is turned off by up to 20 times compared to Sleep mode, delivering sizable energy savings for gamers who enable it.
- **Active Hours**, an energy setting update that allows players to adjust when their console is active, optimizing energy use.
- **New advancements in video content handling**, introduced through a media platform release for Xbox Series S, leading to an average reduction approaching 10% in power consumption across all media apps.

In addition to these software-based tools, we have improved the energy efficiency of the Xbox hardware through advanced manufacturing processes. The latest consoles now include an upgraded system on chip (the "brain" of the Xbox) designed with a TSMC 6-nanometer (nm) manufacturing process, which reduces the size of the tiny transistors inside the chip. This innovation reduces power consumption during gameplay without degrading visual quality.

Empowering game developers with sustainability tools

In 2023, Xbox became the first console platform to release dedicated energy consumption and carbon emissions measurement tools designed specifically for game creators. These tools, developed in collaboration with studios, provide dashboards, case studies, Certification lab analysis, and telemetry data to help developers understand the energy impact of their games and identify opportunities for improvement. With the electricity powering Xbox devices being a major contributor to greenhouse gas emissions, these tools have empowered our developer partners to implement energy-saving measures that are often imperceptible to players but significant in reducing emissions.

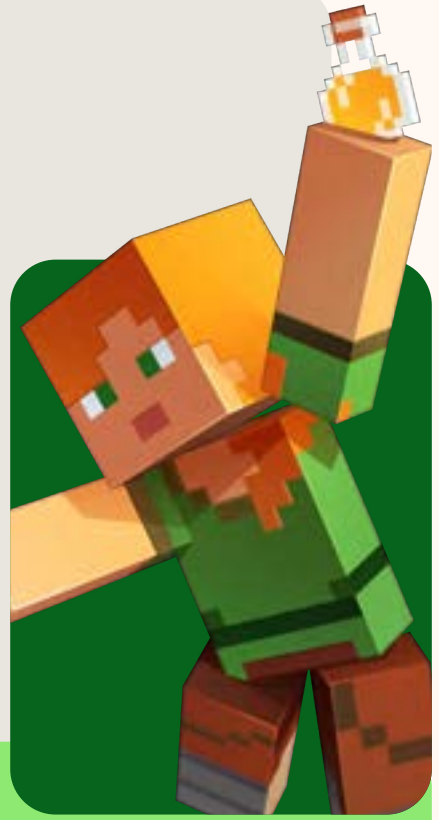
Gaming continued

In 2024, we saw widespread adoption of the Xbox Sustainability Toolkit by both first- and third-party studios.

ZeniMax Online incorporating energy-saving features into The Elder Scrolls Online.

Halo Studios achieving energy efficiency gains in Halo Infinite with 2.5D implementation.

Activision Publishing enhancing efficiency in the Call of Duty franchise by optimizing multiplayer lobbies and in-game menus.



Mojang Studios delivering notable efficiency improvements in Minecraft through a new frame rate limiter feature.

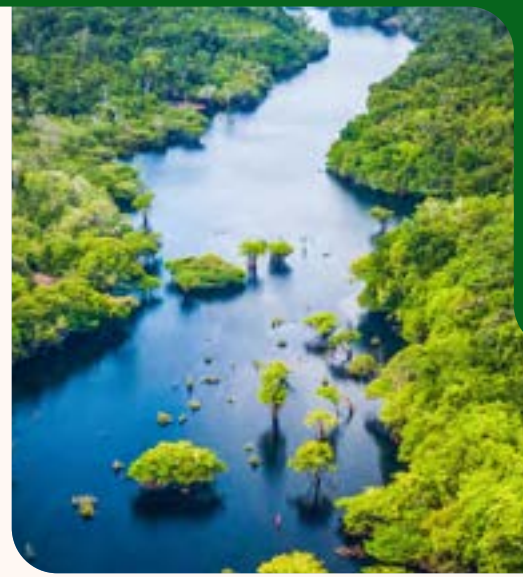
As of June 2024, the Toolkit has expanded to include a new Dynamic Power States API, an innovative prototype platform technology that helps game developers to adjust GPU frequency—the most power-intensive component of a gaming console—when full GPU utilization is unnecessary. This complements the existing toolkit guidance and delivers increased savings without compromising graphical fidelity, further supporting sustainable game development.

Through innovative hardware and software tools, sharing energy-efficient game development resources, and collaborations with studios, Xbox is making gaming more sustainable for players and developers alike. These collective efforts have prevented over 1.2 million $mtCO_2e$ to date, as measured between FY20 and FY23. Xbox remains committed to empowering gamers and creators to enjoy and develop games responsibly, while significantly reducing the environmental impact of play.

Gaming continued

Sparking change (while having fun) with Minecraft

At Minecraft, we're committed to building a better world through the power of play, using our platform to drive real-world impact. Minecraft has evolved into a beacon for eco-friendly gaming, translating digital engagement into tangible sustainability outcomes as well as inspiring and educating a global community to help prioritize environmental stewardship. Our message is clear and purposeful, resonating through our in-game content and collaborations, and each year building on the impact of the projects in both the physical and digital world to enact climate action.



Since 2020, we've expanded our scope by exploring how digital engagement can translate into real-world environmental benefits with initiatives like:

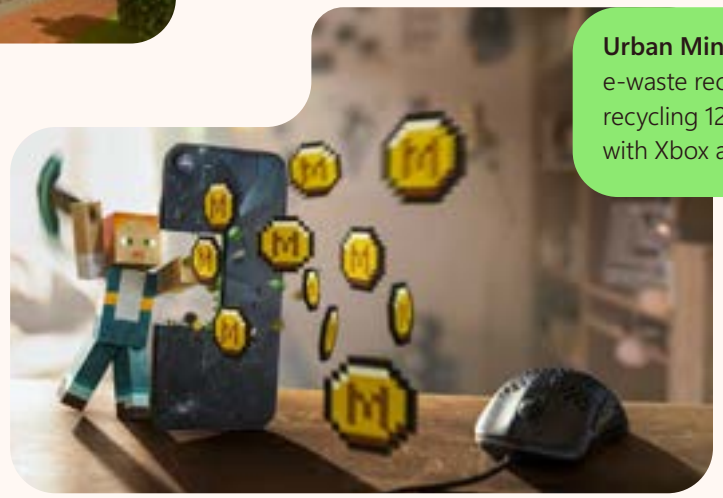
Freedom to Go Beyond, an in-game Minecraft adventure where game players were encouraged to complete various outdoor challenges and interact with the animal kingdom. Burberry and Minecraft also partnered with Conservation International forest conservation efforts to help protect 500,000 trees and help restore 25,000 trees around the world.[17]

PARTNERING FOR IMPACT

Rooted Together, an interactive map where players could explore a mangrove-based ecosystem in-game, while helping The Nature Conservancy to restore and protect 66,000 mangrove trees.

Gaming continued

Schools Reinventing Cities, engaging more than 12,000 students worldwide to tackle climate issues through Minecraft Education in partnership with C40 Cities. The program fosters real-world action and exposes students to green jobs.



Urban Miner, boosting in-store e-waste recycling by 13.8% and recycling 12 metric tons of gadgets with Xbox and Elkjøp Nordic.

The next level: Inspiring further action through play

2024 was a remarkable year for Minecraft, continuing to Build a Better World through the power of play, promoting new climate initiatives, and supporting sustainability education. Minecraft's climate and sustainability content have been downloaded more than 30 million times by players around the world since launch, winning four awards in 2024 for social impact and creative campaigns.

Minecraft recently partnered with The Nature Conservancy to debut a new world called Minecraft National Park, celebrating Earth's wild places and educating players about the importance of preserving them. With net proceeds going to The Nature Conservancy, players can download and roam nine biomes (such as ocean, wetlands, jungle, and savannah), stop in at ranger stations, explore visitor centers, and interact with features like wildlife crossings—a real-life way biologists ensure animals can safely cross roads and keep swathes of habitat connected.

Minecraft also launched the Planet Earth III downloadable content in partnership with BBC Earth, which has seen more than 1 million downloads. In this world, players explore the natural world and impacts of climate change by experiencing survival through the eyes of different creatures like the great white shark and the treehopper.

Our work demonstrates the influential role of community and the power of play in driving positive change and empowering a new generation of innovators. Moving forward, we plan to further integrate sustainability into our core values, keeping our community engaged and motivated to make a meaningful impact.

Arts and culture: Inspiring action at the intersection of art and technology

As our gaming continues to inspire environmental stewardship and action through the power of play, Microsoft's sustainability commitments extend beyond the virtual world. Collaborating with visionary partners like the Natural History Museum, London, we're exploring new ways to blend technology, art, and science to spark hope and optimism for our planet's future.

INNOVATION IN ACTION

Natural History Museum, London

Visions of Nature

Our planet's future is full of hope; sometimes we just need to see it to believe it. In 2024, we partnered with the Natural History Museum, London (NHM) to create *Visions of Nature: A Mixed Reality Experience*. Set in the year 2125, this 18-minute journey transports visitors to an imagined future, inspiring climate optimism and action.

Visions of Nature highlights both the damage humans have caused and the possibilities for recovery. Developed in partnership with SAOLA Studio and NHM researchers, the experience features eight ecosystems that showcase how human innovation and nature's inherent adaptability can help us heal from today's environmental crises. Using Microsoft mixed reality headsets, visitors are transported 100 years into the future to explore a transformed planet inhabited by wildlife like colugos, secretary birds, cuttlefish—and even humans—demonstrating extraordinary resilience and transformation.

Visions of Nature opened in October 2024 and will run until October 2026.

Planetary Computer: Harnessing data to protect our planet and foster resilience

While immersive storytelling offers a glimpse into an optimistic future, the Microsoft Planetary Computer provides the tools to help turn that vision into reality. By harnessing one of the largest repositories of open environmental data, the Planetary Computer empowers individuals and organizations to monitor, model, and identify opportunities that protect Earth's natural resources—bridging the gap between imagination and action.

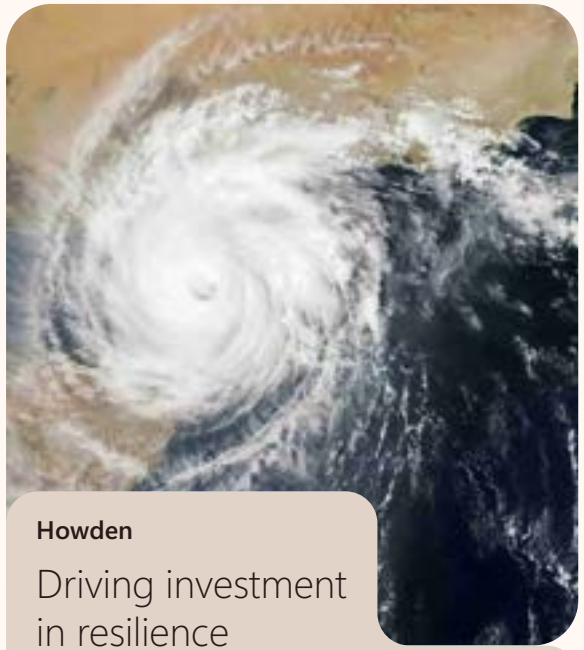
A global tool for a shared planet

In 2020, as part of Microsoft's commitment to protect and preserve ecosystems, we announced our intent to build a Planetary Computer—a platform designed to provide access to trillions of data points collected across space, air, land, and water. Five years later, it has grown to be one of the largest repositories of open Earth observation and Earth science data in the world.

The Microsoft Planetary Computer offers an open, cross-domain geospatial data platform that empowers every person and organization on our planet with the data they need to measure, monitor, model, and protect Earth's natural resources. Accessed billions of times each month, it provides foundational data infrastructure to power countless sustainability applications and analyses globally.

Today, the Planetary Computer hosts over 50 petabytes of Earth observation and science data across more than 120 open data collections, enabling climate researchers, policy makers, and the public to perform geospatial and climate analyses.

INNOVATION IN ACTION



Howden

Driving investment in resilience

Supported by Microsoft, the Howden Resilience Laboratory uses Planetary Computer data, including ERA5 historical atmospheric data and CMIP6 climate projections, to assess climate risks to critical infrastructure. By integrating this data with machine learning models, Howden and Microsoft deliver customer-centric analytical tools to drive investment in resilience and mitigate risks to financial goals and asset insurability.

Planetary Computer continued

PARTNERING FOR IMPACT

Skytec

Supporting cost-effective wetland conservation

In collaboration with the Tennessee Department of Environment and Conservation, Skytec launched the Wetland Screening Tool, using advanced GeoAI workflows and deep learning algorithms to rapidly identify potential wetland locations. Powered by Planetary Computer datasets from NAIP, Sentinel-2 imagery, and LiDAR, this tool supports cost-effective wetland conservation and land-use planning.

In 2024, we continued to expand the Planetary Computer with new datasets, including CONUS404, a high-resolution hydroclimate dataset that covers over 40 years of climate data across the contiguous United States. This dataset is vital for studying long-term climate trends, extreme weather events, and hydrological processes, helping scientists to understand and manage water resources through detailed modeling.

Breaking barriers through AI transformation

Advances in AI are transforming how we interact with data about our planet. In the near future, AI is anticipated to make it easier for anyone, anywhere to access, understand, and apply such data to global challenges. By lowering barriers to data use, AI has the potential to radically accelerate the development and adoption of sustainable solutions. However, this requires machine-readable access to vast repositories of Earth observation data—an area where the Planetary Computer excels.

With one of the largest collections of openly accessible data about our planet, the Planetary Computer can play a critical role in empowering AI innovation. Nearly all of these datasets are API-accessible and aligned to open standards, such as SpatioTemporal Asset Catalogs (STAC), enabling data scientists and machine learning engineers to train new AI models with this data at scale and unlock new, critical insights for sustainability.

Advancing resilience through open data

Climate change affects everyone, but its impacts are not evenly distributed. Those living in poor and marginalized communities, particularly in the Global South, bear a disproportionate burden despite often contributing least to climate change. These communities face intensified droughts, floods, and heatwaves, exacerbating food insecurity, poverty, and other systemic challenges.

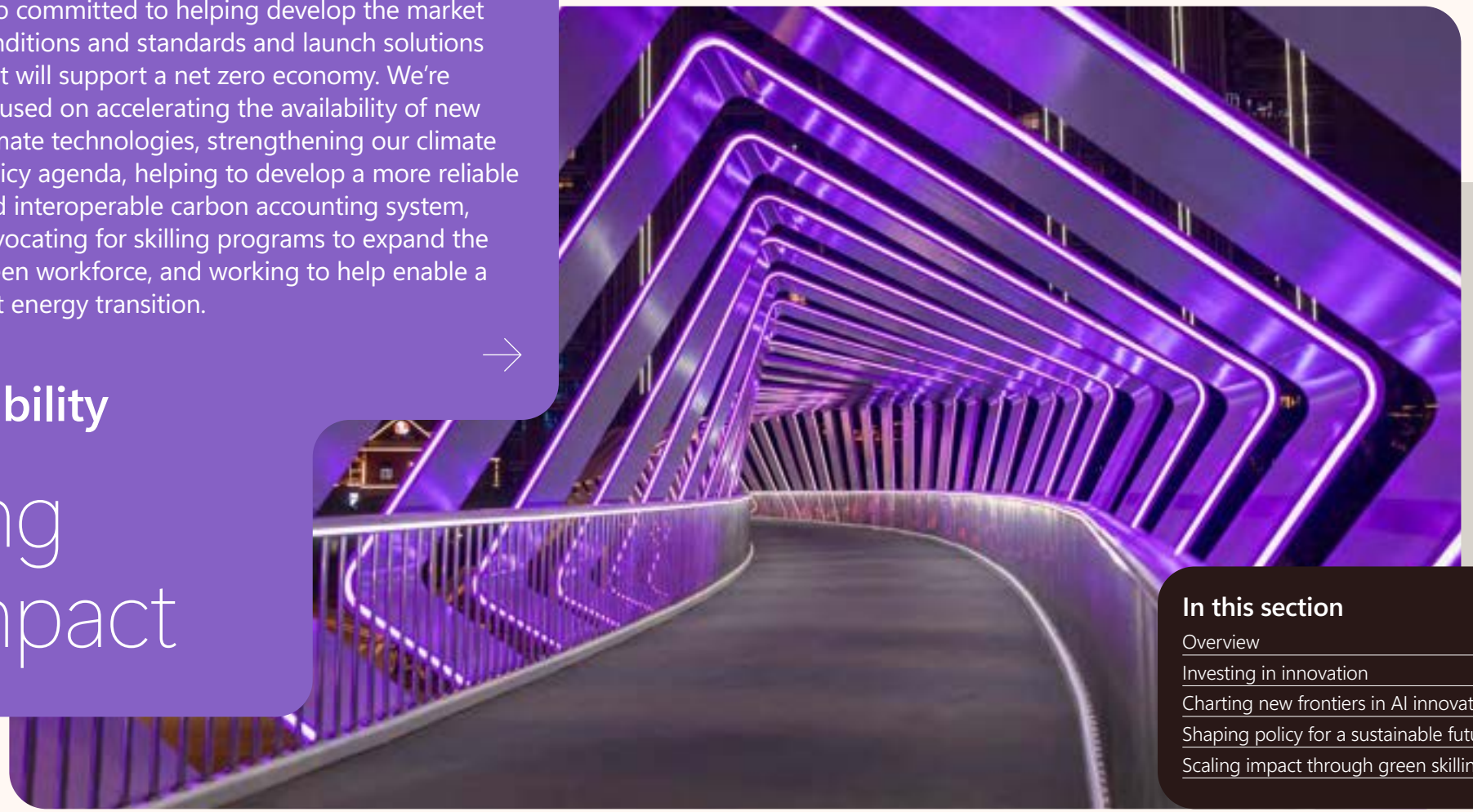
To address some of these inequalities, equal access to reliable, open, interoperable, and timely climate data is essential. The Planetary Computer plays a pivotal role by providing petabytes of environmental monitoring data in analysis-ready formats. This data enables governments, organizations, and citizen scientists to drive adaptation and resilience planning, ensuring that vulnerable communities have the tools to protect their communities and surrounding environment.

Beyond data access, the Planetary Computer offers example code and tutorials to lower barriers for users, empowering universities and organizations worldwide to train the next generation of sustainability professionals. By democratizing access to actionable insights, Microsoft is fostering resilience where it's needed most.

Microsoft's actions alone cannot solve the climate crisis. As a global technology leader, we are also committed to helping develop the market conditions and standards and launch solutions that will support a net zero economy. We're focused on accelerating the availability of new climate technologies, strengthening our climate policy agenda, helping to develop a more reliable and interoperable carbon accounting system, advocating for skilling programs to expand the green workforce, and working to help enable a just energy transition.

Global sustainability

Catalyzing global impact



In this section

Investing in innovation: Building climate markets to reach net zero

Microsoft Climate Innovation Fund

For Microsoft to do well, the world needs to do well. This principle underscores our global sustainability commitments, where we work to develop solutions that support not only Microsoft's goals but also those of our customers and across our global value chain.

Since its inception in 2020, the Microsoft Climate Innovation Fund (CIF) has been a cornerstone of our sustainability efforts. Over the past four years, annual climate capital flows have nearly tripled from $600 billion to approximately $2.1 trillion globally. However, this remains far below the $4.5 trillion per year needed for a net zero transition by 2050.[18] Through CIF, Microsoft has invested in accelerating the adoption of climate solutions. CIF supports technologies, investment vehicles, and invest-to-procure transactions that grow the market supply of climate solutions, while focusing on underfunded markets and ensuring climate equity co-benefits aligned with Microsoft's goals.

Investing in a portfolio to innovate, accelerate, and scale

With a $1 billion investment mandate, CIF has allocated over $793 million in capital to bring new supply to market and accelerate adoption and cost reduction in key target technologies. While private market investments in climate tech have doubled from 2020 to 2022, sectors critical to Microsoft's Scope 3 carbon footprint—industry and manufacturing, building materials, and carbon management—account for approximately 20% of private market climate technology transactions.[19] CIF prioritizes these underfunded sectors.

$793 million

CIF has allocated over $793 million in capital to bring new supply to market and accelerate adoption and cost reduction in key target technologies.

CIF's portfolio has expanded to 63 investees to date, split between 46 companies and project finance entities and 17 fund managers across energy systems, industrial supply chains, and natural systems. These investments execute our invest-to-procure strategy, ensuring our capital catalyzes the scaling of innovative climate technologies globally while supporting our commitments.

CIF was launched in 2020 with a dual mandate to innovate and to accelerate sustainability markets. Since then, our investments have laid the groundwork for sustainable growth in AI, both through direct decarbonization and enabling technologies across our core focus areas. As climate solutions mature and as we advance our sustainability roadmap to 2030, CIF has added a third mandate: to scale adoption of climate solutions. Moving forward, we will focus on invest-to-procure strategies that have proven to be highly effective in bringing new market supply online at scale.

Investing in innovation continued

INNOVATION IN ACTION

Eavor

Eavor is developing a geothermal energy technology that can be deployed globally, providing baseload power and energy autonomy. This clean, reliable technology avoids potential ecological impacts associated with wind, solar, and mining materials for batteries. Eavor's focus is on European combined heat and power (CHP) and western US electricity generation markets, and has strong alignment with Microsoft's datacenter electricity needs.

Climate Asset Management

The Climate Asset Management (CAM) Nature Based Carbon Fund (NBCF) is a $455 million fund focused on investing in nature-based solutions which restore and conserve ecosystems to sequester greenhouse gas emissions and support biodiversity and local communities. NBCF is managed by Climate Asset Management, a joint venture between HSBC Asset Management and Pollination, that has raised over $1 billion to invest in natural capital. The Fund aims to invest in high-quality carbon removal projects that contribute significantly to Microsoft's 2030 carbon removal goals. The NBCF targets projects in developing economies, utilizing flexible financing mechanisms and ensuring substantial benefits for local communities through economic benefit-sharing programs.

Cyclic Materials

Cyclic Materials is revolutionizing the way we approach circularity by enabling the continuous reuse and recycling of critical minerals, reducing waste and environmental impact, and enabling supply chain resilience. By repurposing rare earth elements and base metals at the end of their life-cycle, valuable resources are not lost but instead re-enter the production cycle. With a scalable hub-and-spoke model, Cyclic Materials aims to meet the growing global demand for critical minerals, particularly for electric vehicles, wind turbines, and datacenters, while maintaining a low carbon footprint and zero waste.

SolarCycle

SolarCycle is a leading solar panel recycler in the United States, using proprietary recycling equipment to automate the recycling process and recover over 90% of solar panel materials. The company offers a vertically integrated platform that includes logistics for collecting panels, recycling them, and manufacturing and selling extracted materials like copper and silicon for new panels.

Terradot

Terradot exemplifies Microsoft's investment in using AI and data-driven solutions for sustainability. By integrating vast datasets collected from plant tissues, soils, pore water, ground water, and climate models, Terradot's advanced data platform will enhance the ability to understand and manage Earth's natural systems to capture carbon dioxide from the atmosphere.

Investing in innovation continued

Fostering innovation through partnership

In addition to capital investments, we collaborate with partners to make progress toward our 2030 sustainability commitments by using our strengths as a convening thought leader, technology solutions provider, and advocate. These partnerships accelerate the market supply of emerging climate technologies through proactive engagement with broader climate innovation ecosystems.

Our partnerships have catalyzed significant progress, such as:

University of Washington – Buerk Center for Entrepreneurship

Microsoft's partnership with the Buerk Center for Entrepreneurship in the Foster School of Business cultivates student innovation and leadership in sustainability. Since 2009, more than 1,850 students from the Cascadia Corridor have participated in the Center's Environmental Innovation Challenge (EIC), with over $550,000 in prizes awarded to support early-stage ideas addressing environmental and climate challenges.

Microsoft's partnership extends beyond EIC to include initiatives like a sustainable aviation workshop co-hosted with industry leaders, including Alaska Airlines and the Port of Seattle, which brought together over 100 students to collaborate on advancing SAF.

By combining industry expertise, student engagement, and Microsoft's commitment to sustainability, our University of Washington partnership exemplifies how education and collaboration can drive meaningful environmental impact and cultivate the next generation of leaders.

Build Better Innovation Challenge

Hosted by Elemental Impact, a nonprofit investment platform with 15 years of experience scaling industry and energy solutions, and in collaboration with Capgemini and Bouygues, Microsoft launched the Build Better Innovation Challenge to identify innovative low carbon material solutions that reduce Scope 3 emissions and embodied carbon in building materials. This partnership uses the strengths of global industry leaders to maximize the challenge's impact by offering winners opportunities to:

- Deploy funded pilots with Microsoft and Bouygues.
- Access equity investment from corporate venture funds.
- Receive technical support to scale solutions and reach potential customers.

The 2024 challenge received 78 applications, with nine finalists pitching their ideas to a panel of judges. Six winners—C-Crete Technologies, Carbon Upcycling Technologies, Néolithe, Woodoo, FROOT, and Made of Air—were selected for their groundbreaking solutions. This collaboration exemplifies Microsoft's dedication to advancing decarbonization in the built environment while fostering global innovation in traditionally underrepresented sectors.

E8 Angels and Decarbon8-US

Through a partnership with E8 Angels and the Decarbon8-US philanthropic impact fund, Microsoft is also advancing early-stage innovation in renewable energy and sustainable technologies. Founded in 2006, E8 Angels has mobilized $64 million in private capital to support over 160 climate-focused companies. Since 2020, Decarbon8-US Fund has directed over $9.2 million in philanthropic and direct investments across 17 companies dedicated to decarbonizing key sectors such as agriculture, the built environment, transportation, and renewable energy.

In 2024, the fund concentrated on renewable energy, aligning with global goals to triple global renewable energy capacity by 2030. The program has contributed to upskilling over 360 individuals, the funding of 13 innovative ideas, and the mobilization of over $2.3 million in follow-on capital. The partnership drives critical advancements in renewable energy, including alternative fuels, energy storage, and grid infrastructure, while enabling entrepreneurs in the United States and Canada to scale their solutions.

Investing in innovation continued

Advancing equity and climate innovation

Climate change demands solutions that deliver meaningful impact to the communities most affected. CIF remains committed to advancing equity alongside innovation; 22% of CEOs and founders in our portfolio are women and 21% are from underrepresented backgrounds, and 19% of capital is allocated toward the Global South. Additionally, CIF is partnering with leading programs globally to build an inclusive innovation ecosystem:

Advancing Climate and Clean Energy Leaders (ACCEL)

This accelerator, launched by Greentown Labs and Browning the Green Space (BGS), bolsters climate tech startups and founders from historically underserved communities by addressing structural inequalities through non-dilutive funding, networking connections, resources, and opportunities. The program combines education, prototyping support, mentorship, and networking to accelerate pilots, partnerships, and funding. Supported by CIF, the program has equipped over 100 entrepreneurs with skills, brought 37 climate solutions to market, and mobilized more than $18 million in early-stage capital for sustainability initiatives.

Kinjani African Climate Talent Accelerator

This incubation and investment program empowers African entrepreneurs and science-driven innovators by fostering gender balance, developing critical skills, expanding professional networks, and providing hands-on support to develop talent in critical sectors. Its inaugural cohort includes 29 African founders—55% female—who are developing regenerative solutions in essential areas such as food systems, materials, urbanization, and minerals, which are removing carbon, increasing biodiversity and water access, and improving livelihoods.

Accelerating progress through AI-driven product investments

Earth's growing data footprint offers immense potential for sustainability. For example, a typical farm alone generates around 500,000 data points daily, projected to reach 4 million by 2036.[20] Recognizing the critical role of data in understanding and managing Earth's natural systems, CIF has invested in AI-driven companies with a unique digital product vision.

By investing in AI-driven companies, CIF goes beyond providing capital to accelerate innovation—it connects these companies to a robust ecosystem of support. Tailored programs help CIF portfolio companies scale their impact at every stage of their journey. These programs include:

- Microsoft Founders Hub—a program designed specifically to support startups with a comprehensive suite of benefits.
- Microsoft AI Co-Innovation Lab—a one-week lab available to any Microsoft customer or partner, offering complimentary personalized development sprints for engineering teams to reduce time to market.
- Collaboration with Microsoft teams—opportunities to engage with Microsoft specialists focused on harnessing Earth system data to develop breakthrough products and research, including our engineering teams building solutions like the Azure Data Manager for Agriculture and Microsoft Planetary Computer, as well as the researchers and data scientists with Microsoft Climate Research Initiative and AI for Good.

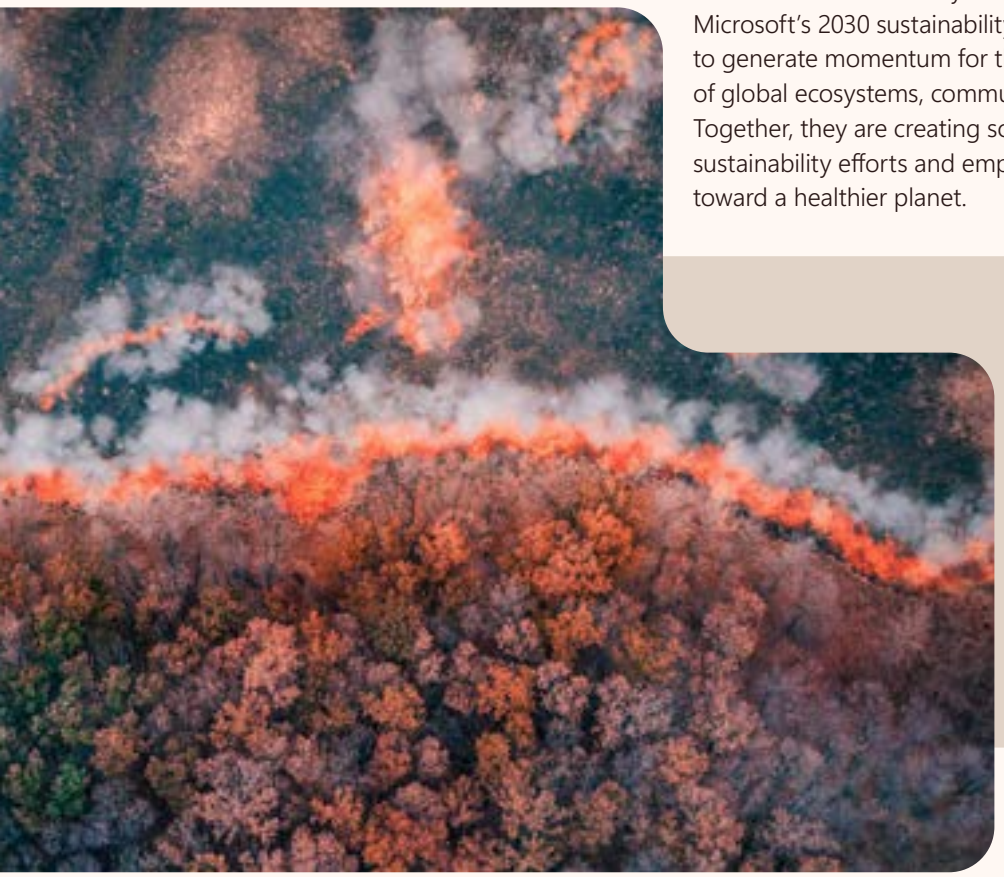
Building scalable sustainability markets

Looking ahead, CIF's strategy will focus on scaling climate technologies as part of Microsoft's net zero roadmap, using AI to drive sustainability outcomes, and integrating climate equity into new market development. By design, CIF invests alongside a diverse network of over 250 co-investors, including both financial venture capital firms and corporations, to foster future markets. CIF's $793 million in commitments has catalyzed over $3.3 billion in follow-on funding, achieving a multiplier effect greater than four times. Moving forward, Microsoft will continue investing to scale sustainability by combining investment, procurement, and partnerships, accelerating the global transition to a sustainable, equitable future.

$3.3 billion

CIF's $793 million in commitments has catalyzed over $3.3 billion in follow-on funding.

Charting new frontiers in AI innovation



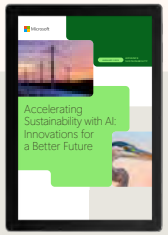
Two specialized teams—Microsoft Sustainability Science and Innovation and Microsoft Research—are at the forefront of applying AI to address some of the world's most pressing environmental challenges.

By developing groundbreaking tools and expanding the application of AI across diverse domains, these teams aim not only to drive progress toward Microsoft's 2030 sustainability commitments but also to generate momentum for the collective betterment of global ecosystems, communities, and industries. Together, they are creating solutions that accelerate sustainability efforts and empower meaningful action toward a healthier planet.

Exploring more sustainable AI innovation

Guided by the Microsoft Accelerating Sustainability with AI playbook, Microsoft is establishing the conditions for AI to become a transformative tool to address environmental challenges. Launched in 2023, the playbook serves as a strategic framework to align AI innovation with sustainability goals, helping to drive measurable impact and set the stage for responsible and effective AI deployment by focusing on five strategies or "plays":

1. Investing in AI for sustainability.
2. Developing digital and data infrastructure for inclusivity.
3. Minimizing resource use, expanding access to carbon-free electricity, and supporting local communities.
4. Advancing AI policies and governance for sustainability.
5. Building workforce capacity to use AI for sustainability.



Download our 2025 update and progress report on the playbook

A core element of using AI to address one key sustainability challenge, climate change, requires our understanding of the complex interplay between AI, energy, and climate. Over the past year, Microsoft has collaborated with internal teams and external experts to explore this evolving nexus, addressing critical questions about AI's role in the global race to net zero. Highlights of this effort include:

- Participating in a workshop hosted by the International Institute for Applied Systems Analysis to examine AI and digitalization for climate scenarios.
- Convening an interdisciplinary team of experts to assess whether AI will accelerate or hinder global decarbonization, with reflections published in Nature.

These collaborations have deepened Microsoft's understanding of AI as both a driver of new climate solutions and a resource-intensive challenge. The insights gained have shaped strategies to optimize AI for maximum benefit while minimizing its environmental footprint. This includes Microsoft's work with leading institutions to build breakthrough innovations for carbon reduction, energy optimization, and sustainable water management.

Charting new frontiers in AI innovation continued

Advancing understanding of Earth's natural systems

Microsoft is combining AI and advanced scientific tools to strengthen our understanding of biodiversity and ecosystem health, carbon budgets, and climate dynamics. These efforts support policymakers, scientists, and organizations in addressing environmental challenges and improving global outcomes.

Supporting biodiversity and ecosystem reporting

In collaboration with internal teams and external partners, Microsoft has identified science-based AI tools for biodiversity and ecosystem reporting—now mandated by the European Union Corporate Sustainability Reporting Directive (CSRD), UK Biodiversity Net Gain law, and emerging national regulations in Australia and China. Collaborations with Planet Labs, the Gund Institute for the Environment at the University of Vermont, and the Natural Capital Project have enabled the development of cost-effective strategies for meeting these requirements. Using advanced Earth observation tools such as automated camera traps, bioacoustics, automated environmental DNA samplers, and high-resolution satellite imagery, these solutions provide robust methodologies for monitoring and reporting ecosystem health at scale.

Investing in nature for sustainability

As we more effectively monitor nature, we can better understand and prioritize whole ecosystem health in investments for sustainability. Microsoft partnered with organizations like CIFOR-ICRAF, the Wilkes Center for Climate Science & Policy at the University of Utah, and University of California Santa Cruz to assess the opportunities and challenges for companies to maximize their nature-positive investments. This collaboration resulted in a white paper outlining lessons from Microsoft's own nature strategy and identifying eight actionable steps companies can take to overcome barriers such as knowledge gaps, resource limitations, and incentive misalignment. This paper emphasizes how AI is already playing a key role in addressing these challenges, enabling organizations to better understand and manage their impact on natural systems.

Understanding and managing Earth's carbon budgets

In collaboration with Tsinghua University, the French Laboratory for Climate and Environmental Sciences, and other leading global scientists, Microsoft Research has developed the world's first near real-time global carbon budget. This analysis provides monthly updates with only a three-month delay, offering important insights into carbon fluxes.

Analysis of 2023 data revealed a steep decline in the land carbon sink to just 0.14 gigatons of carbon per year—the lowest in nearly two decades. This decline, driven by extreme climate events, highlights the fragility of terrestrial carbon systems. Despite stable fossil fuel emissions, increased oceanic carbon uptake was insufficient to counterbalance the loss in land-based sequestration, resulting in a sharp rise in atmospheric carbon dioxide. The Mauna Loa Observatory recorded a 3.37-ppm increase in 2023, marking the highest carbon dioxide levels ever.

By delivering timely, actionable data on carbon fluxes and their underlying causes, this project enhances global understanding of carbon dynamics and informs sustainability initiatives. It demonstrates how innovative technologies and research can empower policymakers and organizations to address urgent climate challenges and work toward carbon neutrality.

Transforming weather and climate forecasting

Enhancing our understanding of global weather patterns

Aurora, Microsoft's cutting-edge AI foundation model for environmental forecasting, uses over 1.3 billion parameters to predict weather patterns and atmospheric processes like air pollution, and to deliver high-resolution global forecasts. Unlike traditional models that train on a single dataset, Aurora was pre-trained on more than a million hours of diverse weather and climate data, building general knowledge before being fine-tuned for specific tasks. This approach enables superior performance in data-sparse tasks, such as atmospheric pollution prediction and extreme weather scenario modeling, offering more accurate forecasts and timely interventions. By improving environmental monitoring and helping mitigate the impacts of extreme weather events, Aurora advances sustainability and resilience efforts.

Sub-seasonal climate forecasting

Collaborating with the Massachusetts Institute of Technology and Atmospheric and Environmental Research, Microsoft has developed an adaptive bias correction framework that uses machine learning to systematically correct errors in dynamical forecasts, enhancing forecasts two to six weeks in advance. This tool significantly improves predictions, helping water managers allocate assets efficiently, enabling early wildfire prevention, and reducing the human and economic costs of extreme events like droughts and floods.

Charting new frontiers in AI innovation continued

Revolutionizing energy systems

Microsoft is combining advanced AI technologies with collaborative partnerships to transform energy systems, creating solutions that address energy storage, distribution, and resilience. These efforts support the transition to renewable energy while empowering communities to achieve greater energy autonomy and sustainability.

Grid energy storage

In partnership with the University of Michigan, Microsoft is developing cost-effective long-duration energy storage technologies using organic redox flow batteries. By applying generative AI to design alternatives to vanadium, central to today's commercially mature flow batteries, these alternative batteries aim to reduce reliance on critical minerals, lower corrosion hazard, and support increased renewable energy integration into the power grid.

AI-powered community solar microgrids advancing energy resilience and equity

Frontline communities disproportionally face the dual challenges of climate disasters and economic inequality, often with limited access to sustainable energy solutions. Microsoft is using AI to create solar microgrids to empower these communities, allowing them to generate, store, and distribute renewable energy that aligns with their specific needs. By reducing dependence on centralized utilities, this project promotes fair energy pricing, enhances resilience to climate disasters, and supports local energy autonomy.

AI technology plays a critical role in predicting energy demand and optimizing distribution, ensuring these systems operate more efficiently and equitably. This project not only increases the reliability of microgrids but also prepares communities to participate in power purchase agreements (PPAs), improving the long-term financial viability for renewable energy projects that contribute to both local resilience and global decarbonization goals.

PARTNERING FOR IMPACT

Partnerships

Fostering sustainability skills

To foster sustainability skills, Microsoft collaborates with community partners such as Remix: The Soul of Innovation, Ayika Solutions, and Vicars Community Center Resilience Hub to co-develop energy transition programs. These initiatives promote environmental literacy through co-design workshops, technology demonstrations, and participatory planning sessions that engage community members in shaping their energy futures. By combining technical innovation with community-driven approaches, this project builds the knowledge, capacity, and opportunities needed to create pathways to sustainable change.

Innovating materials for a circular economy

Through research and collaboration, Microsoft is pioneering breakthroughs in material science to promote circularity and sustainability. By developing innovative polymer composites, these efforts pave the way for more sustainable electronics and a reduction in e-waste.

Composites for printed circuit boards

Through collaboration with the University of Washington, Microsoft Research is advancing circularity in polymer composites with a new class of polymers known as vitrimers. Unlike conventional polymers, vitrimers possess dynamic chemical bonds that allow certain composites to be disassembled and reassembled without compromising material integrity. This property enables easier repair, reuse, and recycling of electronic components, addressing a major challenge in the sustainability of electronics.

These advancements have led to a functional printed circuit board prototype that demonstrates how vitrimers can facilitate component disassembly, recycling, and reuse, paving the way for more sustainable electronics manufacturing. Looking ahead, we have developed generative AI methods for design of next-generation vitrimers with enhanced strength, flexibility, and recyclability. These improved properties aim to expand the applicability of vitrimers in advanced composites, driving greater material efficiency and sustainability across industries.

Charting new frontiers in AI innovation continued

Optimizing building and datacenter efficiency

Microsoft is using AI-driven systems to revolutionize energy and water efficiency in buildings and datacenters. These advancements deliver smarter, more sustainable infrastructure while minimizing resource consumption and operational impact.

Energy and water optimization

Microsoft has developed reinforcement learning (RL)-powered systems to improve traditional heating, ventilation, and air conditioning (HVAC) controls, allowing autonomous, real-time energy-efficient decision making to optimize operations. Using offline reinforcement learning, which trains on a static dataset to reduce reliance on continuous data acquisition, we achieved over 30% energy savings in one of our Redmond campus buildings while maintaining comfort.

The application of RL extends to datacenters, where trials in a Phoenix-based facility demonstrated a 21% reduction in water consumption. The RL system maintains optimal temperature and humidity in the cold aisle, ensuring operational integrity while delivering significant water savings. The next phase will involve collaborating with datacenter teams to integrate these systems onsite and validate their performance through real-world experimentation.

Recent advancements include the integration of LLMs to enhance RL agent robustness and adaptability. Experimental results show that LLM-supported RL agents deliver superior and more consistent performance, even in unfamiliar scenarios, further advancing the potential of this innovative approach.

Enhancing water resource management with accessible AI

By integrating AI-powered solutions with cutting-edge data tools, Microsoft is addressing the complexities of water management. These efforts empower communities and decision-makers to sustainably manage water resources and adapt to growing environmental challenges.

Developing accessible AI for more sustainable water practices

In collaboration with the International Water Management Institute, Microsoft has supported the development of a cutting-edge AI-powered Copilot to address the complexities of water resource management, starting in southern Africa's Limpopo River Basin. This solution integrates and interprets diverse data sources—regulatory documents, scientific reports, real-time sensor data, and remote-sensing workflows—to provide localized insights that support sustainable water management.

Built on advanced data pipelines and accessed via a user-friendly chat interface powered by GPT-4, the Copilot enables natural language queries and delivers actionable insights on water availability forecasts, drought conditions, and environmental flows. By making this information accessible in local languages, this tool empowers decision-makers to explore data, make informed decisions, and promote sustainable resource use.

This initiative enhances the reliability of water management advisory services, offering a transformative solution for the effective management of the Limpopo River Basin while directly supporting local communities and fostering sustainable practices.

Driving innovation for global sustainability

Microsoft is pushing the boundaries of AI to tackle the world's most pressing environmental challenges. By empowering governments, businesses, and communities with transformative tools, such as the Accelerating Sustainability with AI playbook and innovations in biodiversity, ecosystem, and carbon monitoring, Microsoft is driving meaningful action toward a more sustainable future for all.

We remain committed to advancing the role of AI to address global sustainability challenges. From targeted research to experimental applications, we will continue to innovate to meet Microsoft's own sustainability goals while supporting our partners and customers in achieving theirs.

Monitoring biodiversity and complex ecosystems remains a critical focus. AI will be indispensable in monitoring and understanding biodiversity and ecosystems at the scale required for corporate reporting. Our efforts will center on connecting science-driven insights with AI-enabled tools to help companies, governments, and scientists better track, characterize, understand, and manage ecosystems. These tools enable more effective decision-making and support efforts to halt and reverse global biodiversity declines and environmental degradation.

Shaping policy for a sustainable future: Microsoft's global advocacy for change

We believe that Microsoft has an important role to play in advocating for effective and innovative sustainability policy. When we announced our commitment in 2020 to become carbon negative by 2030, we also pledged to use our voice on public policy issues to help advance global decarbonization efforts. Since then, we've developed policy priorities to guide government engagements around our environmental sustainability commitments, published briefs to outline key carbon, electricity, carbon-free power, and AI policy principles, and successfully advocated to support Microsoft's goals.

As part of this effort, we have informed, endorsed, and supported the implementation of landmark policies to expand carbon-free electricity, scale markets for carbon removal and low carbon materials, and enable robust interoperable reporting. These policies include:

- In the United States, the implementation of the Inflation Reduction Act and Bipartisan Infrastructure Law, California Carbon Accounting laws, and regulatory efforts to improve interconnection to the grid and transmission expansion.
- In the European Union, CSRD, updates to the Renewable Energy Directive and the Energy Efficiency Directive, and the Carbon Removal Certification Framework.

As Microsoft's business grows, we are strengthening our policy engagement in the United States and European Union as well as with governments across Asia, Latin America, and Africa to expand carbon-free electricity and grid infrastructure to support Microsoft and our suppliers.

We've identified three primary policy opportunities to unlock carbon-free electricity supply across operating markets:

1. Expand and reform grid planning, interconnections, and infrastructure development.
2. Unlock carbon-free electricity generation development and corporate procurement pathways.
3. Accelerate new carbon-free electricity technologies.

These markets vary greatly depending on the size of the grid, availability of carbon-free electricity, and relevant regulatory frameworks.

To navigate these differences, we embed three foundational principles in our policy advocacy:

1. Driving tangible near-term progress on the pathway to global net-zero emissions by 2030.
2. Approaching policy and the markets where we operate with a flexible, rather than a one-size-fits-all, strategy.
3. Using the importance of digital technology and AI to enable a resilient, reliable, and low-carbon grid, encourage innovation, promote transparency, and enable comparability.

Shaping policy for a sustainable future continued

Accelerating carbon-free electricity

We are working to accelerate carbon-free electricity, expand grid infrastructure, and scale sustainability markets through policy advocacy in the United States, Europe, and Asia.

In the United States, we supported new Federal Energy Regulatory Commission transmission rules to improve and expedite regional grid planning, as well as legislative proposals to accelerate project permitting. We also backed federal and state legislation to support fusion energy development and enhance regulatory processes for advanced nuclear reactors. To strengthen our dedication to these advanced carbon-free solutions, Microsoft joined the global Fusion Industry Association and the U.S. Nuclear Industry Council (USNIC), furthering our engagement on nuclear and fusion energy alongside renewable energy advocacy. Additionally, we advocated for scaling clean energy solutions, carbon removal, low-carbon building materials, sustainable aviation fuel, and manufacturing initiatives that deliver local economic and community benefits.

Across Europe, we've advocated for a robust market for renewable power purchase agreements (PPAs), green certificates enabling around-the-clock renewable solutions, and swift development of transmission, distribution grid, and interconnection reform. Microsoft supported the European Commission in highlighting the critical importance and key principles for developing the European electricity grid to meet the demands of decarbonization, electrification, and digitalization.

Decarbonizing our supply chain in Asia

At Microsoft, 97% of our emissions are in the Scope 3 category, with the majority of these emissions within our supply chain. We are therefore increasingly engaging with suppliers to support their own Scope 1, 2, and 3 decarbonization.

This past year, we focused on improving local supply of carbon-free electricity, which in turn allows suppliers to decarbonize their operations. We are working with governments, suppliers, peers, industry associations, and other third parties to improve carbon-free electricity access in markets where we have a significant supply chain footprint, most notably in Korea, Japan, and Taiwan, where the majority of Microsoft's semiconductors are sourced.

Three priorities include accelerating grid infrastructure, enhancing renewable energy procurement options, and improving the economics of renewable energy. We joined regional and domestic industry associations to deepen our carbon-free electricity policy engagement, including the SEMI Energy Collaborative, the Asia Clean Energy Coalition, and the Japan Climate Leaders Partnership. Examples of cooperation included the provision of coordinated industry inputs to Korea's pending Special Act on Key National Grids, and to Japan's 7th Basic Energy Plan.

Advancing AI and sustainability

Microsoft is working with governments and policy stakeholders to responsibly use AI for sustainability outcomes. This past year, Microsoft provided input and comments to the US Department of Energy's request for information on energy and AI policies. Through our engagement, we outlined ways that AI can advance clean, reliable, and resilient electric power.

In Europe, we advocated for coordinated implementation of the Energy Efficiency Directive and provided thought leadership to drive accurate, transparent regulatory improvements for AI energy needs and opportunities. We also worked to build a shared understanding of AI's potential to accelerate climate action and the carbon-free energy transition through engagement with key stakeholders, including at the International Energy Agency (IEA) Global Conference on Energy & AI, World Economic Forum, and other major convenings. In collaboration with Microsoft, the IEA developed a GPT tool using Copilot Studio on Microsoft Azure to enhance its World Energy Outlook, enabling users to approachably access energy data, trends, and insights for informed policy decisions.

INNOVATION IN ACTION

The AI challenge

Access to carbon-free electricity is critical to reach our 2030 carbon negative goal, both for reducing the Scope 2 footprint from our own operations and for reducing the Scope 3 footprint from our suppliers. However, the power system presents a bottleneck, including limits to grid availability to physically connect new carbon-free electricity generation sources, limits to grid capacity to transport carbon-free power (particularly from intermittent renewable energy sources), and limits to the speed at which requisite new policy, technology, and finance can be rolled out. Nevertheless, AI also presents a significant opportunity to help solve these challenges.

Shaping policy for a sustainable future continued

At the United Nations General Assembly in New York City, we convened key thought leaders to accelerate AI-enabled sustainability solutions in the Global South. At the Convention on Biodiversity COP16 meeting in Cali, Colombia, we showcased the key role of AI in tackling the world's biodiversity challenges through our participation in Project Guacamaya, partnerships with Bloom 24 and Nature House, and the launch of a white paper that highlights the value of investing in nature. At COP29 in Baku, Azerbaijan, through Microsoft's participation in the Early Warning for All Initiative and our partnership with the UNFCCC, we demonstrated how AI can proactively identify at-risk communities affected by climate-related emergencies and how AI can revolutionize the implementation of the Enhanced Transparency Framework reporting under the Paris Agreement.

Advancing robust carbon reporting

Microsoft has advanced robust, consistent, and interoperable carbon reporting processes to support reliable, precise data-led reporting globally. Carbon measurement and reporting processes are also essential mechanisms for measuring progress in carbon emissions reduction.

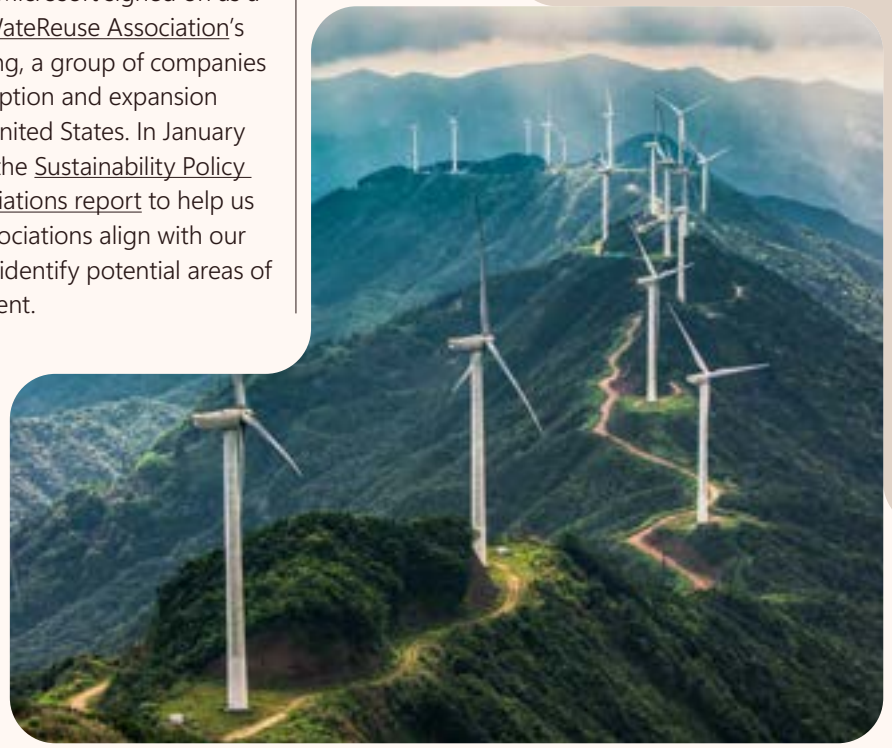
In the United States, Microsoft continued support for efforts to advance consistent and comparable disclosure of investor relevant climate information, including enacted legislation in California.

We filed comments in Malaysia and South Korea highlighting the importance of internationally aligned climate reporting frameworks and the importance of encouraging the use of new technologies to monitor, calculate, and track emissions, supporting emissions reduction.

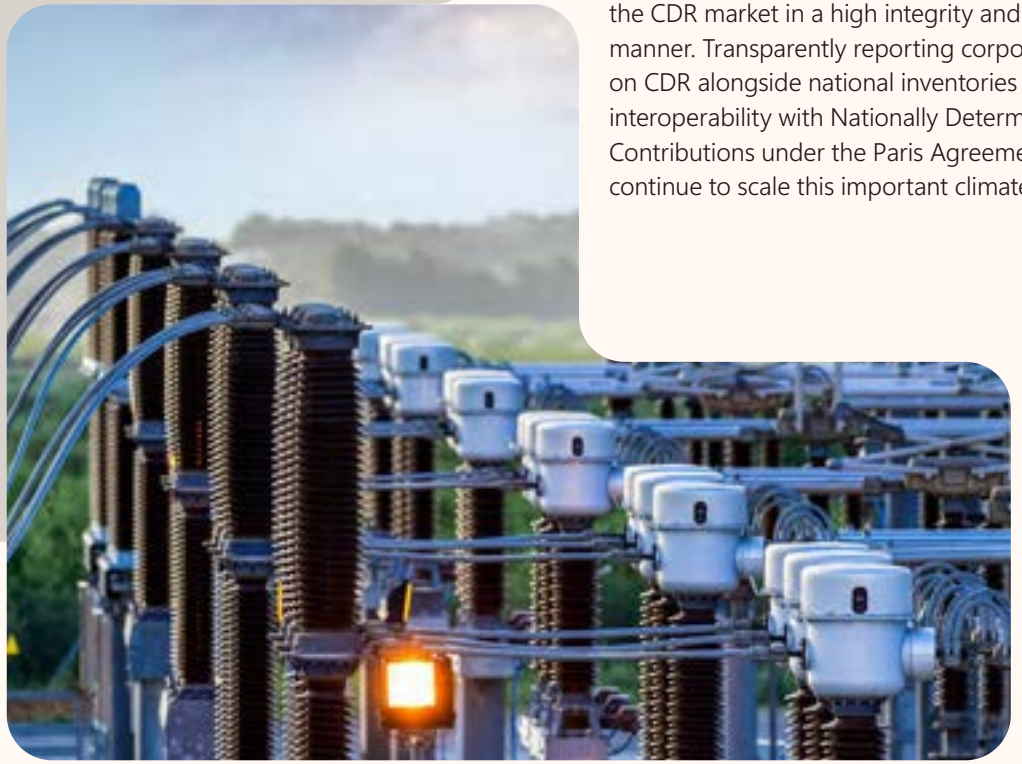
In Europe, Microsoft met with European Union policy officials to help identify efficiencies related to consolidated reporting under the CSRD. We also supported development of the Carbon Certification and Removal Framework and advocated for a clear differentiation between removal and reductions, enhanced sustainability criteria for carbon farming and biomass-based activities, strengthened leakage considerations, and the independence of certification schemes. We also support the European Union Green Claims Directive's ambition to make environmental claims and labels more reliable, transparent, and independently verified in the European Union.

Driving progress toward sustainability goals

Microsoft is continuing to drive progress towards our 2030 commitments, including advocacy related to our waste and water commitments and engagement with trade associations to ensure policy alignment. In the European Union, we are supporting work on the upcoming revision of the Waste of Electrical and Electronic Equipment Directive and advocating for the harmonization of legislation with proportionate collection targets. In 2024, Microsoft signed on as a founding member of the WateReuse Association's Coalition for Water Recycling, a group of companies looking to support the adoption and expansion of water reuse across the United States. In January 2024, Microsoft published the Sustainability Policy Alignment: US Trade Associations report to help us evaluate how our trade associations align with our sustainability goals, and to identify potential areas of collaboration or misalignment.



Shaping policy for a sustainable future continued



What's next in policy?

Scaling high-integrity carbon removal markets

Today, voluntary corporate net zero goals play an integral role in driving private-sector purchases of carbon dioxide removals (CDR) and thus developing the market. As governments develop carbon removal accounting guidelines and implement the consensus agreement reached on Article 6 of the Paris Agreement at COP29, it is critical that new rules facilitate and enable the advancement of the CDR market in a high integrity and equitable manner. Transparently reporting corporate claims on CDR alongside national inventories can enable interoperability with Nationally Determined Contributions under the Paris Agreement and continue to scale this important climate solution.

Harnessing AI for global sustainability policy

We know AI holds transformative potential for addressing global sustainability challenges, from optimizing energy systems to developing climate-resilient innovations. Microsoft is actively engaging policymakers to ensure that AI adoption is supported by forward-looking policies and infrastructure that enable local community access to its benefits. By advancing policies that promote the responsible use of AI, we aim to accelerate its role in driving environmental progress, enabling a low-carbon future, and empowering communities worldwide.

Policy to enable further AI adoption

AI is a vital tool that is already being used to develop faster, cheaper, and improved sustainability solutions. These include accelerating scientific discovery, driving efficiencies in energy systems, and developing climate-resilient crops. As we look ahead, policymakers have the opportunity to implement policies and programs that enable adoption of AI to promote positive environmental outcomes.

AI for optimizing power systems

At Microsoft, we are working to address the complex opportunities and challenges that AI poses on a global scale. We have developed AI-based propositions and partnerships that can help improve power systems efficiency in the short term, for both generation assets and the grid itself. Use cases include:

- Enabling dynamic grid optimization, involving better matching supply and demand.
- Improving forecasting, including for power loads, prices, and renewable energy resource availability.
- Accelerating permitting, including streamlining processes based on historical data.
- Increasing capacity on transmission lines, using dynamic line rating technology.
- Optimizing generation assets, including finding operational efficiencies and providing these insights to plant operators.

All these applications, and others, will help significantly accelerate the energy transition, and we are increasingly engaged in policy and regulation to advance their deployment.

Scaling impact through green skilling

With a global community of over one billion members, LinkedIn is helping to close the green skills gap through four main approaches: upskilling members, coaching young jobseekers, training employees, and supporting green workforce development partners. LinkedIn Learning has grown its sustainability course library to more than 200 offerings, covering topics such as ESG basics and sustainable business practices. These courses equip professionals to integrate sustainability into their roles and align with environmental goals, with many of our most in-demand courses made freely available throughout the year.

LinkedIn also supports sustainability nonprofits by helping them connect with core audiences on the platform. In FY24, LinkedIn provided $6 million in free advertising to sustainability-focused organizations through its Ad Grant program, amplifying their impact and outreach. In partnership with Microsoft, INCO Academy, a global nonprofit that launched the Green Digital Certificate through its Academy, helps workers access economic opportunities through the dual climate and digital transitions.

To support young jobseekers, LinkedIn has employees spearheading the Green Coaches program, training Gen Z and Millennial participants—particularly those from underrepresented backgrounds—with guidance on finding green jobs using the LinkedIn platform. In 2024, nearly 2,000 participants gained free year-long LinkedIn Premium access, and 30 active Green Coaches trained candidates to navigate the growing green economy.

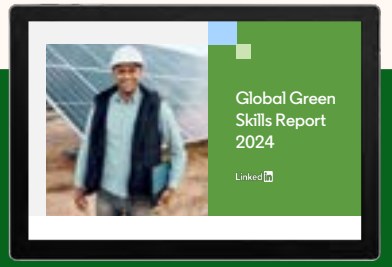
PARTNERING FOR IMPACT

Beyond LinkedIn's platform, strategic partnerships are expanding equitable access to green job opportunities worldwide. Programs like GRID Alternatives upskill individuals from underrepresented backgrounds for careers in the solar industry. In 2024, GRID installed more than 4 MW of solar across 800+ projects, benefitting more than 1,040 families and generating lifetime savings exceeding $20 million. LinkedIn also supports organizations like IPÊ (Institute for Ecological Research) in Brazil, which empowers eco-entrepreneurs to conserve the Amazonian rainforest, and Bush Heritage Australia, which works to protect native ecosystems, in partnering with Aboriginal Traditional Custodians and other landholders.

Scaling impact through green skilling continued

Green Skills Report

Recognizing the urgent need to align workforce development with climate action, LinkedIn's 2024 Green Skills Report highlights critical trends and gaps in the global labor market. Demand for green talent continues to outpace supply, with key areas of growth including renewable energy, building decarbonization, sustainable procurement, and ecosystem management. By advocating for workforce investments in climate policies, LinkedIn ensures that economic opportunities in the climate transition are accessible to all.



Read the report at economicgraph.linkedin.com/research/green-skills-resources

11.6%

Global demand for green talent grew twice as quickly as supply between 2023 and 2024—with demand increasing by 11.6% and supply by 5.6%.

54.6%

Job seekers with green skills or titles see a 54.6% higher hiring rate than the workforce overall.

1 in 2

By 2030—halfway to the deadline for fulfilling nationally determined contributions (NDCs)—one in five jobs will lack the green talent to fill it. By 2050, this gap will balloon to one in two jobs.

Green skilling in gaming: Empowering developers and players for industry sustainability

Just as LinkedIn addresses the green skills gap across the global workforce, Microsoft gaming is leading efforts to foster sustainability across the industry.

Building both knowledge and skills sharing, Microsoft Gaming hosts an annual "Sustainafest", a cross-organizational summit dedicated to advancing Sustainability skills across the industry. Experts from Gaming, partners from Microsoft divisions, and external organizations share insights on a full range of sustainability topics including eco-design, AI for Sustainability, energy efficiency in game development, biomimicry, and other emerging technologies which represent new potential for advancing meaningful environmental progress in the industry.

Demand for green talent continues to outpace supply, with key areas of growth including renewable energy, building decarbonization, sustainable procurement, and ecosystem management.

Appendix

In this section

Appendix A

How we report

Reporting principles and external standards

Microsoft works to conduct business in ways that are principled, transparent, and accountable. We annually publish this Environmental Sustainability Report to provide information on our strategy, our performance and progress against our goals, and key challenges and trends we see in this work. We also publish our environmental data, which is included in the separate Environmental Data Fact Sheet. We present greenhouse gas emissions in accordance with the GHG Protocol and management's criteria and select environmental metrics that both reference the Global Reporting Initiative (GRI) Standards and are reported in accordance with management's criteria as of and for the fiscal year ended June 30, 2024 (FY24). Microsoft's environmental data reporting covers global wholly owned and partially owned subsidiaries over which Microsoft has management and operational control, including Microsoft owned and leased real estate facilities and datacenters. Environmental data reported is subject to Microsoft's recalculation and structural changes policy as described in our Environmental Data Fact Sheet.

Our Reports Hub available at Microsoft.com/transparency provides a consolidated, comprehensive view of our ESG reporting and data ranging from our carbon footprint to workforce demographics to political donations. This Environmental Sustainability Report is an important part of that overall set of disclosures. For this and other reports, we inform our disclosure strategies with careful consideration of commonly used global standards. We have reported carbon emissions and energy data to CDP since 2004 and water data to CDP since 2011. On climate-related issues, we strive to align with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) in our TCFD report.

Working together with stakeholders

We know that the decisions we make can affect our employees, customers, partners, shareholders, suppliers, and communities, and we take their voices into consideration. Microsoft receives input from millions of people each year—from individual customers to policymakers and global human rights specialists. We bring outside perspectives into the company and inform our business decisions through a variety of feedback channels. We often go beyond formal channels, proactively engaging with key stakeholders, advocacy groups, industry experts, corporate social responsibility (CSR) rating agencies, CSR-focused investors, and many others. We also share our learnings and practices, thereby generating industry dialogue, informing public debate, and advancing greater progress.

ESG priority

Our ESG reporting describes the topics we consider to be the most important annually to stakeholders when evaluating environmental, social, and governance issues at Microsoft. Therefore, ESG prioritization in our reporting does not align to the concept of corporate "materiality" applied in U.S. securities law. A listing of what we currently identify and categorize as our top ESG issues can be found at Microsoft.com/sustainability.

Governance

The Environmental, Social, and Public Policy Committee of Microsoft's Board of Directors provides oversight and guidance on Microsoft's environmental sustainability strategy and efforts. Our Vice Chair and President and our Chief Sustainability Officer present to this committee on our overall sustainability agenda, including our climate-related work, and solicit high-level input on new and emerging initiatives. Additional information on Microsoft's corporate governance is available at Microsoft.com/investor.

Forward-looking statements

This report includes estimates, projections, and other "forward-looking statements" within the meaning of the Private Securities Litigation Reform Act of 1995, section 27A of the Securities Act of 1933, and section 21E of the Securities Exchange Act of 1934. These forward-looking statements generally are identified by the words "believe," "project," "expect," "anticipate," "estimate," "intend," "strategy," "future," "target," "efforts," "goal," "tactic," "roadmap," "commitment," "opportunity," "plan," "may," "should," "will," "would," "will be," "will continue," "will likely result," and similar expressions.

Forward-looking statements are based on current expectations and assumptions that are subject to risks and uncertainties that may not be anticipated and/or which may cause actual results to differ significantly. We describe risks and uncertainties that could cause actual results and events to differ materially in our reports filed with the Securities and Exchange Commission. We undertake no obligation to update or revise publicly any forward-looking statements, whether because of new information, future events, or otherwise.

A number of our ESG goals may depend on the adoption of certain behaviors and/or activities by third parties, including our customers and partners. If those parties do not adopt certain behaviors or activities, or invest in certain evolving technologies, we may not be able to meet some goals. Additionally, we are engaged in certain projects, solutions, and technologies that, should they not perform as we expect, could negatively affect our ability to meet some ESG goals on time or at all. Finally, we make certain claims regarding our products and projects, including through our funding of certain projects, and the ability of those products, projects, and funding efforts to affect third parties' sustainability efforts; however, there can be no guarantee that our products, projects, or funding efforts will have the effects we anticipate or intend.

Appendix B

Endnotes

1. World Economic Forum. *Innovation and Adaptation in the Climate Crisis: Technology for the New Normal.* January 2024. https://www3.weforum.org/docs/WEF_Innovation_and_Adaptation_in_the_Climate_Crisis_2024.pdf
2. This estimate is calculated based on the EPA estimate of the typical passenger vehicle emitting 4.6 tons of carbon dioxide per year.
3. In FY24, we contracted 2.8 million metric tons of carbon removal expected to be delivered toward FY30—in addition to 575,000 metric tons that we contracted in FY23—for a total amount of 3.4 million metric tons of contracted carbon removal to-date.
4. Low-carbon building materials are those that have a reduced carbon footprint compared to traditional materials. This means they have lower emissions, specifically in terms of the greenhouse gas (GHG) emissions generated by the manufacturing, transportation, installation, maintenance, and disposal of construction materials. Read more about our strategy here: https://www.microsoft.com/en-us/microsoft-cloud/blog/2024/12/04/sustainable-by-design-advancing-low-carbon-materials/?msockid=36f9cd13211e6cbf12b4d84120336d3f
5. Fennell, Paul, et al. "Cement and Steel—Nine Steps to Net Zero." *Nature*, March 23, 2022. https://www.nature.com/articles/d41586-022-00758-4
6. Microsoft defines carbon-free electricity (CFE) technologies as including technologies with zero direct emissions and biogenic technologies with life cycle emissions equivalent to renewables. CFE technologies include wind; solar; geothermal; sustainable biomass; hydropower; nuclear; fossil with complete carbon capture, utilization, and sequestration; and storage charged with CFE generation. Microsoft acknowledges that CFE technologies have indirect carbon dioxide emissions and these are accounted for in our LCAs. CFE transition in the supply chain includes the onsite generation and purchase of verified Energy Attribute Certificates (EACs) by suppliers that are allocated to Microsoft-specific production volumes.
7. This estimate is calculated based on the EPA estimate of the typical passenger vehicle emitting 4.6 tons of carbon dioxide per year.
8. Surface AI PCs include Surface Pro 10 and Surface Laptop 6. Surface Copilot+ PCs include Surface Pro (11th Edition) and Surface Laptop (10th Edition). Surface Pro 10 and Surface Pro (11th Edition) enclosure includes Bucket and Kickstand. 100% recycled aluminum alloy in Bucket and Kickstand. Surface Laptop 6 enclosure includes A Cover, C Cover, and D Bucket. 100% recycled aluminum alloy in A Cover. Surface Laptop (7th Edition) enclosure includes A Cover, C Bucket, and D Cover. 100% recycled aluminum alloy in A Cover and C Bucket. 100% recycled rare earth metals in magnets. Based on validation performed by Underwriter Laboratories, Inc. using Environmental Claim Validation Procedure, UL 2809-2, Second Edition, November 7, 2023.
9. Replacement components available through Surface Commercial authorized device resellers. Components can be replaced on-site by a skilled technician following the Microsoft Service Guide. Microsoft tools (sold separately) may also be required. Availability of replacement components and service options may vary by product, market, and over time. See Surface service options at Microsoft Learn. Opening and/or repairing your device can present electric shock, fire, and personal injury risks and other hazards. Use caution if undertaking do-it-yourself repairs. Unless required by law, device damage caused during repair will not be covered under Microsoft's Hardware Warranty or protection plans.
10. Opening and/or repairing your device can present electric shock, fire, and personal injury risks and other hazards. Use caution if undertaking do-it-yourself repairs. Unless required by law, device damage caused during repair will not be covered under Microsoft's Hardware Warranty or protection plans.
11. This estimate calculated based on 7,140 square meters per standard soccer field.
12. This information has been self-reported by the organization and has not been verified by Microsoft.
13. Battery life varies significantly with settings, usage, device, and other factors.
14. Testing conducted by Microsoft in October 2024 with Surface Pro (11th Edition - Wi-Fi) Snapdragon® X Plus 10 Core 512 GB, 16 GB RAM devices using Windows 11 Home 24H2. Testing consisted of a partial battery discharge while running the Windows ADK web browsing battery life workloads with Energy Saver enabled and disabled. All settings were default except screen brightness set to 150 units with Auto-Brightness/Adaptive Brightness disabled. Wi-Fi was connected to a network. Actual energy efficiency varies significantly based on settings, usage, and other factors.
15. Based on a snapshot of aggregated internal usage data for devices connected to Microsoft internal network July 1–September 30, 2024, comparing average weighted daily energy consumption per device per usage minute for a population of Surface Copilot+ PCs (Surface Laptop (7th Edition) and Surface Pro (11th Edition)) to a population of Surface Laptop 4, 5, 6 and Surface Pro 8, 9, X. Actual energy efficiency varies significantly by organization and device, and is based on settings, usage, and other factors.
16. The baseline (no interventions) scenario models the same product without any sustainability interventions in the production phase of the device: (a) no additional renewable energy in the supply chain beyond what is already modeled in the regional grid mixes from Ecoinvent v3.9.1, (b) the carbon footprint of materials and manufacturing processes assuming no recycled content or additional eco-design interventions as of the date of Ecoprofile where the life cycle carbon footprint is published, and (c) the default US distribution, use, and end of life modeling assumptions of the specific product model.
17. Conservation International. "Burberry: Freedom to Go Beyond." 2022. https://www.conservation.org/corporate-engagements/burberry-freedom-to-go-beyond
18. Buchner, Barbara, et al. *Global Landscape of Climate Finance 2023*. Climate Policy Initiative, November 2, 2023. https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2023/
19. CTVC. "$32bn and 30% Drop as Market Hits Pause in 2023." *CTVC by Sightline Climate*, January 5, 2024. https://www.ctvc.co/32bn-and-30-drop-as-market-hits-pause-in-2023/
20. PR Newswire. "IBM AI and Cloud Technology Helps Agriculture Industry Improve the World's Food and Crop Supply." *PR Newswire*, May 22, 2019. https://www.prnewswire.com/news-releases/ibm-ai-and-cloud-technology-helps-agriculture-industry-improve-the-worlds-food-and-crop-supply-300855333.html

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Learn more about our sustainability journey and sign up for news and updates here.

2025 Microsoft Environmental Sustainability Report