



2022 Environmental Sustainability Report

Enabling sustainability for our company,
our customers, and the world



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1.4M

We contracted 1,443,981 metric tons of carbon removal in FY22.

12,159

We diverted 12,159 metric tons of solid waste from landfills and incinerators across our direct operational footprint in FY22.

1M

We reached just under one million people with clean water and sanitation solutions by the end of the calendar year 2022.

12,270

In FY22, we protected 12,270 acres of land in Belize. Another 4,998 acres in the United States is contracted.

>600M

Since its inception, Microsoft has allocated over \$600 million of impact investment capital from our Climate Innovation Fund.

Overview

Reviewing our 2022 progress and learnings

We are focused on new ways to harness the power of technology, partnerships, investments, and policy to drive impact at scale and pace to help the world protect ecosystems and biodiversity.

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Foreword

Enabling sustainability for our company, our customers, and the world

2022 marked the sixth warmest year in history. Extreme weather caused devastating droughts, wildfires, famine, floods, and heat waves with alarming frequency. We felt the effects of climate change like never before, and as the planet warms, we'll continue to see and feel the negative impacts on ecosystems and communities around the world. The [most recent report](#) from the Intergovernmental Panel on Climate Change (IPCC) underscores the severity of the climate crisis, and the urgent need for global collective action.

As we look toward 2030—and beyond—we remain optimistic about our collective ability to decarbonize the global economy while continuing to grow and prosper as a global community.



Melanie Nakagawa, Chief Sustainability Officer
Brad Smith, Vice Chair and President

Meaningful climate action requires an enduring commitment from both government and business, with the private sector playing an increasingly important role in the transition from pledges to progress. As we reflect on the seriousness of the climate crisis, we have expanded our ambition to meet this urgent climate need by investing in a broad range of initiatives, technologies and approaches that support a net zero future.

Microsoft's approach to addressing the climate crisis starts with the sustainability of our own business.

In 2020, we made a bold set of commitments: to be a **carbon negative, water positive, zero waste** company that **protects ecosystems**—all by 2030. Three years into this journey, we remain steadfast in our commitment. 2022 was a reminder that to mitigate the most severe impacts of climate change, our commitments need to extend beyond our four walls, and we must continue to accelerate investments that will enable progress for decades to come.

In 2022 we launched Microsoft Cloud for Sustainability, a comprehensive suite of enterprise-grade sustainability management tools. We also helped to advance a set of global sustainability initiatives that aim to benefit every person and organization on the planet. These include accelerating the availability of new climate technologies through our Climate Innovation Fund, 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 enable a just transition for the vulnerable populations of the global south.

We believe that Microsoft has an important role to play in developing and advancing new climate solutions, but also recognize that the climate crisis can't be solved by any single company, organization, or government. The global community needs partnerships, new innovations, policies, and global commitment to ensure a healthy future for all.

A closer look at 2022

Getting our own house in order

Microsoft's own sustainability is our first sphere of influence, and we remain focused on **getting our own house in order and delivering on our 2030 commitments**. We made ambitious commitments in 2020 and we knew that progress would not always be linear. These commitments are rooted in science and take the necessary steps to protect our ecosystems and prevent the most severe impacts of climate change. We are firmly focused on achieving our 2030 commitments and making the right long-term investments that support the sustainability of our business for decades to come. In addition to our long-term focus, it's important to pause and evaluate our progress in 2022.

In 2022, our business grew by 18 percent and our overall emissions declined by 0.5 percent. This in part is a result of a reduction in our direct operational (Scope 1 and 2) emissions by 22.7 percent. At Microsoft, Scope 1 and 2 emissions account for less than four percent of total emissions, while indirect emissions, or Scope 3, account for more than 96 percent. Our Scope 3 reported emissions increased slightly in 2022, by 0.5 percent, despite a 25 percent increase in purchased goods and services due to business growth. The more positive outcomes in 2022 are the result of improvements in our operations, real-time device telemetry-based measurement, renewable energy investments, sustainable aviation fuel (SAF) purchases, and procurement of unbundled renewable energy certificates (RECs).

Foreword (continued)

While we continue to work to reduce our Scope 1 and 2 emissions to near zero, Scope 3 is the ultimate decarbonization challenge. It necessitates the co-evolution of best practices for business, technology, and policy among thousands of global stakeholders. When we made our carbon negative commitment in 2020 it wasn't just a challenge to support the sustainability of our business, it was also an invitation to the world to participate in this journey, translating ingenuity into action, and action into impact.

In addition to our carbon negative commitment, we've also made encouraging progress toward our 2030 commitments in water, waste, and ecosystems:

Water positive

We contracted for replenishment projects that are estimated to provide more than 15.6 million m³ in volumetric water benefits, increasing our running total of replenishment projects to 35 million m³. Additionally, we provided more than 850,000 people with access to clean water and sanitation solutions, including 163,000 in Brazil, India, Indonesia, and Mexico.

We are firmly focused on achieving our 2030 commitments and making the right long-term investments that support the sustainability of our business for decades to come.

Zero waste

We increased our reuse and recycle rates of all cloud hardware to 82 percent and continue to pace toward our 2030 reuse and recycle goal of 90 percent. We also reduced single-use plastics across all Microsoft product packaging to 3.3 percent and are on track to eliminate their use by 2025. In total, we have diverted 12,159 metric tons of solid waste from landfills.

Ecosystem protection

We continue to maintain our commitment to protect more land than we use. In 2022, 12,000 of the over 17,000 acres of contracted land were officially designated as protected. The amount of land protected in 2022 exceeds the approximately 11,200 acres of land we currently use.

Amplifying our impact and helping our customers achieve more

Our second sphere of influence is **customer sustainability**. As a technology company, we have a role to play with the thousands of corporate customers who put their trust in Microsoft technology. The majority of our customers have already made a climate pledge and Microsoft is working to help them move from pledges to progress.

While Microsoft's emissions footprint is a tiny percentage of global emissions, we also have a role to play in helping reduce or remove the other 99.97 percent of global emissions. It's important that our approach to sustainability extends beyond our own four walls and supports the sustainability needs of our customers.

Companies can only manage what they can measure, and Microsoft is committed to helping our customers measure their environmental impact in a timely and accurate manner. In June 2022, we launched Microsoft Cloud for Sustainability, a comprehensive environmental sustainability management platform that includes Microsoft Sustainability Manager. These new digital tools can interoperate with virtually any business system and unify data intelligence for organizations at any stage of their sustainability journey. Sustainability Manager enables organizations to record, report, and reduce their Scope 1, 2, and 3 emissions.

Microsoft Azure customers also benefited from significant upgrades to the Emissions Impact Dashboard (EID), which helps customers to understand the emissions impact that results from their use of the Microsoft Cloud. The EID estimates Microsoft's direct and indirect emissions related to a customer's cloud usage, as well as the emissions customers have avoided by running workloads in the cloud rather than on-premises.

In 2022, we also released a preview version of the Microsoft Planetary Computer to enable customers to measure, monitor, and subsequently to manage ecosystems that may be affected by their operations, and to make important decisions related to climate risk. The Planetary Computer draws on more than 60 petabytes of open-source geospatial data. This data, when combined with the analytic capabilities of our AI for Good Lab, delivers a new level of planetary insights to corporations and governments around the world.

Enabling and supporting a more sustainable world

Finally, our third sphere of influence is to impact **global sustainability**. Just as the reach of Microsoft technology extends to almost every country in the world, so should the impact of our sustainability programs.

In November 2022, the world's climate leaders convened for COP27. There were important conversations at COP27 focused on the uneven impacts of climate change and how the least developed countries in the world are disproportionately affected. For example, the nations of Africa together account for less than 5 percent of global emissions but have experienced far more than their share of the negative impacts of climate change. At Microsoft, we are focused on climate policies and programs that will have a positive impact on all eight billion inhabitants of planet Earth.

Policy

Microsoft is deeply committed to using our voice to influence sustainability policies around the world. We support public policy initiatives to accelerate carbon reporting, reduction and removal, the transition to clean energy, water access and stress reduction, and the ability to measure, manage, and protect ecosystems. In 2022, we further committed to shaping public policy by releasing policy briefs on carbon and electricity.

Carbon measurement and the Carbon Call

In February 2022, Microsoft, ClimateWorks Foundation, and over 20 leading organizations launched an important new initiative called the [Carbon Call](#). The objective of this program is to unify the world around a carbon accounting system that is more reliable and interoperable. ClimateWorks Foundation is building this program to a global scale. The Carbon Call now has over 80 signatories, and released its [initial roadmap](#) at COP27.

Foreword (continued)

Climate Innovation Fund

We believe that innovation is a critical component to solving the climate crisis, and that the investment of capital plays an important role in accelerating the availability of new solutions. Microsoft is investing in accelerating climate innovation through our \$1 billion Climate Innovation Fund (CIF). We invest in innovative technologies and business models that have the potential for meaningful, measurable climate impact by 2030. Since the founding of the CIF in 2020, Microsoft has allocated more than \$600 million into a global portfolio of more than 50 investments, including sustainable solutions in energy, industrial, and natural systems.

Africa data lab

In November we announced an expansion of our AI for Good Lab into Egypt and Kenya, building a new team of data scientists on the ground in Africa that will work to improve climate resilience. The work of these data labs will be informed by a new Africa AI Innovation Council comprised of representatives from leading African organizations.

Sustainability skills

Delivering on the ambition of the Paris Agreement will require a global initiative focused on the proliferation of sustainability skills throughout the labor market. In November 2022, Microsoft and BCG released a new report, [Closing the Sustainability Skills Gap: Helping Businesses Move from Pledges to Progress](#). This report reinforces the need for employers and governments to invest in upskilling the current workforce through learning initiatives focused on sustainability knowledge and skills, to prepare the next generation for sustainability jobs of the future. Microsoft is working with partners to develop and share new sustainability learning materials to accelerate the development of the sustainability workforce of the future.

A decade of innovation and decisive action

As we look toward 2030—and beyond—we remain optimistic about our collective ability to decarbonize the global economy while continuing to grow and prosper as a global community. We will continue investing in three key areas that will enable the scale of sustainability solutions needed to address the climate crisis:

- 1 Advancing AI solutions for greater climate impact.**
- 2 Accelerating the development of sustainability markets through investment.**
- 3 Creating tools that advance emissions measurement and compliance.**

This will be a decade of innovation and decisive action, from expanding the use of AI to address sustainability to forging new public and private sector partnerships. To move from pledges to progress, we cannot be deterred by near-term challenges, and must remain focused on developing innovative new solutions and in many cases, accelerating our actions. At Microsoft, we're deeply committed to sustainability as a company, as a technology provider, and as citizens of planet Earth.



The Microsoft Planetary Computer enables customers to measure, monitor, and manage ecosystems and make climate risk decisions.

Brad Smith
Vice Chair and President

Melanie Nakagawa
Chief Sustainability Officer

2022 progress

Microsoft Cloud for Sustainability

The Microsoft Cloud for Sustainability data model centralizes emissions data from disparate sources in a shared data language—streamlining data ingestion, integration, and calculations and enabling more accurate and reliable reporting. The Microsoft Cloud for Sustainability data model initially focused on carbon and was expanded in 2022 to include water data.

Advanced policy

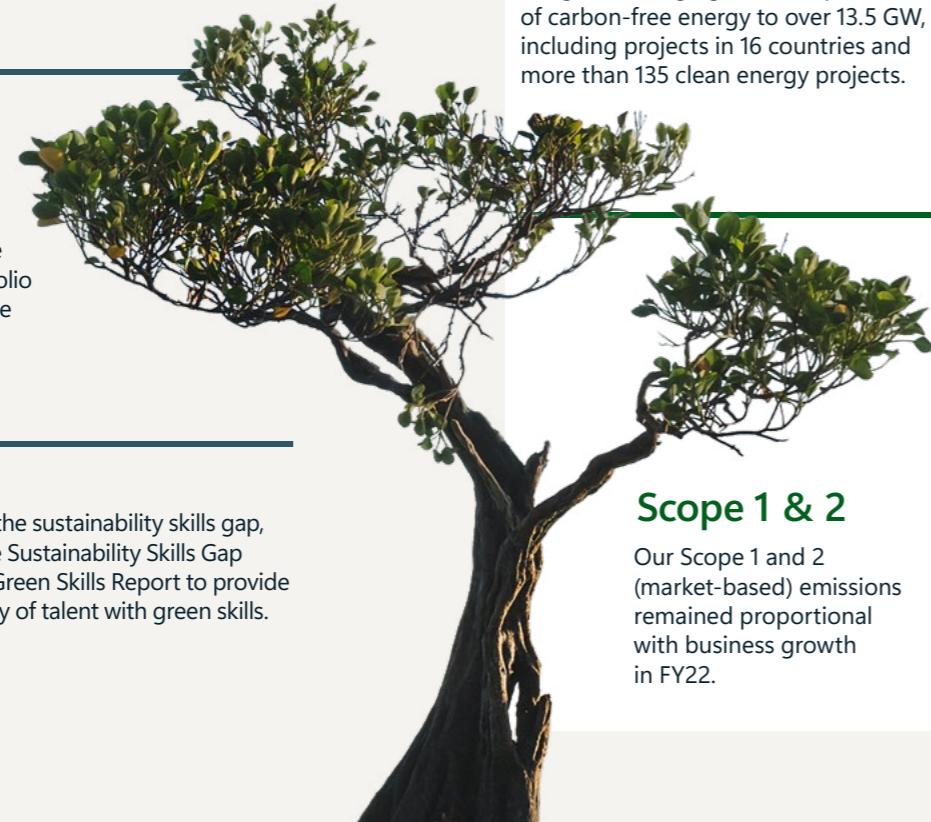
To support our policy work, we published several briefs on carbon and electricity policy to share the priorities and principles that guide Microsoft's policy advocacy work around the world.

>\$600M in climate innovation

Since its inception, Microsoft has allocated over \$600 million impact investment capital from our Climate Innovation Fund into a global portfolio of investments, featuring sustainable solutions in energy, industrial, and natural systems.

Sustainability skills gap

To better understand how to close the sustainability skills gap, Microsoft published the Closing the Sustainability Skills Gap report and LinkedIn published the Green Skills Report to provide insights into the demand and supply of talent with green skills.



Carbon

1.4M metric tons

We contracted 1,443,981 metric tons of carbon removal in FY22. We also made first-of-a-kind multi-year forward offtake commitments to carbon removal, which we view as the model for scaling this industry.

13.5 GW

In FY22, we signed new PPAs around the globe, bringing our total portfolio of carbon-free energy to over 13.5 GW, including projects in 16 countries and more than 135 clean energy projects.

Scope 1 & 2

Our Scope 1 and 2 (market-based) emissions remained proportional with business growth in FY22.

Water

15.6M m³

In FY22, we contracted for replenishment projects that are estimated to provide more than 15.6 million m³ in volumetric water benefit over the lifetime of these projects.

1M

By the end of FY22, we provided more than 550,000 people with access to clean water and sanitation solutions in Brazil, India, Indonesia, and Mexico and reached just under one million people by the end of the calendar year 2022.

Environmental justice

Environmental justice is embedded in our water access target, and we are looking for ways to be more intentional about integrating environmental justice into our replenishment investments.

Waste

12,159 metric tons

In FY22, we diverted 12,159 metric tons of solid waste from landfills and incinerators across our direct operational footprint.

82%

Our reuse and recycle rates of servers and components across all cloud hardware reached 82 percent in FY22.

29%

We reduced single-use plastics in our Microsoft product packaging by more than 29 percent, a decrease from 4.7 percent to 3.3 percent by weight (on average) of plastic per package in FY22.

Ecosystems

12,270 acres

In FY22, we protected 12,270 acres of land in Belize. We now protect more than the 11,206 acres of land that we use.

Big game migration program

Through the NFWF Western Big Game Migration Program, we invested in projects in the American West that are vital for preserving the migration corridors of endangered and at-risk species, including mountain lions and grizzly bears.

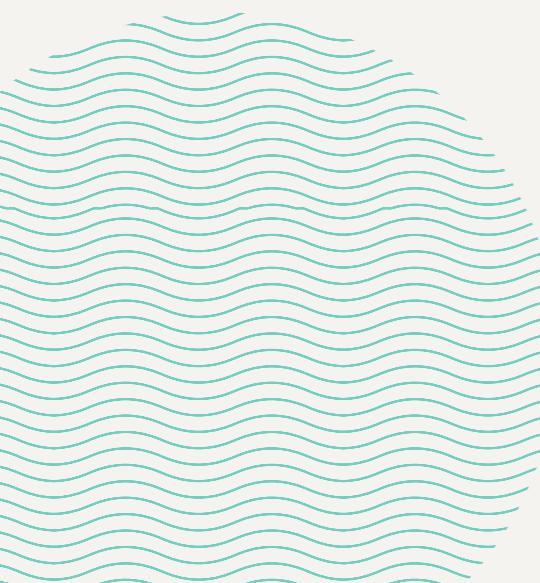


Protecting biodiversity

Last year, we contributed to the TNC Belize Maya Forest Project (BMF) to protect an additional 236,000 acres in a global biodiversity hotspot.

How we work

For any organization's environmental sustainability journey, it is critical to set commitments, develop a strategy, and build an operational roadmap—all while measuring progress and ensuring accountability. We've learned a lot over the last three years of Microsoft's sustainability journey, and we hope that sharing our approach can help other organizations as they develop their own roadmap.



1 Set commitments based on science

Sustainability science has been at the center of our commitments. In 2019, Microsoft took a step back to look at the science behind climate change and saw that our commitment to being carbon neutral was not enough. The world needs to reach net zero by or before 2050, and achieving it relies heavily on private sector partnership and action. This guided us to make our commitments to be a carbon negative, water positive, zero waste company by 2030.

2 Consider all positions of influence

As a global technology leader, Microsoft has many opportunities to influence—as a customer, supplier, investor, employer, policy advocate, and innovation partner. We know it will take commitment across our entire value chain to reach our goals. We also focus on the larger impact that we can have with research, investments, innovation, strategic partnerships, policy, and advocacy.

3 Establish sustainability as part of culture

At the heart of the Microsoft culture is the belief that for Microsoft to continue to do well, the world around us also needs to do well. As we continue to grow, we are pursuing opportunities that help solve the problems of people and the planet—and we have made sustainability core to our brand and our business. Our senior leadership team has a deep and enduring commitment to sustainability, which sets the tone across all levels of our organization.

4 Make it central to business

To move from pledges to progress, Microsoft set commitments and built sustainability into the strategy, operations, and roadmaps of each business group and every subsidiary across the globe. We are also working across our value chain on sustainability commitments and support our customers and partners by delivering capacity-building tools and solutions.

5 Ensure governance and accountability

Governance and accountability are critical to ensure cross-company alignment and prioritization of sustainability commitments. At Microsoft, we hold our business groups accountable for their carbon emissions via an internal carbon fee. Achieving our sustainability commitments is a core priority for every business group; we publish scorecards twice yearly and review progress quarterly. We established a Climate Council of senior leaders across the company to govern our sustainability progress and priorities.

6 Report on everything, not just progress

Transparency needs to be a component of any sustainability initiative. Microsoft is committed to sharing our progress, learnings, innovations, methodology development, and thought leadership through our annual sustainability report, white papers, blogs, and journal publications. We share playbooks from our successes, as well as learnings when we uncover new challenges or setbacks. These learnings also inspire us to champion global issues such as more reliable and interoperable global carbon accounting, a more systematic approach to building a multidisciplinary workforce of sustainability experts, and the development of innovative technology solutions for our customers and partners.

About this report

We think about Microsoft's role in sustainability through three spheres of influence: Microsoft sustainability, customer sustainability, and global sustainability.



Transparent and accountable reporting on progress

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](#).

Microsoft sustainability

Taking care of our own environmental footprint

Our sustainability work starts with getting our own house in order. We are taking accountability for our operational footprint and are committed to sharing learnings, accelerating markets, scaling solutions, and being transparent about our progress.

Customer sustainability

Delivering digital technology for net zero

We are committed to providing the digital technology needed to help build a more sustainable world. We are delivering technology to help organizations measure and manage their environmental footprints and monitor the health of the planet's natural ecosystems.

Global sustainability

Enabling a more sustainable world

We understand that our actions alone will not solve the climate crisis. As a global technology leader, we are also committed to helping build the enabling societal conditions that will support a net zero economy.

Microsoft sustainability

Taking care of our own environmental footprint

Our sustainability work starts with taking accountability for our operational footprint. In 2020, Microsoft made industry-leading commitments to be carbon negative, water positive, and zero waste by 2030, and to protect more land than we use by 2025. This means taking accountability for our operational footprint across our campuses, datacenters, devices, software, and value chain. We look at our operations across the entire lifecycle of 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.

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Getting to carbon negative

Carbon

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Our approach

In January 2020, Microsoft committed to be carbon negative by 2030. Operationally, we see this commitment as a journey that starts with reducing carbon emissions as much as possible, replacing our electricity consumption with carbon-free energy, and removing the emissions that remain.

In FY22, our business grew by 18 percent and our overall emissions were down 0.5 percent. Our total company emissions were just under 13 million metric tons of carbon dioxide equivalents (mtCO₂e) (market-based and management-defined criteria for Scope 3 Category 11). Taking into account our renewable energy purchases, our Scope 1 and 2 emissions were approximately 428,000 mtCO₂e. More than 96 percent of our emissions are in Scope 3, which includes

emissions from our supply chain, the lifecycle of our hardware and devices, travel, and other indirect sources. We saw a 0.5 percent increase in our Scope 3 emissions this year based on investments in real-time device telemetry-based measurement, improvements in our operations and supply chain, and purchases of renewable energy.

As the world transitions to a lower-carbon, clean energy economy, we're using our purchasing and investing power to help advance innovation and the development of new solutions—helping us meet our own commitments while catalyzing the creation of broader market supply for others. We fund purchases of renewable energy, sustainable aviation fuel, and carbon removal through our internal carbon fee, which we established in 2012. The fee is designed to accelerate carbon reduction and allocate funding to projects that jumpstart and scale decarbonization technologies. In FY22, we redesigned and increased our carbon fee to accelerate Scope 3 emissions reduction, tying the fee to the costs abatement for different sources—electricity, fuel, and other emissions. We will continue to evaluate the carbon fee design to align our business operations and 2030 carbon commitments.

In 2022, we were able to disaggregate and identify previously unreported electricity for some of our leased datacenters due to improvements in our ability to capture such data. We have revised FY20 and FY21 Scope 2 and Scope 3 Category 3 market and location values to include this additional information. In FY22, we included this activity in our results and procured unbundled renewable energy credits (RECs) to mitigate the increased emissions for FY22. Our year-over-year figures show a 23 percent reduction in Scope 1 and 2 market-based emissions, which is driven in part by our procurement of RECs for FY22. Without this revision, our Scope 1 and 2 market-based emissions would have remained proportional with business growth.



13.5 GW

In FY22, we signed new power purchase agreements around the globe, bringing our total portfolio of carbon-free energy to over 13.5 GW.

Commitments and progress

Carbon negative by 2030

We are committed to being carbon negative by 2030 and by 2050 remove from the atmosphere an equivalent amount of all the carbon dioxide our company has emitted either directly or by our electricity consumption since we were founded in 1975.

Our commitment

Reducing direct emissions

We will reduce our Scope 1 and 2 emissions to near zero by increasing energy efficiency, decarbonization, and reaching 100 percent 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.

Replacing with 100/100/0 carbon-free energy

By 2030, 100 percent of our electricity consumption will be matched by zero carbon energy purchases 100 percent 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 emissions.

Other achievements

10th year of CDP A List for Climate Change

Microsoft was named to the CDP A List for Climate Change for the 10th consecutive year.

Our progress

Net zero Scope 1 and 2 emissions

Our Scope 1 and 2¹ emissions remained proportional with business growth in FY22.² More than 95 percent of our Scope 2 emissions were reduced by renewable energy from power purchase agreements (PPAs), green tariff programs, and unbundled renewable energy certificates.

Scope 3 emissions increased by 0.5 percent

Our value chain or Scope 3 emissions increased slightly at 0.5 percent, despite a 25 percent increase in purchased goods and services due to business growth. This result was driven by improvements in our operations, telemetry-based measurement, renewable energy investments, sustainable aviation fuel purchases, and procurement of unbundled renewable energy certificates (RECs).³

13.5 GW of carbon-free energy

In FY22, we signed new Power Purchase Agreements (PPAs) around the globe, bringing our total portfolio of carbon-free energy to over 13.5 GW, including more than 135 projects in 16 countries.

Over 1.4M metric tons of carbon removal

We contracted 1,443,981 metric tons of carbon removal in FY22. We also made first-of-their-kind multi-year forward offtake commitments to carbon removal, which we view as the model for scaling the industry.

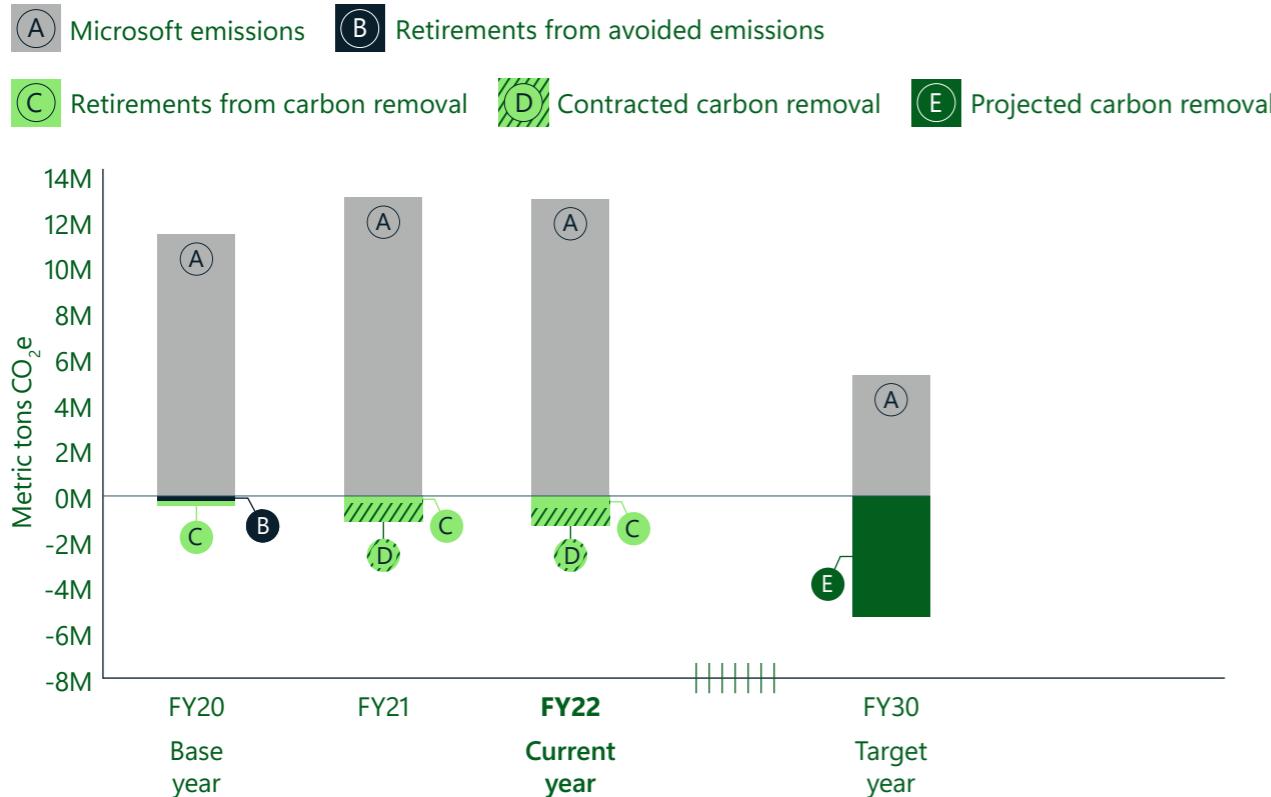
Carbon fee redesign

We redesigned our carbon fee, tying it to the costs of abatement of electricity, travel, and other emissions sources.

Carbon Table 1

Tracking our yearly progress toward carbon negative by 2030

In FY22, we procured 1.44 million metric tons and retired 514,156 metric tons of carbon removal as part of our effort toward achieving our annual carbon commitment to be carbon neutral. Carbon removal contracted each year includes credits retired in the same year and to be retired in future years.



▶ Learn more in the Environmental Data Fact Sheet

- The chart has been updated to reflect the latest actual values which incorporate the latest methodology, management's criteria metrics, and structural change adjustments. Scope 2 and 3 values are market-based and management's criteria metrics.
- Carbon negative by 2030: A company is carbon negative when it removes more carbon than it emits each year.

Carbon Table 2

Tracking our emissions across Scopes 1, 2, and 3

Microsoft's overall emissions decreased by 0.5 percent in FY22. This was driven by improvements in our operations, telemetry-based measurement, renewable energy investments, sustainable aviation fuel purchases, and procurement of unbundled renewable energy certificates (RECs).



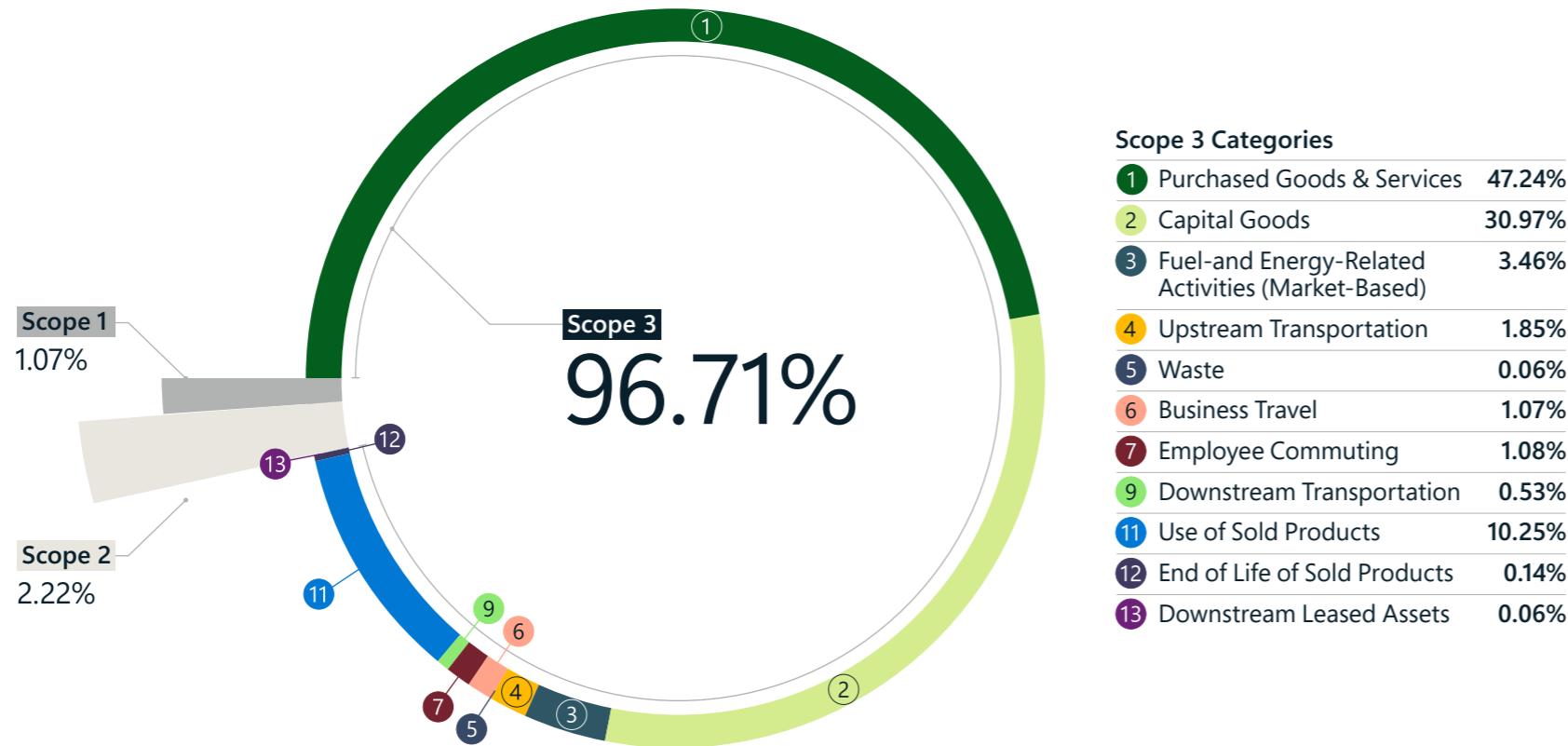
▶ Learn more in the Environmental Data Fact Sheet

- Scope 2 and 3 values are market-based and management's criteria metrics.
- Reported emissions for FY20 and FY21 have been recalculated for improved accuracy in accordance with our internal recalculation policy. We were able to disaggregate and identify previously unreported electricity for some of our leased datacenters due to improvements in our ability to capture such data.

Carbon Table 3

Breaking down our FY22 Scope 3 emissions by source

Microsoft's Scope 3 emissions account for more than 96 percent of our total emissions, 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).



Learn more in the Environmental Data Fact Sheet

a. Scope 2 and 3 values are market-based and management's criteria metrics.

Tackling Scope 3

Scope 3 represents 96 percent of Microsoft's annual emissions in FY22. Our Scope 3 emissions result primarily from the operations of our tens of thousands of suppliers (upstream) and the use of our products across millions of our customers (downstream).

Reducing Scope 3 emissions requires unprecedented scaling of corporate clean energy purchases across Microsoft's value chain, to address both the electricity consumed by our products, like Xbox devices or Surface laptops, and used to manufacture everything from semiconductors to fiber optic cables. Moreover, tackling Scope 3 means decarbonizing hard-to-abate industries, including the steel, concrete, and other building materials used in our datacenters, as well as jet fuel for business travel and logistics.

Reducing Scope 1 and 2 emissions

Sustainability is a key priority across all phases of our campus and datacenter projects—from integrated design and construction through operations and decommissioning.

Scopes explained

Scope 1

Direct emissions created by a company's activities



Scope 2

Indirect emissions from a company's activities



Scope 3

Indirect emissions from all other activities up and down the value chain



[Learn more about GHG emissions](#)

Ensuring energy efficiency

Ensuring our buildings are energy efficient is a key first step in reducing emissions.

Building datacenters for optimum power usage effectiveness

The power usage effectiveness (PUE) ratio is a metric of how efficiently a datacenter consumes and uses energy. We design and build Microsoft datacenters as close to a PUE of 1 as feasible. Our newest generation of datacenters have a design PUE of 1.12 and, with each new generation, we strive to become even more efficient. In addition, all future built datacenters will be LEED Gold certified. We are also investigating how to encourage transparency and efficiency improvements at leased sites.

Promoting grid stability via energy storage solutions

Wind farms generate more than 35 percent of Ireland's electricity. As the supply of wind and other renewable energy increases, electric power grid operators need to ensure that they have resources available to balance variable power production. Banks of lithium-ion batteries at our Dublin datacenter, typically used for backup power, will help grid operators provide uninterrupted service when demand exceeds renewable supply—reducing the need to rely on coal or natural gas to support a stable grid. The uninterruptible power supply for the Dublin datacenter includes new technology that enables real-time provision of services to the grid. We're also researching and testing alternatives to lithium-ion batteries, to address the challenges of high demand for raw materials and end-of-life disposal.

Innovating with thermal energy in our campuses

As part of our Redmond Campus Modernization project, we built the [Thermal Energy Center](#). Nine hundred deep wells are the foundation of a large system that heats and cools the new buildings. The wells will compose one of the largest geoexchange fields in the United States to take advantage of the temperature difference between sub-ground soil, which remains constant year-round, and that of ambient air, which changes with the seasons. More than 220 miles of piping will distribute 320,000 gallons of water as a heat-exchange medium across the wells and the new campus in a closed loop system. The Thermal Energy Center houses chillers, cooling towers, backup generators, solar panels, and 65-foot tanks that can store thousands of gallons of water as thermal energy. The system is expected to reduce energy consumption by more than 50 percent of a typical utility plant.

Designing energy efficiency into our campuses

Our global campus projects adhere to strict sustainability standards which have energy efficiency measures embedded in our design requirements. All major projects must achieve LEED Gold or Platinum certification, ensuring high energy efficiency design. Each of our campuses has a sustainability plan with energy efficiency projects planned each year to drive down our energy usage.



Ensuring the energy efficiency of our buildings, including owned datacenters, is a key step in reducing our emissions.



Reducing Scope 1 and 2 emissions (continued)

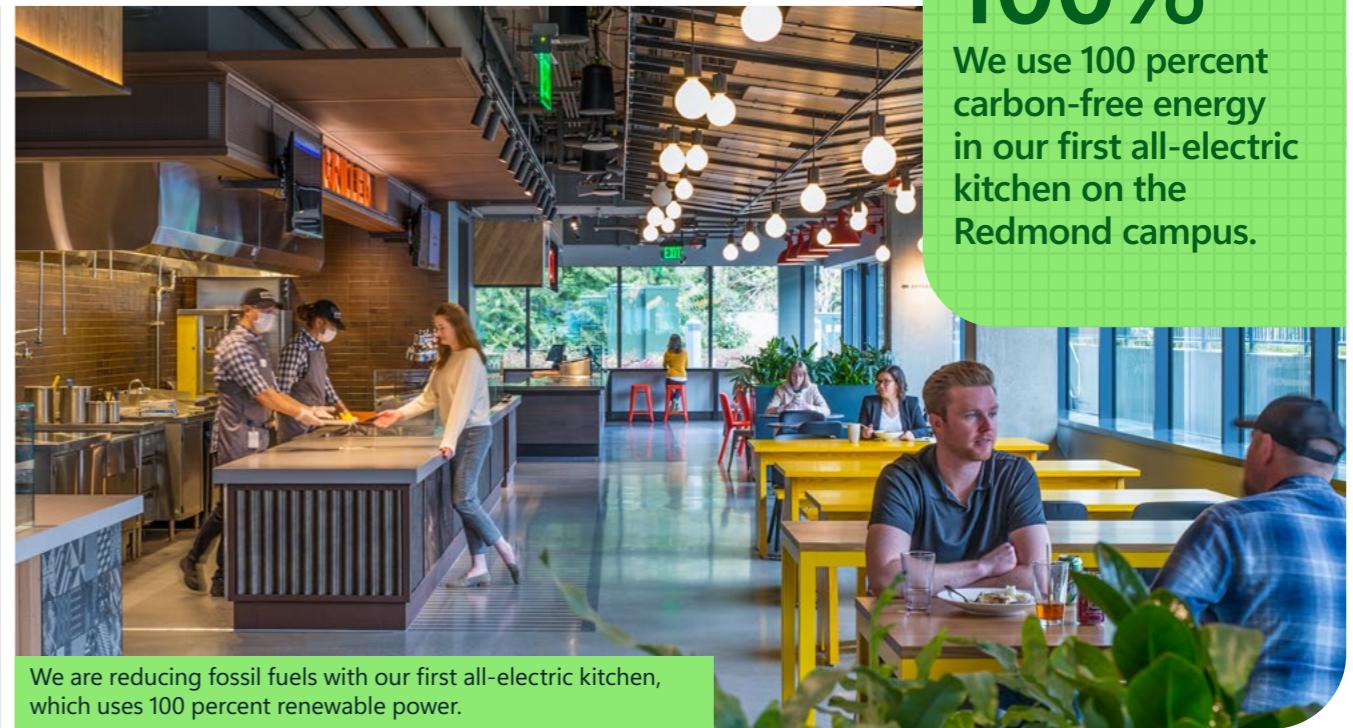
Reducing fossil fuels

Microsoft is committed to being diesel free in our datacenter operations by 2030, moving to all-electric kitchens, and electrifying our campus fleet.

Developing hydrogen fuel cells for datacenters

The decreasing cost of renewable sources, advancement of green hydrogen production technology, and increasing legislative focus are starting to show potential to reduce the datacenter industry's reliance on fossil-based diesel fuels. Microsoft is demonstrating the application of green hydrogen at industrial scales—with a first of its kind, zero emission, 3 MW hydrogen polymer electrolyte membrane (PEM) fuel cell backup power generator piloted in July 2022. PEM fuel cell technology combines hydrogen and outside air in a chemical reaction that generates electricity, heat, and water. While hydrogen fuel cell technology has been commercialized at smaller scales, this is the first time it has been demonstrated for multi-megawatt generation needs at datacenters.

This year, Microsoft opened our first all-electric kitchen on our Redmond campus. The One Esterra food hall includes 12,200 square feet of all-electric cooking space, which supports more than 1,000 meals a day and uses 100 percent renewable hydro power.



Implementing all-electric kitchens

This year, Microsoft opened our first all-electric kitchen on our Redmond campus. The One Esterra food hall includes 12,200 square feet of all-electric cooking space, which supports more than 1,000 meals a day and uses 100 percent renewable hydro power. In collaboration with Jade Range, we created custom commercial grade electric cooking equipment. Moving forward, we intend to construct all new kitchens with all-electric equipment and are developing retrofit plans for existing operations. We released a new [Dining All-Electric white paper](#) sharing our lessons learned, technical details, and decision making. One Esterra is a preview of our Redmond Campus Modernization which will have over 77,000 square feet of all-electric dining operations and serve more than 10,000 meals a day.

Electrifying our fleet

We are committed to fully electrifying our global campus operations vehicle fleet of over 1,800 vehicles by 2030. To date, we have received five all-electric buses in Ireland and sites in China are running all-electric routes through service providers. In Redmond, Microsoft purchased land to build an eight-acre electric vehicle charging and maintenance facility for its internal and external commute fleet of electric buses and shuttles.

100%

We use 100 percent carbon-free energy in our first all-electric kitchen on the Redmond campus.

Reducing Scope 3 emissions

Our Scope 3 commitment is our most powerful opportunity to help accelerate global decarbonization efforts by engaging suppliers and customers in our value chain and partnering to reduce emissions associated with the business we do together.

Microsoft's Scope 3 emissions account for more than 96 percent of our total emissions, with the vast majority of these emissions coming from three categories: Purchased Goods and Services (Category 1), Capital Goods (Category 2), and Use of Sold Products (Category 11).

Overall, our Scope 3 emissions increased by 0.5 percent in FY22 compared to FY21. This is attributed to a few notable carbon reduction initiatives. First, we've extended the useful life of servers and network equipment from four to six years, resulting in a decrease in emissions related to Capital Goods. Second, we introduced a new telemetry-driven methodology to help us account for the energy consumption from our Surface devices and our rapidly growing base of Xbox users. This new data led us to purchase unbundled renewable energy certificates (RECs) to offset a portion of the emissions footprint from these devices. Just as is the case for Scope 2 reduction efforts, we plan to phase out the use of unbundled RECs in future years as programs to reduce emissions take effect, including substantial forward investments into new clean energy facilities yet to commence operation.

Improving Scope 3 measurement and methodologies

Accurate measurement is one of the biggest challenges in Scope 3 emissions reduction. Microsoft has prioritized improving the methodologies we use for collecting data and calculating emissions for greater precision and granularity.

Increasing data quality from our supply chain

Supply chain and capital goods are our biggest drivers of emissions, and we need better data in these categories to drive the right reduction strategies. In July 2022, we updated our Supplier Code of Conduct (SCoC) sustainability requirements to include independent third-party assurance of emissions data and to deliver a minimum 55 percent greenhouse gas (GHG) reduction by 2030.

Improving accounting methodologies

For capital goods, we are developing new methodologies to use product specific emissions factors for building materials from the Embodied Carbon in Construction Calculator (EC3). This methodology is under development (not yet reflected in Scope 3 reporting metrics) and, in combination with using EC3 in project decisions to track and reduce embodied carbon at each phase of construction, will enable us to reduce embodied carbon emissions on our construction projects as well as demonstrate those product-level reduction decisions in future reporting cycles.

Advancing lifecycle assessments

Microsoft is promoting circular design principles for the cloud hardware and devices communities. This year, we contributed to the "[Life Cycle Assessment \(LCA\) Guidelines for Cloud Providers](#)" and provided the guidelines to the Open Compute Project (OCP) to encourage other cloud hardware organizations to better understand and reduce their environmental impact. We are also evolving our approach to [LCAs in our devices](#). The LCAs will feed into an advanced Carbon Data Platform to provide the most representative emissions profile possible for our devices. The platform will be used for reporting and improved decision-making with visibility into actionable and granular environmental impacts.

Optimizing devices based on real-world data

We are using real-world, anonymized insights from users of Surface and Xbox devices who opt to share information with us to inform our carbon emissions assessments. The data provides an estimate of how energy is consumed by those devices based on factors such as battery drain and CPU utilization. We use this data to calculate high-quality estimates of the daily energy use in different geographies. In the future, we are exploring how to increase accuracy by shifting to hourly energy use tracking paired with more granular, impact-relevant grid emission rate data.



Microsoft has prioritized improving the methodologies we use for collecting data and calculating emissions for greater precision and granularity.

We are using real-world, anonymized insights from users of Surface and Xbox devices who opt to share information with us to estimate how energy is consumed by those devices.

Reducing Scope 3 emissions (continued)

Reducing emissions by consuming less

Our top priority for reducing Scope 3 emissions is to design efficiency and circularity into construction and purchasing from the start, so our supply chain uses less energy.

Improving efficiency to reduce the number of datacenters

Datacenter resources are often designed and built for peak power usage, which can lead to underutilization and the need to build new datacenters. Microsoft is focused on improving datacenter efficiency by reducing peak power, safely harvesting unused power, and increasing server density in existing datacenters through intelligent utilization, service level agreement (SLA)-driven power harvesting, and power-aware virtual machine allocation. We use the inherent redundancy in Microsoft-internal software services to tap into datacenter capacity that is traditionally reserved for use only during power grid or infrastructure failures, so we can increase the number of servers in datacenters by up to 33 percent and, in turn, reduce the number of datacenters needed overall.

Reducing embodied carbon in buildings and interiors

To drive deeper reductions in embodied carbon, we are pursuing the use of transformational low-carbon materials. This year, we piloted a new concrete mix using recycled glass pozzolans, reducing embodied carbon for the slab structure by around half. We completed a lab-scale pilot of structural materials made from biogenic limestone and algae-based concrete, which have the potential to drive down embodied carbon of concrete installations to near zero. Microsoft also completed a study of embodied carbon emissions in furniture, carpeting, and other interior building features to establish the baseline for reduction in our design standards. These standards, using the Embodied Carbon in Construction Calculator (EC3), set thresholds for mineral wool insulation, cold-formed steel framing, carpeting, and gypsum.

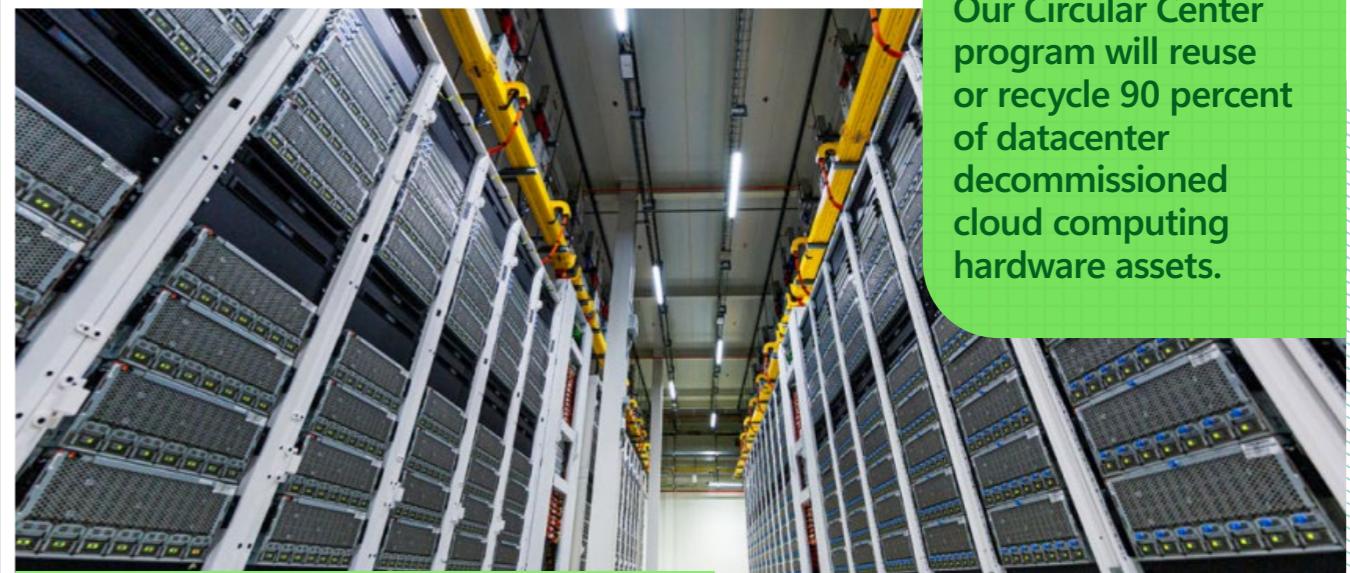
Reimagining circularity of cloud hardware

Microsoft has taken an innovative approach by implementing Circular Centers in our datacenter campuses, aligning our end-of-life dispositioning processes with an integrated plan across the entire supply chain. Over the past year, we engaged new suppliers who can remanufacture assets and components, enabling new lifecycles for our assets. We have demonstrated takeback/buyback models with several of our original asset suppliers, closing the loop on assets and enabling suppliers to repurpose or reuse assets and components, resulting in emissions reduction and material recovery. Our Circular Center program will reuse or recycle 90 percent of datacenter decommissioned cloud computing hardware assets, contributing directly to emissions reductions.

Engineering carbon out of our cloud operations and hardware supply chain

We are focused on engineering carbon out of our value chain via the infrastructure equipment we use in the operation of our datacenters. Using LCAs and environmental product declarations, we partner with our suppliers to assess hotspots of embodied carbon in the equipment we purchase, so we can better understand how we can help reduce emissions in our supply chain.

In FY22, our cloud hardware designers worked with material and component suppliers to design components that reduced dependency on virgin plastic, introducing up to 35 percent post-consumer recycled (PCR) plastic in select server components. We also redesigned certain rack components to drive material reduction, resulting in a reduction of plastic in those components by 12 percent.



Our Circular Centers contribute directly to emissions reductions by reusing or recycling hardware assets.

Boosting efficiency of device usage

Surface Pro 9 and Surface Laptop 5 are among the most energy efficient Surface computers, and both are ENERGY STAR® Certified, consuming less than half the recommended energy limit from the latest ENERGY STAR computer specifications.⁴ Surface Pro 9 5G, powered by ARM technology, combines the energy efficiency of modern mobile devices with the computing power of a traditional computer. We also use software to reduce carbon emissions associated with our devices' use stage, such as with the energy-efficient Shutdown (energy saving) mode for Xbox, which cuts power use by up to 20 times when it is off, compared to Sleep mode.

90%
Our Circular Center program will reuse or recycle 90 percent of datacenter decommissioned cloud computing hardware assets.

Reducing Scope 3 emissions (continued)

Transforming the market through purchasing

Through our Supplier Code of Conduct (SCoC) and purchasing commitments, Microsoft is sending demand signals to our supply chain that we expect lower-carbon inputs and business models.

Roadmapping our supply chain

Since 2020, our SCoC has required that suppliers disclose GHG emissions and plans to reduce those emissions. Last year, we met with our top suppliers to understand their sustainability objectives and establish a shared approach to how we measure emissions, establish baselines, identify difficult to reduce areas, and review commitments to align on the priorities. In the indirect purchasing space, including consultancies and marketing companies, suppliers are starting to consider policies for hybrid work and exploring options for how best to transition to renewable electricity.

In FY22, we supported the avoidance of 28,000 mt of CO₂e savings in partnership with our suppliers by shifting cargo from carbon intense modes (air and truck) to lower-carbon modes (ocean and rail).

We partner with suppliers to shift to lower-carbon modes of transport, resulting in a measurable emissions reduction.



Reducing emissions in our devices supply chain

We continue to work with our device suppliers on carbon reduction interventions, renewable energy alternatives, and manufacturing process improvements. These reductions include 12 suppliers switching to renewable energy, with six converting to 100 percent renewable energy as members of RE100. Learn more about our efforts in our [FY22 Responsible Sourcing Report](#).

Decarbonizing transportation

We partner with our transportation logistics ecosystem to implement decarbonization solutions across our logistics network. In 2022, our logistics teams explored new ways to mitigate sources of logistics emissions. Based on the Global Logistics Emissions Council (GLEC) Framework and cutting-edge tooling, the new emissions approach will enable strategic investments and optimizations across Microsoft's logistics operations in support of decarbonized transportation. In FY22, we supported the avoidance of 28,000 mtCO₂e in partnership with our suppliers by shifting cargo from carbon intense modes (air and truck) to lower-carbon modes (ocean and rail). We also launched the first alternative energy vehicle (AEV) pilots for trucking.

Advancing sustainable aviation

Microsoft is advancing efforts to increase the production of and accounting standards for sustainable aviation fuel (SAF). In 2022, we piloted the [Roundtable on Sustainable Biomaterial's \(RSB\)](#) "book and claim" process, which will result in a SAF certificate for Microsoft in collaboration with United Airlines and AirBP. In July 2022 Microsoft announced a partnership with Alaska Airlines and Twelve, a Climate Innovation Fund investee, to operate the first demonstration flight using e-Jet, a low-carbon jet fuel produced from recaptured carbon dioxide, water, and renewable energy. Microsoft worked together with the Environmental Defense Fund to publish the [High Integrity Sustainable Aviation Fuel Handbook](#).

Transitioning to carbon-free energy

Electricity use accounts for the vast majority of Microsoft's operational carbon emissions footprint. In parallel to energy reductions and efficiencies, our work supports the growth and adoption of more carbon-free energy.

Our long-term vision is to reach a state where, on all the world's grids, 100 percent of electrons, 100 percent of the time, are generated from zero-carbon sources. On the path to reaching this vision, our commitment is to cover 100 percent of Microsoft's load with renewable energy purchases by 2025, and by 2030 to ensure that we meet our 100/100/0 commitment, meaning 100 percent of Microsoft's electricity consumption, 100 percent of the time, will be matched by zero-carbon energy purchases.

In FY22, we continued to work with industry-leading partners such as Shell, Constellation, and ENGIE to procure new carbon-free energy resources to meet our goals. To continue advancing the green energy economy in the United States and in recognition of the opportunity to proactively collaborate on driving a more reliable domestic solar module supply chain, Microsoft is collaborating with Hanwha to increase domestic green energy manufacturing through a first-of-its-kind initiative for major equipment and associated construction services. By partnering with Hanwha, Microsoft seeks to facilitate quicker adoption of domestic green energy equipment supply through its pipeline of domestic power purchase agreements (PPAs).

In FY22, we signed new power purchase agreements around the globe, bringing our total portfolio of PPAs for carbon-free energy to over 13.5 GW. This includes deals across 16 countries including New Zealand, the Netherlands, Chile, Singapore, Austria, Ireland, and the United Kingdom. Globally, we have more than 135 renewables projects in our PPA portfolio and are positioned to continue to grow our renewable resource procurement to meet our goals.

Committing to environmental justice in carbon-free energy procurement

In addition to carbon-free energy, Microsoft has made commitments to diversity and inclusion, and to racial equity. An important point of intersection for these is environmental justice. To support environmental justice outcomes in a reimaged energy sector, Microsoft is in its third year of modeling approaches that link our carbon-free energy commitments with community-led clean energy and resiliency projects.

Through partnerships, we have established new renewable energy procurement models that create new opportunities for frontline communities by equitably distributing the benefits of the clean energy economy. We've shared our lessons learned in a position paper with Volt Energy Utility, including an Environmental Justice Measurement & Evaluation Framework that guides our initiatives.

Examples of how we've worked to integrate equity and justice into our approaches include the following:

- We supported the development of two new community solar gardens in Illinois, which are expected to have a capacity of 4.75 MW with a focus on expanding access to renewable power to traditionally under-resourced populations. ENGIE and Microsoft are working with a leading community solar organizer and provider, Solstice, who engage directly with residents and community organizations in cities and counties across the United States to provide access to renewables for customers that cannot afford to install rooftop solar. Solstice pioneered EnergyScore, a unique solution that uses utility payment history and other customer data to provide a more accurate and inclusive prediction of an individual's ability to pay an energy bill. Once fully subscribed, the two solar gardens could save Illinois subscribers more than \$100,000 a year in total electricity costs, while also reducing carbon emissions equivalent to more than 1,000 households' average electricity usage.
- We supported a 6.6-MW solar facility in Panola County, Mississippi, which provides first-time solar access to consumers in a county with majority Black residents and a poverty rate that is double the United States average. By using emissions data to determine where new solar generation can displace the most carbon, Clearloop is collaborating with Microsoft to expand access to clean energy in a state that currently relies on fossil fuels to power nearly 90 percent of its electricity. Clearloop will also collaborate with local community programs to provide workforce development, training, and hiring opportunities.

To support environmental justice outcomes in a reimaged energy sector, Microsoft is in its third year of modeling approaches that link our carbon-free energy commitments with community-led clean energy and resiliency projects.

12%
We also redesigned rack components, resulting in a reduction of plastic by 12 percent for certain components.

Transitioning to carbon-free energy (continued)

Contribution to collective action to decarbonize the electric grid

This year, with Sustainable Energy for All (SE For All), an organization that works in partnership with the United Nations, Microsoft committed to take actions that drive toward decarbonization of the electric grid to combat climate change. Energy Compacts were introduced in 2021 as a key outcome of the High-level Dialogue on Energy, which calls for affordable, reliable, sustainable, and modern energy for all by 2030. Microsoft joins national and local governments, businesses, foundations, and international civil society and youth organizations from every region who have submitted Energy Compacts, reflecting actions and finance commitments. Microsoft's Energy Compact documents its 100/100/0 commitment to carbon-free energy.

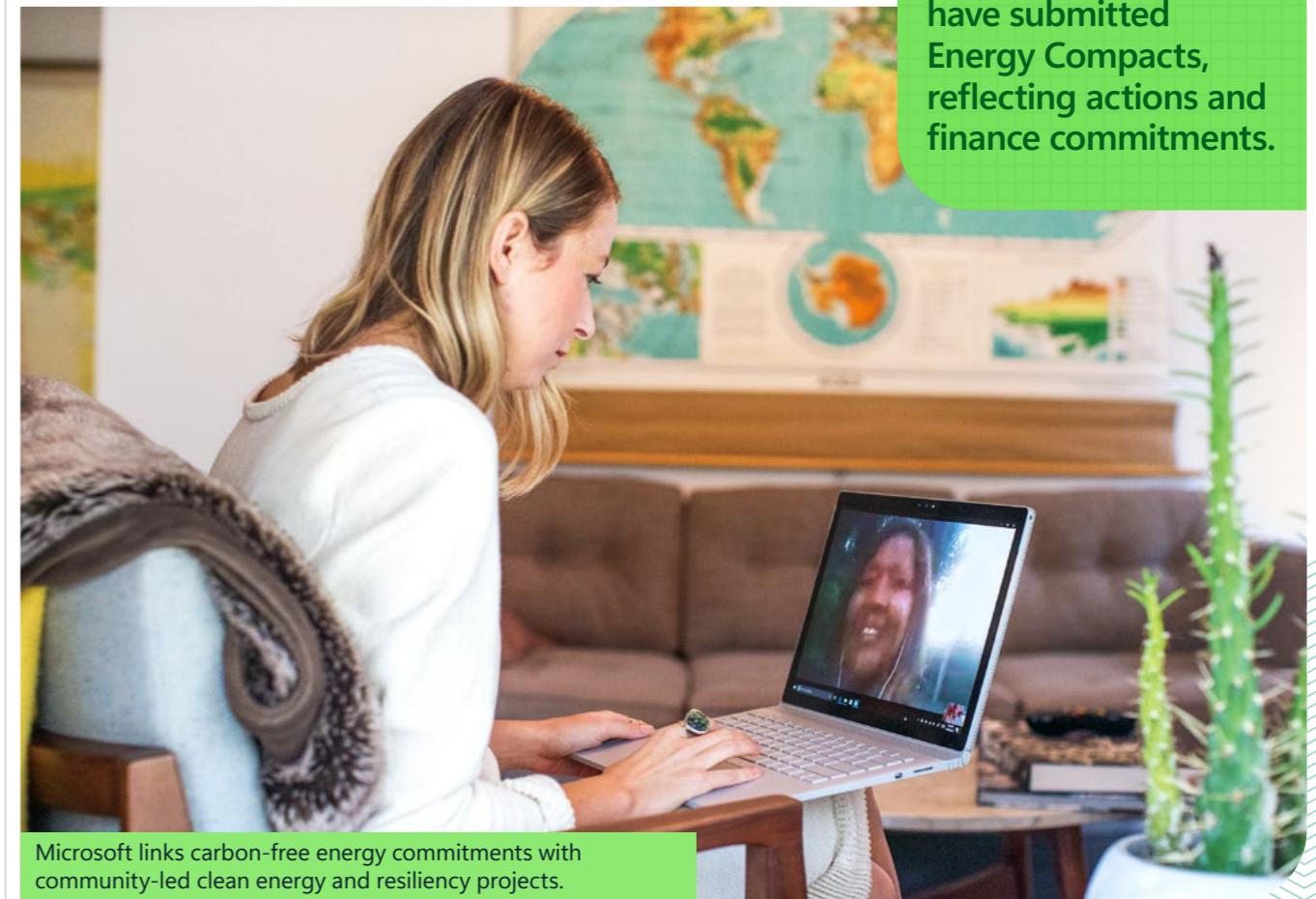
Other projects

- With **PosiGen Louisiana Solar**, we supported the reduction of electricity bills for low-to-moderate income residents through financing solar and energy efficiency projects that can also strengthen resiliency for homes in underserved communities.
- We supported programs with **California Rooftop Solar** at Wildmind Science Center, which funds environmental engagement programs for 120,000 at-risk youth.
- Microsoft has purchased solar RECs from school districts that were supported by the California Bright Schools program. The program identifies energy saving opportunities for schools, saving general fund dollars and providing educational opportunities for students and teachers.

- We supported the purchase of "Peace RECs" (P-RECs) in Sub-Saharan Africa. These credits are generated through projects located in countries with high risk of conflict, high vulnerability to climate change, low levels of electrification, and limited access to renewable energy finance. In May 2022, Microsoft made the largest P-REC transaction to date, building on our first P-REC purchase in 2020. This first purchase funded the installation of public streetlights connected to Nuru's 1.3-MW solar mini-grid in Ndoso neighborhood in Goma, Democratic Republic of the Congo. Our 2022 purchase also supports first-time electricity connections for households, businesses, and social institutions, and deploys additional streetlights that improve nighttime security and allow local businesses and markets to operate during evening hours. The purchase also contributes directly to the financing of Nuru's new 3.7 MW solar metro-grid, which is anticipated to serve 5,000 customers and enhance more than 25,000 lives. Together, these projects are some of the largest off-grid mini-grids operating in Sub-Saharan Africa, eventually benefiting 125,000 people and raising the average electricity rate from three percent to around 20 percent.

With Sustainable Energy for All, an organization that works in partnership with the United Nations, Microsoft committed to take actions that drive toward decarbonization of the electric grid to combat climate change.

We join national and local governments, businesses, foundations, and international civil society and youth organizations who have submitted Energy Compacts, reflecting actions and finance commitments.



Removing carbon

We are three years into our mission to build the carbon dioxide removal (CDR) capacity that the world will require to prevent the worst effects of climate change.

Our focus

- 1** Nascent, high-quality solutions that need early support to scale
- 2** Mature proposals for large-scale projects (for example, >500,000 metric tons/year)
- 3** Financial institutions ready to provide, or curious about, project-level lending against credit-worthy offtakes
- 4** Other buyers ready to syndicate offtakes to assure capacity gets built
- 5** Insurance, assurance (such as independent MRV), and performance-guarantee players across CDR approaches

Our first offtake agreement with Climeworks was announced in July 2022.



Over the past 18 months, we have developed the process and structures to create long-term carbon removal offtake agreements designed to get new projects built. This is how we can move past many of the quality challenges prevalent in the market today and take CDR to scale.

Our offtake agreements are built on our experience procuring renewable energy, tailororable to the risks faced by diverse removal approaches, and structured to enable projects to gain outside financing. We are now building a portfolio with the goal of greater than five million metric tons a year in offtakes in order to hit our 2030 goals, balanced across low, medium, and high-durability solutions. We are moving into the next phase of our carbon removal journey.

Offtake agreements

Our first offtake agreement with Climeworks was announced in July 2022 and we've followed up with several additional large investments of increasing scales. We are targeting multiple multi-year purchases of up to 250,000 tons per year to serve as a risk-diversified portfolio of projects meeting our needs in 2030 and beyond.

2022 projects and results

In FY22, we contracted 1,443,981 metric tons of carbon removal. We also made multi-year commitments to carbon removal. These projects will provide around 300,000 metric tons towards our greater than five million metric ton goal in 2030. Projects include:

CarbonFuture

Together with Pacific Biochar, CarbonFuture is re-tooling lumber mills' bioenergy plants to produce more biochar compared to energy—a process which can be scaled across the mill bioenergy fleet.

Neustark

Neustark is removing carbon within the Swiss concrete recycling industry by carbonating demolished concrete with carbon dioxide from biogas production.

Acorn

This program from Cooperative Rabobank UA assists in the transition to agroforestry systems in the tropics—including in Colombia, Ivory Coast, Nicaragua, and Peru—and is replicating that financing model in additional areas.

Removing carbon (continued)

What's next on carbon removal

Looking ahead, we're focused on several exciting and necessary developments. First, taking high-quality and additional nature-based solutions to greater scale. Second, bringing in more demand for CDR after the landmark announcements of the First Movers Coalition and Frontier Climate. Third, trialing the emerging set of second wave, hybrid carbon removal solutions that are coming to market, such as Heirloom, which combines advantages of carbon mineralization and direct air capture (DAC) to amplify the natural ability of limestone to remove carbon dioxide from the air. Fourth, identifying the best ways to embed carbon removal solutions in an overall circular economy.

2023 carbon removal key projects



Climeworks offtake

In July 2022, we signed a 10-year forward agreement with Climeworks to purchase DAC removals from their Orca and Mammoth plants, building on our earlier purchase commitment with Climeworks. This prototypical agreement is our model for taking carbon removal to scale and meeting our ambitious goals.



Climate Robotics

Early in 2022, we signed a small deal with Climate Robotics and we doubled-down in August with a four-year, 75,000 metric ton contract. We believe this is among the largest direct biochar CDR procurements to date. Climate Robotics' novel approach to biochar production will eliminate the transport of biomass to central plants, instead taking pyrolyzers to the fields where crop waste is processed and re-tilled.



O.C.O Technology

In September 2022, we signed a deal for 25,000 metric tons of CDR from O.C.O.'s mineralization technology, which takes industrial waste (like fly ash) and uses it as the core of manufactured limestone. That's a neat bit of upcycling and a great way to work carbon removal into a circular-economy solution. Moreover, O.C.O showed pragmatic, long-term thinking by holding back some tonnage until empirical results clarify marginal carbon accounting uncertainty.



CommuniTree

We renewed our investment in the CommuniTree project in November 2022, signing for 700,000 metric tons in the form of ex ante credits over the next two years, which we project will deliver >100,000 metric tons of ex post verified carbon in 2030 and subsequent years. CommuniTree engages smallholder farmers in Nicaragua to plant and maintain native trees alongside existing farming practices, restoring ecosystems and improving local livelihoods.

Key trends

1 Geopolitics are affecting supply chains

Geopolitical implications of world conflict and the global pandemic have hit supply chains hard, with impact on renewable energy supply and suppliers' ability to go beyond business as usual to deliver innovative new goods and services, such as decarbonization technologies.

2 Emissions data quality needs to improve across the value chain

Data quality continues to be an area of need across the sustainability landscape—especially in supply chain, capital goods, and logistics. Our update to our SCoC to require suppliers to have their data assured aims to improve the quality of our supply chain data.

3 Data methodologies will continue to evolve

Methodologies are evolving and will continue to do so for the next several years. Like other companies, we are focused on improving our calculation methodologies to lead the industry and improve the actionability of our data and opportunities.

4 Corporate investment is needed to scale nascent markets

Stakeholder expectations are increasing for corporate involvement in renewable energy, SAF, and carbon removal markets. While we are further along the trajectory toward higher-impact vehicles for renewable energy, we see credit-based mechanisms for funding SAF, green steel, green concrete, and carbon removal as critical for jumpstarting these nascent markets.

5 Lower embodied carbon in materials needs to be a focus

Lower embodied-carbon solutions for key materials—such as semiconductors—have yet to be developed commercially or at scale. We are looking ahead to cross-sector partnerships to help jumpstart these strategies.

Resources

Carbon removal lessons learned

Microsoft's carbon removal lessons learned from our first two years of corporate purchasing.

 [Read the 2022 paper](#)  [Read the 2021 paper](#)

Sustainable aviation fuel guidance

Microsoft supported the Environmental Defense Fund in developing a handbook which provides expert guidance on using high-integration sustainable aviation fuel.

 [Read the paper](#)

All-electric kitchens

Microsoft released a new white paper, *Dining All-Electric*, where we share our lessons learned, technical details, and decision making for all-electric kitchens.

 [Read the paper](#)

Environmental justice in renewable energy procurement

Microsoft and Volt energy shared lessons learned on environmental justice in renewable energy procurement.

 [Read the paper](#)

Circular design principles for cloud hardware

Microsoft and WSP developed the paper, *Life Cycle Assessment (LCA) Guidelines for Cloud Providers*, and provided the guidelines to the Open Compute Project (OCP).

 [Read the paper](#)

What's next

Scope 3 emissions reduction

Many of the technology solutions needed to reduce Scope 3 emissions are either nascent or currently unavailable at scale. GHG accounting standards provide limited guidance on how to address Scope 3 emissions. For too long, the lack of a clear starting point has led to persistent inaction on Scope 3. The private sector needs a new approach; one that prioritizes learning by doing and innovation through experience. We are enacting a five-part Scope 3 strategy:

- 1 Increasing efficiency:** We will design our products and infrastructure in ways that reduce energy and carbon intensity, minimizing both downstream and upstream carbon emissions.
- 2 Building markets:** Scaling sustainability initiatives, such as the Microsoft Climate Innovation Fund and carbon fee, position us to invest in and purchase from nascent technology providers, like Heirloom, to build supply chains for decarbonized materials and fuels.
- 3 Forging partnerships:** Microsoft cannot achieve carbon negative alone. We will scale supply chain decarbonization by aligning financial and government leadership, to signal global market demand and infuse investment into infrastructure and technology solutions worldwide.

4 Improving measurement: We cannot manage what we cannot measure. We are developing improved Scope 3 data visibility and carbon accounting methodologies to better guide and reflect meaningful actions towards reducing carbon emissions.

5 Advocating for policy: We will propose and endorse public policies that enrich markets, partnerships, and measurement activities, with a focus on "greening the grid," by further opening the power sector to corporate clean energy purchases and upgrading electric transmission.

Scope 3 is perhaps the ultimate decarbonization challenge, necessitating the co-evolution of commercial, technology, and policy best practices among thousands of global stakeholders. Our carbon negative commitment is an invitation to the world to participate in this journey, translating ingenuity into action, and action into impact.



Getting to water positive

Water

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Our approach

In 2020, we made a commitment to be water positive by 2030 and co-founded the Water Resilience Coalition (WRC), an industry-driven, CEO-led coalition of the UN Global Compact CEO Water Mandate to reduce water stress by 2050. For Microsoft, being net water positive means we will reduce water consumption across our global operations, replenish more water than we use, provide people across the globe with access to water and sanitation services, drive innovation, and engage in water policy.

Our internal water fee, modeled after our carbon fee, plays a critical role in enabling our progress against our water commitment. The fee was established in FY20 and is used to fund replenishment and access projects around the globe. It is charged to business groups based on annual water consumption projections at a rate that was determined with historical data and guidance from experts on the cost of replenishment projects. The objectives of the fee are to incentivize businesses across Microsoft to take steps to reduce water use and to raise internal awareness of our water positive commitment.

We are strengthening how we manage water within Microsoft, while working to improve the way the world evaluates and manages water today and for future generations.



15.6M

In FY22 we contracted replenishment projects that are estimated to provide more than 15.6 million m³ in volumetric water benefit.

Commitments and progress

Water positive by 2030



Our commitment

Replenishing more water than we use

By 2030, we will replenish more water than we consume across our global operations in water-stressed regions where we work.

Increasing access to water

We will provide 1.5 million people with access to clean water and sanitation services by 2030.

Investing in replenishment projects helps support communities and protect ecosystems.



Our progress

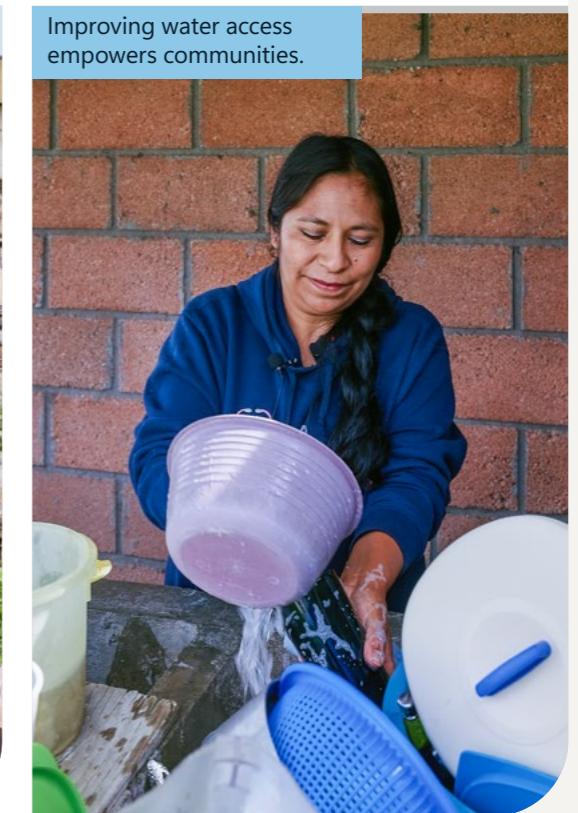
15.6 million m³ of water replenishment

In FY22, we contracted for replenishment projects that are estimated to provide more than 15.6 million m³ in volumetric water benefit over the lifetime of these projects. Since the inception of this program, we have contracted for projects that are estimated to provide more than 35 million m³ in volumetric water benefit over the lifetime of these projects.

Water access for 1 million people

By the end of FY22, we provided more than 550,000 people with access to clean water and sanitation solutions in Brazil, India, Indonesia, and Mexico and reached just under one million people by the end of the calendar year 2022.

Improving water access empowers communities.

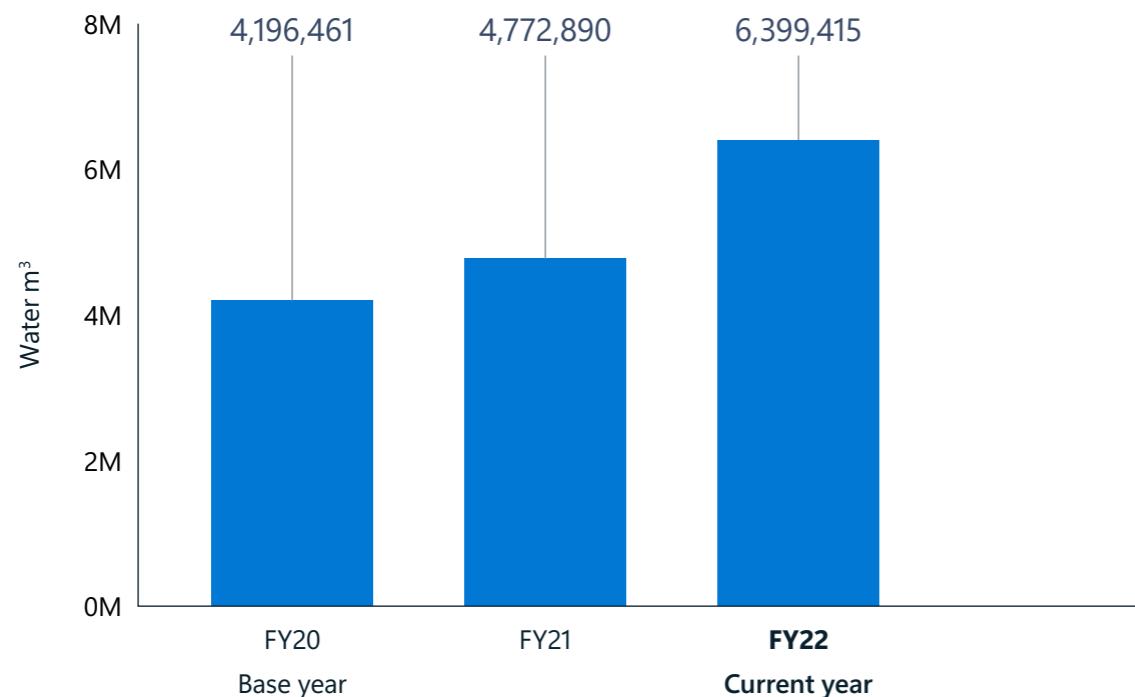


Water Table 1

Measuring our annual water consumption to help inform our replenishment targets

In FY22, we consumed nearly 6.4 million m³ of water from our operations. The increase in consumption was proportional to our business growth year-over-year. This data informs the amount of water we need to replenish to ensure we are making progress against our water positive commitment.

Total water consumption



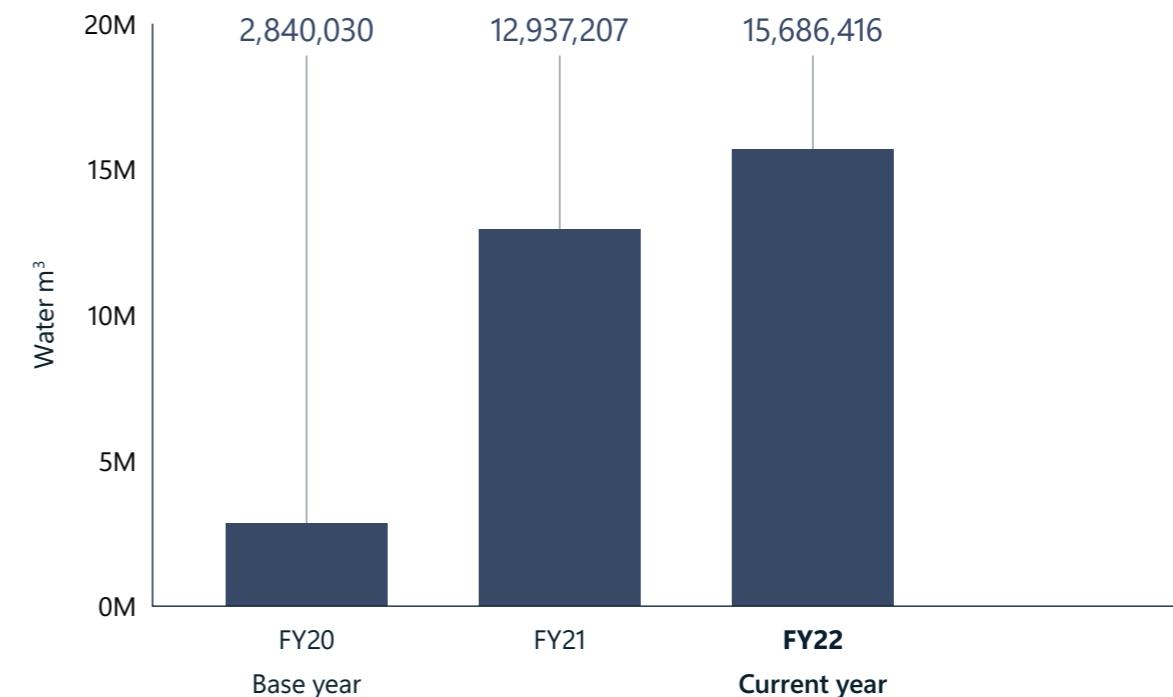
Learn more in the Environmental Data Fact Sheet

Water Table 2

Replenishing more water than we consume on our journey to water positive by 2030

In FY22, we contracted for replenishment projects that are estimated to provide more than 15.6 million m³ in volumetric water benefit over the lifetime of these projects.

Total contracted water replenishment



Learn more in the Environmental Data Fact Sheet

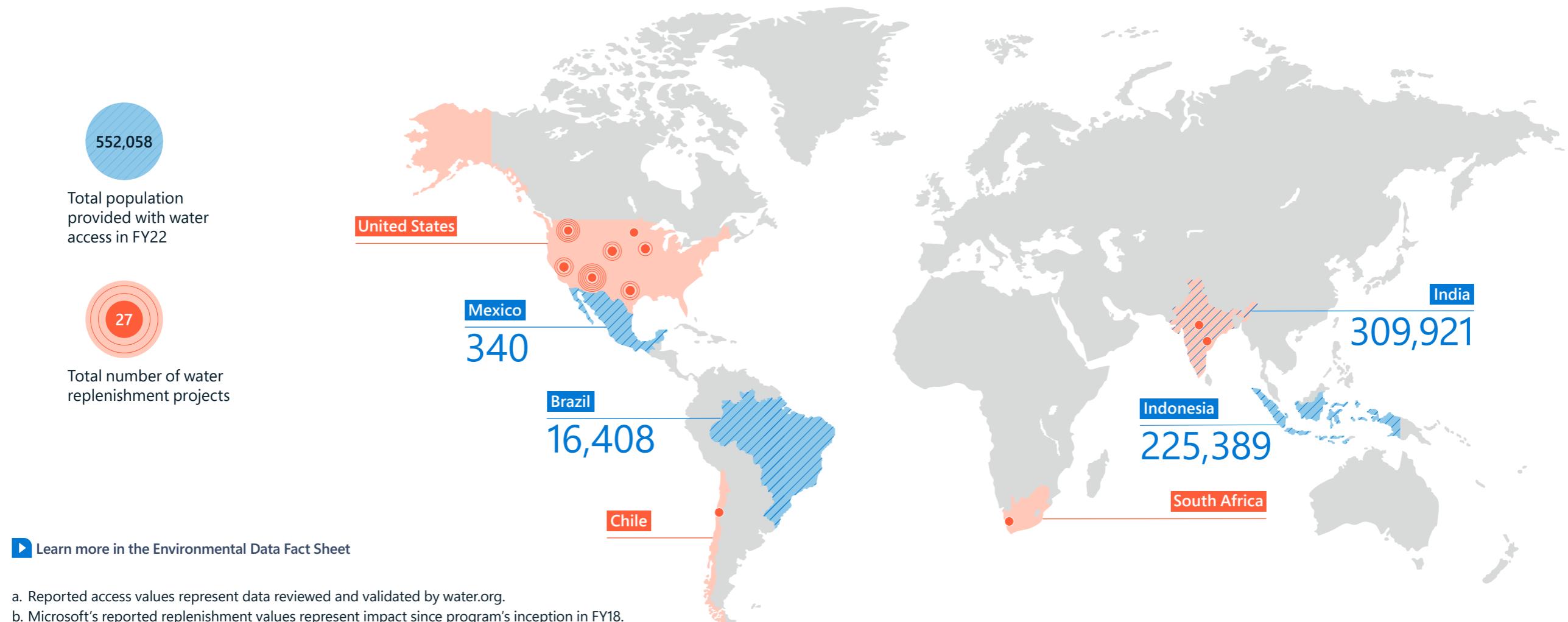
a. Reported replenishment values were updated to represent contracted impact over the lifetime of a project. This update in reporting was driven by our effort to improve our measurement methodologies.

Water Table 3

Delivering on our water positive commitment by enabling access to water and sanitation services, and through water replenishment projects

In FY22, Microsoft provided 552,058 people with water access across Brazil, India, Indonesia, and Mexico. From the program's inception through December 2022, we have provided nearly one million people with water access across these regions.

Since year one, we have contracted 27 replenishment programs in water-stressed basins, which are contracted to deliver more than 35 million m³ of replenishment over their lifetime.



Reducing our water footprint

We take a holistic approach to water reduction across our campuses and datacenters from design to efficiency in existing systems, recycling and repurposing, and innovating new technologies. We measure and report the global water use of our campuses and datacenters to drive efficiency and reuse.

5 Pillars of water positive

- 1 Reducing** our water footprint across our direct operations
- 2 Increasing access** to water and sanitation services
- 3 Replenishing** more water than we consume across our operations
- 4 Scaling** water solutions through **innovation and digitization**
- 5 Advocating** for effective and innovative **water policy**

Designing for efficiency

Microsoft employs a comprehensive lifecycle assessment methodology in our datacenters that goes beyond typical carbon-centric measurements and considers the GHG emissions, energy, water, and other environmental impacts of technology, from servers to full datacenters. Our approach accounts for the entire cycle of production, transport, use, and end of life in order to calculate the environmental burdens of these systems and identify opportunities for reductions. It is empowering our own teams to consider the full environmental impact of their designs—both today and in the future. In 2022 we formally shared our standard operating procedure (SOP) recommendations so that others in the datacenter industry can improve their own lifecycle assessment.

As our datacenter business continues to grow, Microsoft is committed to reducing the intensity with which we withdraw from our resources, both water and energy.



Increasing efficiency in existing systems

Water usage effectiveness (WUE) is a key metric relating to the efficient and sustainable operations of our datacenters and is a crucial aspect as we work towards our commitment to be water positive by 2030. WUE is calculated by dividing the liters of water used for humidification and cooling of the datacenter by the total annual amount of power (measured in kWh) needed to operate our datacenter IT equipment. There are variables that can affect WUE, many of which relate to the location of the datacenter. Datacenters in some parts of the world, like Sweden and Finland, operate in naturally cooler environments and require no freshwater for cooling, whereas warmer climates like Phoenix will require water for portions of the year. Our datacenter designs minimize water use through all climates. As our datacenter business continues to grow, Microsoft is committed to reducing the intensity with which we withdraw from our resources, both water and energy, focusing on being as efficient as possible while balancing the needs for power and water in the regions where we develop. All future built datacenters will be LEED Gold certified with an emphasis on water and energy conservation.

Reducing our water footprint (continued)

Recycling and repurposing

Wherever possible, we look at recycling and repurposing water at our datacenters and campuses, including harvesting rainwater, procuring reclaimed water, and reusing water within our facilities.

Recycling and reusing water

We measure and monitor reused water at datacenters and campuses across the globe and use meters to collect real-time data on usage, including recycling, for owned datacenters. We design our cooling systems to reduce consumption to address stressed areas, geographic locations, and poor water quality. For recycling, in our Arizona and Mexico datacenters we are treating the incoming water to maximize cycles and minimizing water discharge to drain. Our Johannesburg office greywater treatment plant is separately metered to track water reused monthly. At our Silicon Valley campus, which is pursuing net-zero water certification and is on track to be one of first tech campuses to secure this certification, we operate a water treatment plant to process on-site grey and black water for reuse and have established a water budget to quantify the amount of water captured, recycled, and reused on-site.

We incorporate rainwater harvesting and reuse at our campuses and datacenters around the globe.

Procuring reclaimed water from utilities

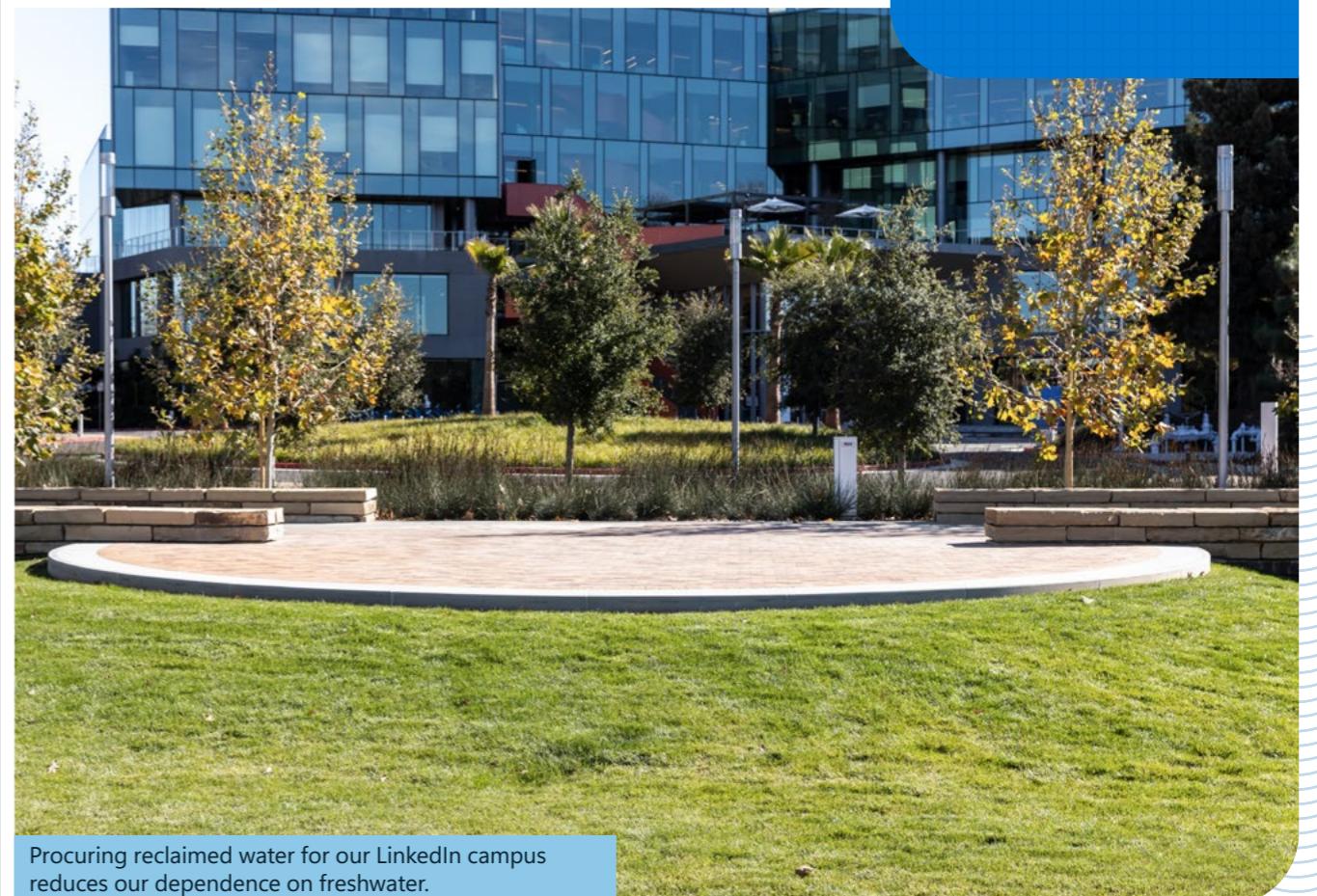
While availability of reclaimed water is limited, we procure reclaimed water from utilities where it is available to reduce our dependence on freshwater supply. We are procuring reclaimed water at our datacenters in Washington, Texas, California, and Singapore. We also continue to move forward on plans to access municipal recycled water for landscaping and plumbing at LinkedIn's Mountain View headquarters. We are currently testing municipal recycled water quality to confirm on-site treatment requirements. This project is anticipated to save approximately 30,500 m³ of potable water annually when implemented, which we expect to be completed in 2023.

Harvesting rainwater

We incorporate rainwater harvesting and reuse at our campuses and datacenters around the globe. We are harvesting rainwater in our Netherlands, Ireland, and Sweden datacenters and have rainwater harvesting in the designs for new datacenters in England, Finland, Italy, South Africa, and Austria. At our Silicon Valley and Beijing campuses, harvested rainwater is used for toilet flushing, landscaping irrigation, road washing, and more. We also have plans for rainwater harvesting at our Redmond, England, Ireland, and Namibia campuses.

Improving the quality of stormwater runoff

Our Redmond Campus Modernization project is focused on improving the quality and quantity of stormwater runoff. We implemented an underground parking garage, removing approximately 13.9 acres of previous surface parking and roadways, and avoided copper and zinc coated metal panels in our campus to eliminate any toxicity to downstream aquatic life. The campus is also Salmon-Safe Certified, reducing the impacts it has on water quality and fish habitat.



13.9

**We removed
13.9 acres of surface
parking and roadways
at our Redmond
Campus.**

Reducing our water footprint (continued)

Innovating new water technologies

Innovation is a critical component of our water reduction approach at campuses and datacenters. We are investing in water reduction technologies including thermal energy, cooling technologies, and air-to-water generation.

Saving water through thermal energy

Our Thermal Energy Center in Redmond is predicted to save over 37,850 m³ of water per year through several unconventional approaches to heat rejection. The geoexchange field transfers heat into the ground, which is approximately 50 degrees Fahrenheit. The system's wells and tanks will store water as heat energy for future use, instead of expelling it through the cooling towers, which is expected to reduce water use by 30,280 m³ a year or roughly the volume of 12 Olympic pools.

As Microsoft and the industry continues to advance immersion cooling technology, we're also looking at ways to optimize the performance of chips beyond their pre-defined voltage, thermal, and power design limits, a concept called overclocking.

Keeping datacenters cool with less water

We continue to integrate our standards in water reduction technologies where we use direct outside air most of the year to cool servers. We otherwise cool through direct evaporation that requires a fraction of the water compared to other, conventional water-based cooling systems such as water-cooled chillers. By powering our datacenter with power from the Sun Streams 2 Solar Project owned by local partner, Longroad Energy, we are displacing the water needed in the traditional electricity generation process.

Pioneering liquid immersion cooling

In 2021, Microsoft was the first cloud provider to run two-phased liquid immersion cooling in a production environment. At the component level, we're testing new biodegradable materials to empower greater circularity of our servers and exploring microfluidics to cool chips more efficiently. As Microsoft and the industry continues to advance immersion cooling technology, we're also looking at ways to optimize the performance of chips beyond their pre-defined voltage, thermal, and power design limits, a concept called overclocking.

Investing in air-to-water generation

As climate change exacerbates water risks, air-to-water generation is an important innovation that we are investing in, both within our own four walls and through our recent investment in SOURCE, a renewable water technology that is powered by solar. We are also investing in air-to-water generation across our operations. Four new air-to-water generators were installed at our Hyderabad campus in 2020 and 2021, each has an installed capacity of 500 liters. We installed an adiabatic cooling system at our Bengaluru campus, which has reduced our energy consumption, in line with our efforts to make our HVAC systems more efficient.



Advancing liquid immersion cooling technology helps to reduce water consumption in our operations.

37,850 m³

The Redmond Campus Thermal Energy Center is predicted to save over 37,850 m³ of water per year.

Replenishing water

Microsoft is committed to replenishing more water than we consume across our operations. We focus on investing in replenishment projects that protect watersheds, restore wetlands, and improve infrastructure in water-stressed regions where we operate. We use the Volumetric Water Benefit Accounting (VWBA) guidance to quantify the estimated volumetric water benefits that can be claimed from a range of different replenishment project types. We seek to align the project type with the unique needs of each location; for example, in a location with high water quality challenges, we will focus on projects that help to improve water quality in the basin.

We have contracted for 27 replenishment projects, totaling more than 35 million m³ of potential volumetric water benefit and have invested \$7 million in the program overall.

In FY22, we invested in six new projects, which are expected to replenish more than 15 million m³ of water in the next decade. To date, we have contracted for 27 replenishment projects, totaling more than 35 million m³ of potential volumetric water benefit and have invested \$7 million in the program overall.

We are building the infrastructure to ensure that we can scale to 40 priority water-stressed locations across the globe and are looking at a blend of traditional and more innovative replenishment projects. We are also partnering with companies and other key stakeholders to further define how organizations should account for benefits and the types of projects that should be prioritized in key locations.

In FY22, we invested in a range of different types of projects from agricultural water efficiency to groundwater restoration to watershed restoration, including the following:

Supporting water infiltration and groundwater recharge in San Antonio

In 2021, we partnered with the Edwards Aquifer Authority to acquire a conservation easement and keep lands from being developed in San Antonio, Texas. The easement focuses on lands that are most likely threatened by rapid development or negative-management practices and ensure these lands are not developed to allow for water infiltration and groundwater recharge. Targeted acquisition of conservation easements and implementation of land management practices are projected to protect, on average, 0.6 acre-feet of recharge-per protected acre—with the potential to increase average recharge rates over time through the establishment of land-management practices.

Restoring Sembakkam Lake and wetlands in Chennai, India

We supported The Nature Conservancy (TNC) in improving water quality, storage capacity and groundwater recharge of Lake Sembakkam. The [project](#) is establishing a nature-based wastewater treatment system at the lake using a constructed wetland system that is estimated to treat 6,000-7,000 m³ of wastewater entering the lake per day and benefit approximately 10,000 people. These solutions will improve groundwater recharge, biodiversity habitat, and flood control. They will also create a waterfront to serve as a recreational site for community members.

Improving precision agriculture in Santiago, Chile

In 2022, we contracted a project to improve agricultural water efficiency and overall water supply reliability in the Maipo Basin in Chile, the key watershed that Santiago depends upon. The project is expected to begin realizing benefits in 2023. Microsoft is partnering with Kilimo and using its IT platform to catalyze change by educating and supporting farmers in optimizing water use. The project aims to increase agricultural efficiency and productivity, reduce water demand, and protect ground and surface water resources. The project will support expanded applications of Internet of Things (IoT)-based satellite moisture and irrigation management systems on 360 hectares of private irrigated family farms to decrease water pumping and diversion.



Improving access to water

We continue to make progress towards our commitment to provide 1.5 million people with access to safe drinking water and sanitation solutions by 2030. One in four people across the globe do not have access to clean water and this is expected to increase as water challenges are exacerbated by climate change. In 2020, we committed to providing Water.org with \$3 million over three years to provide micro-loans to cover a range of solutions, such as installation of household taps and toilets, rainwater harvesting, storage and well restoration for communities and schools.

We are helping to develop resources that support organizations in understanding the different types of accessibility projects they can invest in across different types of water, sanitation, and health (WASH) solutions.

In FY22, Microsoft's contribution has provided more than 550,000 people with access to clean water and sanitation services in Brazil, India, Indonesia, and Mexico. This project reached just under one million people by December 2022.

We are also helping to develop resources to support organizations in understanding the different types of accessibility projects they can invest in, as well as how to quantify the benefits and impacts from these investments across different types of water, sanitation, and health (WASH) solutions.

Increasing water access in Mexico

Mexico is facing extreme water challenges as a result of increasing demands on water resources. In peri-urban towns outside of Mexico City, the local government subsidizes water for their residents. This is a common approach to help improve household access to water; however, it is not holistic. Patty, a healthcare worker, was unable to get the amount of water her family needed through the program. She used to wait hours each month to receive her household ration of water, taking time away from work and earning income. To supplement the water she did receive, Patty bought bottled water and saved rainwater in a makeshift bucket to use for cooking, laundry, and bathing. Contigo, a local partner of Water.org, allowed Patty to affordably finance a rain storage solution with a large tank, gutters, and a cistern to cover her household water needs. This represents one of the roughly 150,000 micro-loans that Microsoft's funding has supported across the globe.



550,000

In FY22, Microsoft's contribution to water.org has provided more than 550,000 people with access to clean water.

Key trends

1 Water requires a collective approach

Working collectively to solve challenges at the basin scale is critical. Water is a resource that every person and business on this planet needs to survive. We can use as little water in a location as possible and replenish more than we use, yet that basin can still be highly stressed and not provide local communities with what they need.

2 Replenishment needs to evolve and scale if companies are going to meet their goals

Replenishment is a nascent market with limited guidance on what it means, how to account for benefits, how to make credible claims, and how to ensure replenishment investments are having a significant impact in high-stressed basins. Furthermore, the supply of replenishment projects in many global markets is limited or non-existent. Cultivation of credible partners to manage and implement replenishment projects, as well as investment in innovative replenishment projects with non-governmental organizations (NGOs) and private sector entities, are critical to scale the market and collective impact.

3 Innovation is a critical piece of the puzzle

Water challenges will become more extreme in the years to come. If we continue with the status quo, we will not protect freshwater resources for future generations. Organizations need to innovate within their own operations, supply chain, and the communities in which they operate by investing in solutions that maximize efficiency and reduce dependence on freshwater resources. There is also an important role for organizations and investors to play in providing the capital to scale water technologies needed to tackle water scarcity, quality, and access.

Resources

Water Action Hub 4.0

Identify organizations to partner with in specific basins and use a wide range of tools and case studies. A new tool allows companies to evaluate their water management maturity and compare progress against peers.

 Use the tool

Volumetric Water Benefit Accounting (VWBA)

This guidance document provides corporate water stewardship practitioners with a standardized approach and set of indicators to quantify and communicate the volumetric water benefits and complementary indicators of water stewardship activities.

 Read the guidance

Water Risk Monetizer

The free tool, built by Microsoft and Ecolab, allows you to assess the true value of water and risk exposure you face.

 Use the tool

WRI Aqueduct Tool and WWF's Water Risk Filter

Understand the local water stress and scarcity concerns where you operate.

 Use the WRI tool  Use the WWF tool

What's next

1 Investing in innovative replenishment projects

We anticipate increasing the number of innovative replenishment projects that we invest in between now and 2030. We will look at projects with innovative funding mechanisms, such as revolving or low-interest loans. We also plan to look at projects where we procure volumetric water benefit from private sector entities, including start-ups, that offer a unique solution to the water challenges we face today, for example leak detection projects in distribution networks and transmission mains. As we invest in these projects and track learnings, we remain committed to sharing those with others.

2 Integrating environmental justice into replenishment

Environmental justice is embedded in our water access target, and we are looking for ways to be more intentional about integrating environmental justice into our replenishment investments as well. This includes looking at ways we can ensure our replenishment investments support disadvantaged communities, as well as the potential unintended consequences of projects that could cause harm to disadvantaged communities in the locations where we operate.

3 Scaling our efforts to reduce water use across operations

Investment in reduction is a critical component of our water positive commitment and one we are focusing on as we get closer to 2030. While we continue to maximize our efficiency for our datacenters and campuses, we will also continue to look for opportunities to invest in innovations that will help us to further reduce our dependence on freshwater sources.

4 Investing in projects that will increase access to water and sanitation solutions

We are looking for ways to scale our investments in new and existing locations where people lack access to water and sanitation services. Micro-loans are a unique solution and fill a need in many locations across the globe. There are also many people across the globe who can't afford a loan and thus are not supported through the types of investments we have made thus far. As we move towards 2030 and beyond, we will be looking for ways to support populations that are not being reached.



Getting to zero waste

Waste

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Our approach

Every year, people consume 100 billion tons of materials, and in 2020 only 8.6 percent of those materials were cycled back into the economy after use, according to the [2022 Circularity Gap Report](#). Linear take-make-waste systems and existing infrastructure are not adequate to maintain, collect, and redistribute materials effectively for a global circular economy.

We recognize the urgent need to reduce carbon emissions associated with the lifecycle of these materials. As a company that manufactures devices, builds campuses and datacenters, and uses manufactured goods in our operations, we have committed to responsibly design and source materials and build a more circular approach into our work and the world.

To reach our commitment to become a zero waste company by 2030, Microsoft is taking an increasingly circular approach to materials management to reduce waste and carbon emissions. Our strategy goes beyond waste diversion as we work across our value chain, beginning with design and material selection. Wherever possible, we reduce the amount of materials needed. We responsibly source materials for our operations, products, and packaging. We are increasing the use of recycled and recyclable content, reducing hazardous substances, and designing out waste. We aim to keep products and materials in use longer through reuse and repair. We reduce waste generation at end of life with recycling and composting programs.

We are taking an increasingly circular approach to materials management to reduce waste and carbon emissions.



Commitments and progress

Zero waste by 2030 across our direct waste footprint

Our commitment

Driving to zero waste operations

We will achieve 90 percent diversion of operational waste at datacenters and campuses, and 75 percent diversion for all construction and deconstruction projects by 2030.

Increasing reuse and recycling of servers and components

By 2025, 90 percent of servers and components for all cloud hardware will be reused and recycled with support from our Circular Centers.⁵

Eliminating single-use plastic

By 2025, we will eliminate single-use plastics in all Microsoft primary product packaging and all IT asset packaging in our datacenters.

Making fully recyclable products and packaging

We will design Surface devices, Xbox products and accessories, and all Microsoft product packaging to be 100 percent recyclable in [OECD countries](#) by 2030.

Other achievements

Zero waste campuses

In FY22, we piloted a durables-first campaign in Dublin and Puget Sound, focusing on replacing items such as single-use cups and takeaway containers with reusable solutions.

Our progress

12,159 metric tons of operational waste

In FY22, we diverted 12,159 metric tons of solid waste from landfills and incinerators across our owned datacenters and campuses. In FY22, we renewed Zero Waste certifications for our San Antonio, Texas; Quincy, Washington; Boydton, Virginia; and Dublin, Ireland datacenter locations. Our Redmond campus has been Zero Waste certified for six consecutive years.

82% reuse and recycling

Our reuse and recycle rates of servers and components across all cloud hardware reached 82 percent in FY22. We opened four new Circular Centers in FY22 in Boydton, Virginia; Chicago, Illinois; Dublin, Ireland; and Singapore. We are launching our next Circular Centers in Quincy, Washington in FY23 and in Texas in FY25.

More than 29% plastic reduction

We reduced single-use plastics in our Microsoft product packaging by more than 29 percent, a decrease from 4.7 percent to 3.3 percent by weight (on average) of plastic per package in FY22.

Devices

Recycled materials in devices

Without compromising on our design and quality, we constantly evaluate any opportunities for recycled materials. For example, many of our PC accessories contain recycled materials, including the new Microsoft Adaptive Accessories and Audio Dock, both made with at least 30 percent post-consumer recycled plastic resin.

Repairability

The new Surface Laptop 5, Surface Pro 9, and Surface Laptop Go 2 are the most repairable devices in their product lines with more replaceable components and repair options than ever before.

Device recyclability

We are in the process of switching to a new methodology to assess product and packaging recyclability, consistent with the EN 4555 standard, to increase the accuracy of our recyclability reporting.

Improving data on construction and demolition waste

We are partnering with our vendors to improve data collection processes and tools to gather high-quality construction and deconstruction waste data. We'll use this data to inform innovative construction processes to reduce waste throughout our entire lifecycle and supply chain.

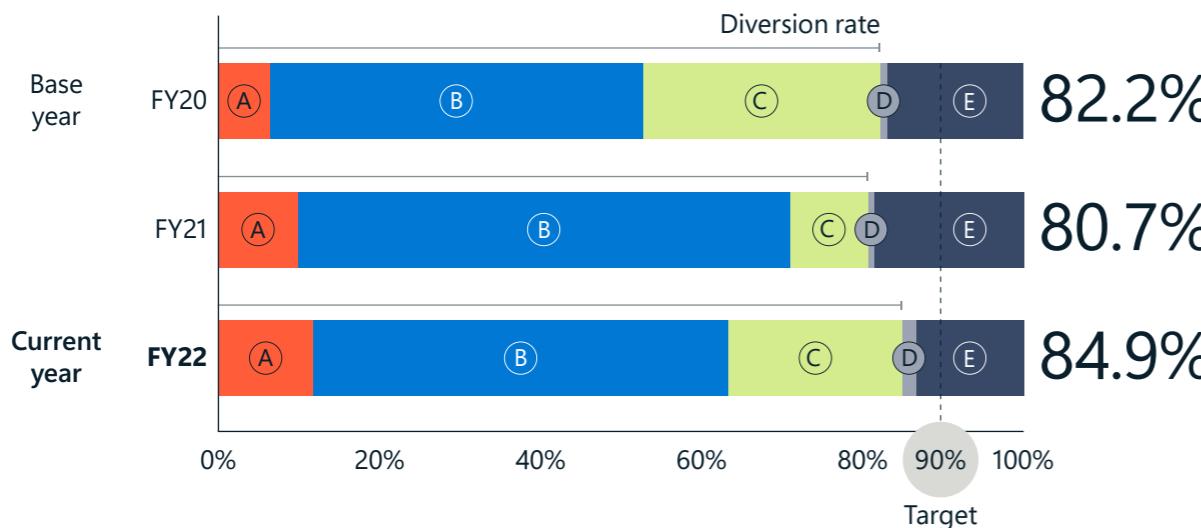
Waste Table 1

Working towards our target to divert 90 percent of operational solid waste from landfills and incinerators across our owned datacenters and campuses

In FY22, Microsoft's diversion rate increased to 84.9 percent and we diverted more than 12,100 metric tons of waste from being landfilled or incinerated.

Diverted
(A) Reused (B) Recycled (C) Composted

Non-diverted
(D) Incinerated (E) Landfilled



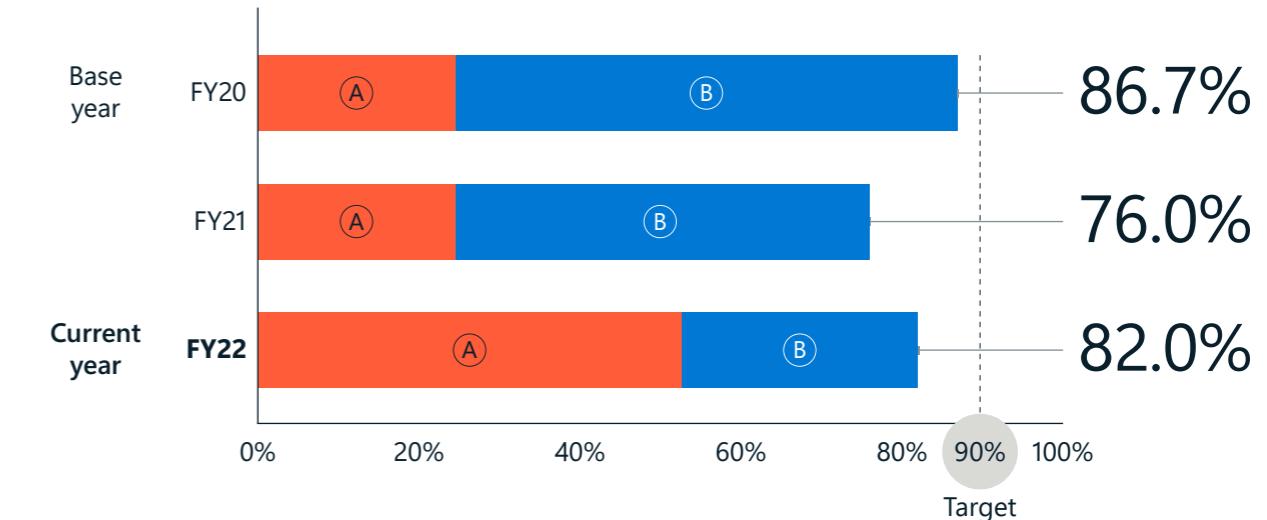
Learn more in the Environmental Data Fact Sheet

Waste Table 2

Ensuring 90 percent of servers and components for all cloud hardware will be reused and recycled by 2025

In FY22, Microsoft increased reuse and recycling of servers and components to 82 percent. Additionally, to align with upcoming definitions in circular economy regulations and more accurately describe the steps we are taking operationally to meet our commitment, in 2022 we adjusted our terminology to "reuse and recycling". The operational scope, strategy, and metric has not changed. Expansion of our Circular Centers program and investments in systems and policy changes will further enable us to achieve our 90 percent reuse and recycling target of servers and components by 2025.

(A) Reused (B) Recycled



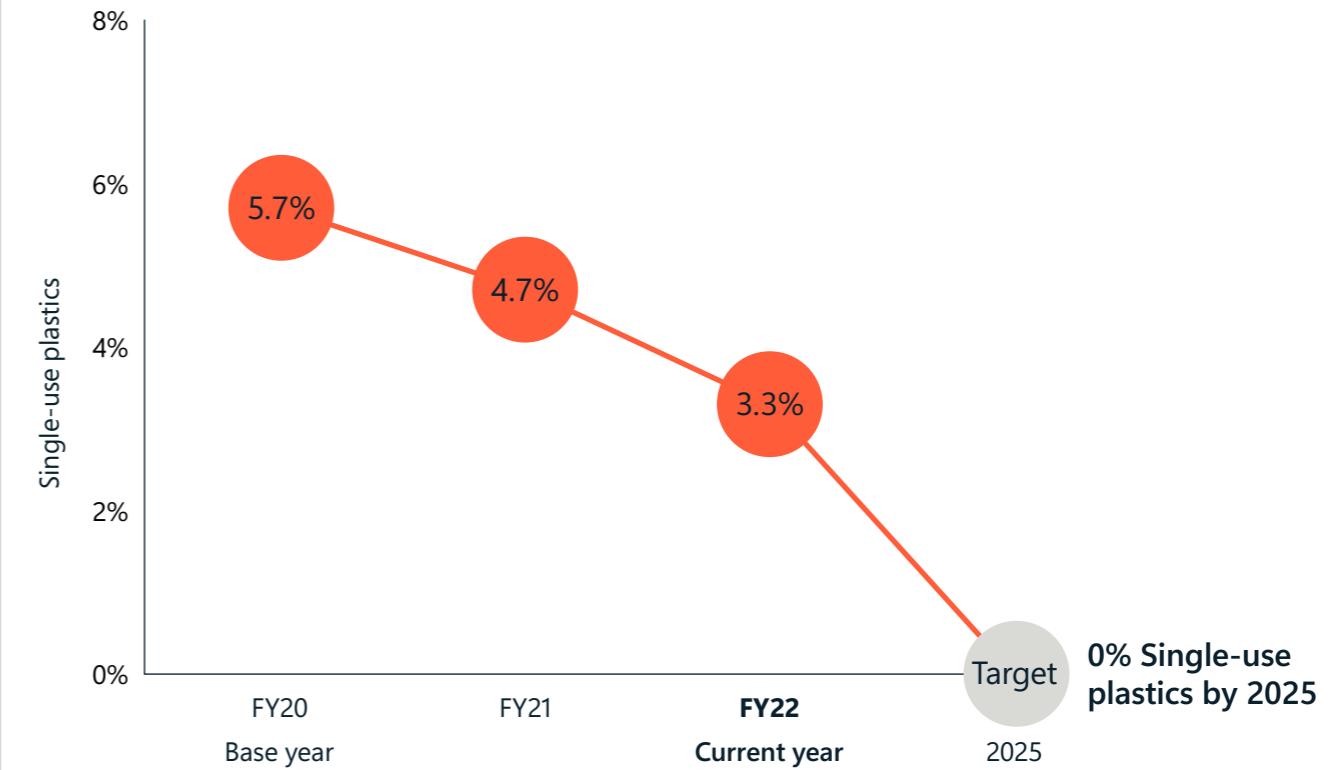
Learn more in the Environmental Data Fact Sheet

a. Starting in FY22 we transitioned to a methodology with improved accuracy in mass accounting and standardized recycling efficiency coefficients.

Waste Table 3

Designing our product packaging for circularity

In FY22, we achieved a rate of over 94 percent recyclability and decreased single-use plastics to just over three percent across all Microsoft product packaging.



Learn more in the Environmental Data Fact Sheet

a. Reported metrics consider all hardware and consumer software packaging of the Microsoft products produced and sold during the reporting year.

Reducing our waste footprint

To meet our commitment to being zero waste by 2030, we are reducing, reusing, and recovering waste in our campuses and datacenters. We are focused on keeping our products and packaging in use longer.

Reducing waste in our cloud hardware

A critical piece of achieving our zero waste goal is managing cloud hardware at our growing fleet of datacenters. We have taken an innovative approach towards designing and implementing circularity into our datacenters by launching [Circular Centers](#) to optimize reuse.

Reusing and recycling cloud hardware

In FY21, we piloted our new approach to asset reuse by building a Circular Center within our Amsterdam datacenter campus, which represented seven percent of our server capacity globally. We process decommissioned cloud hardware to service strategic routes, secondary markets, and suppliers using intelligent routing software. Our Amsterdam Circular Center model achieved reuse and recycle of 82 percent of all decommissioned assets in FY22. Our Circular Centers also achieved a four percent reduction in carbon per server. Based on the success of the Amsterdam location, we opened four new Circular Centers in FY22 in Boydton, Virginia; Chicago, Illinois; Dublin, Ireland; and Singapore. We are launching our next Circular Centers in Quincy, Washington in FY23 and in Texas in FY25. This model enables suppliers to reuse assets and components, resulting in significant carbon emissions reduction and material recovery.

We are designing and implementing circularity into our datacenters by launching Circular Centers that optimize reuse.

Developing technology to drive a circular cloud

Our Circular Center approach starts with sustainable design and responsible sourcing of an asset.

Microsoft designs a growing portion of its own hardware portfolio, and we make sustainability considerations a key part of the entire Microsoft Azure hardware design process—including energy efficiency, repairability, upgradability, and durability.

To enact these principles at scale, we developed a patent-pending Intelligent Disposition and Routing System (IDARS) that establishes and executes a zero waste plan for our cloud hardware assets. IDARS is an end-to-end system that identifies the most sustainable disposition path for every part at any point in its lifecycle across the supply chain. Paired with Microsoft Dynamics 365 Supply Chain Management and Microsoft Power Platform, IDARS utilizes the bill of materials of assets, inventory, and demand to optimize the sustainable path, and provides Circular Center technicians with precise instructions on how to steward

the asset onto its next phase. This technology, along with our close collaboration with both upstream and downstream partners, offers a model for the technology industry.

Defining design requirements for cloud hardware

In 2022, Microsoft published ecodesign requirements for cloud hardware. This specification outlines the sustainability guidelines, including energy and material efficiency requirements, that suppliers must follow when designing hardware for the Microsoft Cloud, such as the use of post-consumer recycled (PCR) plastics and use of recycled content requirements in some packaging. In the same timeframe, we began collecting material content and sustainability data for transport packaging materials. Using our current hardware data collection process, we can now digest data such as weights, material type, and recycled content that can be used for regulatory purposes and to enable our suppliers to deliver energy and material efficient hardware contributing to carbon and waste reduction.



Reducing our waste footprint (continued)

Designing and building circular devices

Over the past year, we have continued our work to reduce the environmental impacts of Microsoft devices by increasing circularity and reducing carbon intensity across the entire product lifecycle.

Designing for lower-carbon and circular devices use

Our accessory devices have shorter development cycles, making them a great vehicle to test new circular materials. We test new materials in individual products and, if successful, expand their use across a broader product portfolio. Circular design must also account for a future in which products can easily be returned, repaired, refurbished, and resold. Microsoft devices are also built to last, which helps increase circularity by keeping materials in use longer. The Microsoft Authorized Refurbisher Program gives new life to used and returned devices—repurposing over three million devices in FY22.

Innovating with suppliers on materials

We are partnering with suppliers on more sustainable material innovations. In our hardware supply chain, we are working on using 100 percent recycled tin solder paste and 100 percent recycled gold in our printed circuit boards. We are phasing out single-use plastics in battery packs by reusing packs multiple times. We are also reducing waste in our software supply chain by eliminating physical cards and enabling digital downloads for games, apps, and gift cards.

Designing for and enabling repair

Repairability can offer significant carbon emissions and waste reduction benefits. Microsoft continues to invest in this important space and the findings will aid in our product design and plans for expanding device repair options for our customers that are safe, effective, and sustainable. Our latest Surface products feature a host of replaceable components.

Repairability goes beyond design. This year, we piloted the sale of spare parts on Microsoft.com and began expanding our network of local Authorized Service Providers who are qualified to repair Microsoft devices. Microsoft has spent the past several years investing in local repair hubs in major geographies that are equipped to repair a customer's Microsoft device instead of replacing it.

Designing for recyclability

As we make progress towards our goal of 100 percent recyclability of Surface devices and Xbox consoles and accessories, we are engaged with the electronics recycling industry to learn about and improve how our products are recycled at end of life. Our research showed a gap between the processes used at electronics recycling centers and the tools available for us to calculate the recyclability of our products. To address this, we are in the process of switching to a new recyclability methodology, consistent with the EN 45555 standard, to increase the accuracy of our recyclability reporting.

Reducing plastic packaging waste

Microsoft is committed to making fully recyclable packaging for our products by 2030. We are focused on eliminating single-use plastics in our device packaging and for cloud hardware in our datacenters.

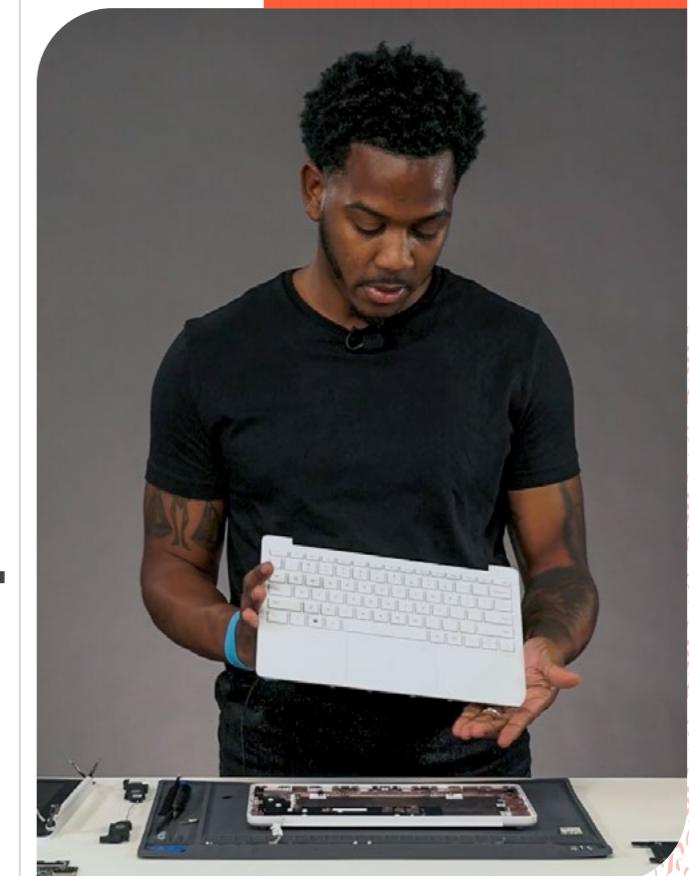
Reducing single-use plastics in device packaging

In FY22, we reduced single-use plastics in our Microsoft device packaging by 29.8 percent, a reduction from 4.7 percent to 3.3 percent by weight (on average) of plastic per package. We made significant progress on our journey to eliminate single-use plastic packaging, introducing several 100 percent plastic-free packages during the year including the Surface Adaptive Kit and Microsoft Ocean Plastic mouse. This packaging is made from 100 percent renewable materials and fully recyclable. In FY22, our product packaging was on average 94.4 percent recyclable in OECD countries. Our most recent wave of Surface Laptop 5 and Pro 9 retail packages use less than one percent plastic (by weight) and are over 99 percent recyclable. All virgin paper/fiber used for these packages is certified as responsibly sourced.

We have spent the past several years investing in local repair hubs in major geographies that are equipped to repair Microsoft devices.

29.8%

In FY22, we reduced single-use plastics in our Microsoft device packaging by 29.8 percent.



Designing for repairability reduces waste by keeping hardware in use longer.

Reducing our waste footprint (continued)

Reducing operational waste

Getting to zero waste at our campuses and datacenters requires more ambitious efforts to reduce as much waste as we can, reuse products to extend use life, and recycle or compost wherever possible. We're thinking through everything from durable serviceware to air filters with circularity in mind.

Transforming to zero waste campuses

Our Puget Sound campus has been Zero Waste certified since 2016. LinkedIn has been collecting annual waste data from most of its high impact sites and plans to continue expanding the collection to other sites in the next two to three years. The goals are to reduce pre- and post-consumer food waste, avoid waste collection contamination, reduce packaging in kitchen deliveries, transition all parts of the program to 100 percent reusable dishware, and eliminate single-use packaging in micro kitchens.

Zero waste
San Antonio, Quincy,
Boydton, and Dublin
datacenter locations
all renewed their zero
waste certifications
in FY22.

Achieving zero waste datacenters

Microsoft has a goal to achieve 90 percent reuse or recycle of our cloud computing hardware assets by 2025. In FY22, we renewed Zero Waste certifications for our San Antonio, Quincy, Boydton, and Dublin, datacenter locations.

In FY22, we invested in enhancing the program's business intelligence using a suite of waste data tools, including Microsoft Power Apps and Power BI, to track the waste performance of our datacenters.

Going beyond our operations

As we pursue our zero waste and circularity goals, we also look for opportunities to provide community co-benefits where we operate. Atlanta's [Zero Waste Westside initiative](#), sponsored with Microsoft grant funding, shows the power of justice-centered community-led sustainability enterprises. The collaboration brings food waste collection and recovery, composting services, and education to the Westside Atlanta community. The concept was also informed by the [Environmental Justice Measurement and Evaluation Framework](#), co-created by Microsoft and the Just Transition PowerForce. The enterprise is run by three local organizations led by Black women with long-standing commitments to social and environmental justice. With Microsoft's support, the collective secured farm equipment to improve composting processes and more than double output at their community compost lab. It is poised to scale service offerings to businesses.

As we pursue our zero waste and circularity goals, we also look for opportunities to provide community co-benefits where we operate.

Reducing construction and deconstruction waste

Microsoft is approaching the design, construction, and deconstruction of the buildings in our datacenter and campus portfolio with circularity in mind and identifying ways to prevent waste from the offset.

Innovating the construction process

We are innovating our construction processes to reduce waste throughout our entire lifecycle and supply chain. In FY22, we developed a playbook that standardized our internal processes for diverting construction waste. We implemented a construction and deconstruction waste app to collect data from our general contractors globally to increase transparency and traceability. We also implemented a new database that stores, displays, and analyzes real-time global waste diversion data. Moving forward, priority strategies including construction circularity, upstream design considerations, a steel scrap take-back program, repurposing of excess concrete, and mitigation of hard-to-recycle materials, are all becoming standard elements of our datacenter construction projects.

Improving our diversion rates

We have a goal of 75 percent construction and deconstruction waste diversion for all projects, including tenant improvement, and 90 percent diversion for core and shell projects over 75,000 square feet.

Key trends

1 Circularity can reduce embodied carbon

As industries like design and construction align around embodied carbon measurement tools, significant opportunities open up to reach not just circularity and waste reduction goals but also carbon reduction goals. Implementing responsible materials management and circular practices with technologies allows for optimized reuse and recycling of materials.

2 Innovation in data acquisition must be prioritized

Further strides are needed to improve waste data. Currently, downstream systems are dependent on estimation of material volume and weight. Systemic investment is needed across the value chain to provide actual and real-time data, which includes data points from collection, processing, and material availability. Improvements in data accuracy will provide critical insight into an organization's footprint, informing immediate next steps and driving long-term innovation.

3 Data methodologies must be standardized

To effectively use information from across the value chain, industry standards must be introduced to ensure consistency of measurement and interpretation of data. Circularity will be accelerated through global benchmarking, coordinated efforts to track progress, and cross-industry accountability.

4 A circular transition should be a just transition

Engagement with underrepresented and under-resourced communities is imperative to ensure a holistic approach to circularity. People are at the center of any economic transformation and ensuring accessibility and equity must be prioritized. Alongside any mitigation efforts for environmental impact, community engagement and investment are paramount to any circular economy.

Resources

Microsoft Circular Centers

Learn how Microsoft Circular Centers are designing and implementing circularity into our cloud.

 Watch the video

Sustainability benefits of Microsoft device repair

 Read the paper

Repair your Microsoft Surface

 Learn how

End-of-life programs for devices, batteries, and packaging

 Learn more

Reducing packaging waste

Microsoft participated in the development of a cross-industry white paper on stretch wrap alternatives.

 Read the paper

Circular economy vision

Find out more about the circular economy and the vision for an economic system that's better for the people and the environment.

 Learn more

Circularity Gap Report 2022

Understand the systemic benefits of a transition toward a circular economy and learn more about the status of circularity globally.

 Read the report

Circular Electronics Roadmap

The Circular Electronics Partnership has developed a cross-industry strategy to accelerate the circular transition in a collaborative way.

 Read the report

What's next

1 Accelerating progress towards zero waste by 2030

Microsoft will use roadmaps across the company to enable key activities that result in zero waste outcomes that center circularity. We will continue to scale our programs, including Circular Centers, design for circularity in buildings and hardware, and the elimination of single-use plastics from packaging for Microsoft products and across our cloud hardware supply chain.

2 Expanding our circular strategy across Microsoft

In efforts to further accelerate progress towards our zero waste and Scope 3 carbon reduction commitments, we are working across the enterprise and with external partners to prioritize actions that align with our circular strategy. By taking a coordinated approach, we will use the expertise of our team to unlock key barriers and further drive innovation at scale.

3 Streamlining our collection systems

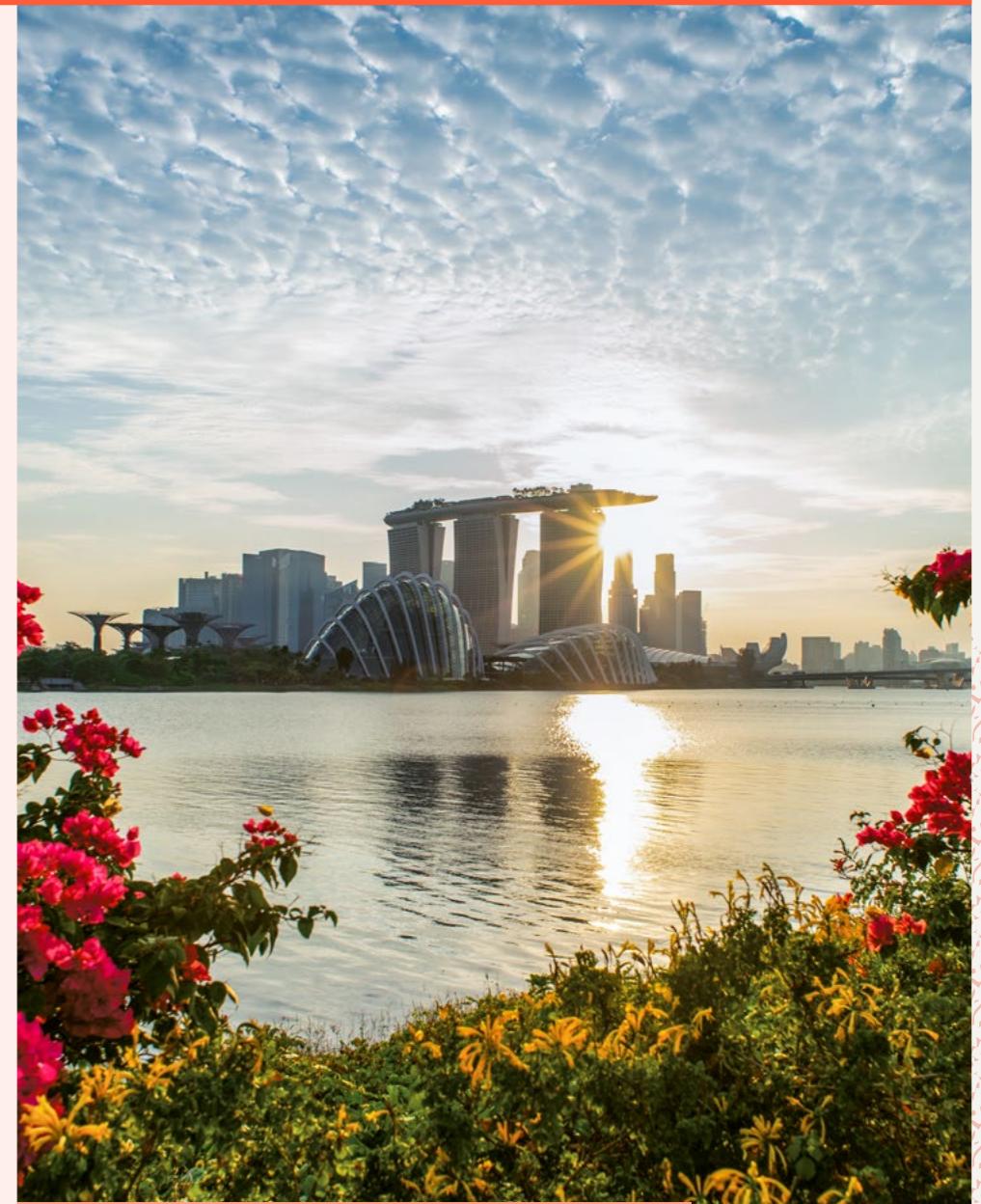
We are engaging with industry collaborators on piloting new electronic collection systems. These new systems will allow for better data such as weights, material type, and recycled content, ensuring regulatory compliance and supporting decision making around driving circular economy initiatives.

4 Growing the scope and impact of our environmental justice initiatives

As we learn from our existing partnerships, we are building out the framework to integrate environmental justice into our activities. We will continue to build on existing community partnerships, such as our partnership with Zero Waste Westside, and explore new ones in communities we operate in to create opportunities for economic inclusion and community well-being.

5 Redesigning cloud rack packaging

To further our progress towards our zero waste objectives, our Cloud Logistics Team has undertaken a deeply collaborative process with stakeholders from across the enterprise to source and design world class reusable solutions for the safe and sustainable transportation of Microsoft's server racks. Today, the transportation of each server rack from integration to our datacenters results in over 100kg of packaging waste. We're aiming to reduce this to zero with our new solutions, enabled by a circular supply chain and logistics network design.



Designing for circularity accelerates our path to zero waste by 2030.

Protecting more land than we use

Ecosystems

Taking responsibility for our land footprint

48

Key trends and what's next

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Our approach

Microsoft directly operates on approximately 11,000 acres of land around the world, and we recognize that our own land footprint has an impact on ecosystems. We have made a commitment to permanently protect more land than we use by 2025. We are also committed to being good stewards of the land we use – as well as going beyond our own operations and actively working to protect the environmental health of the communities that host our datacenter operations and where our employees live and work.

We have contracted to protect 17,268 acres of land, which is over 50 percent more than the land we use to operate.

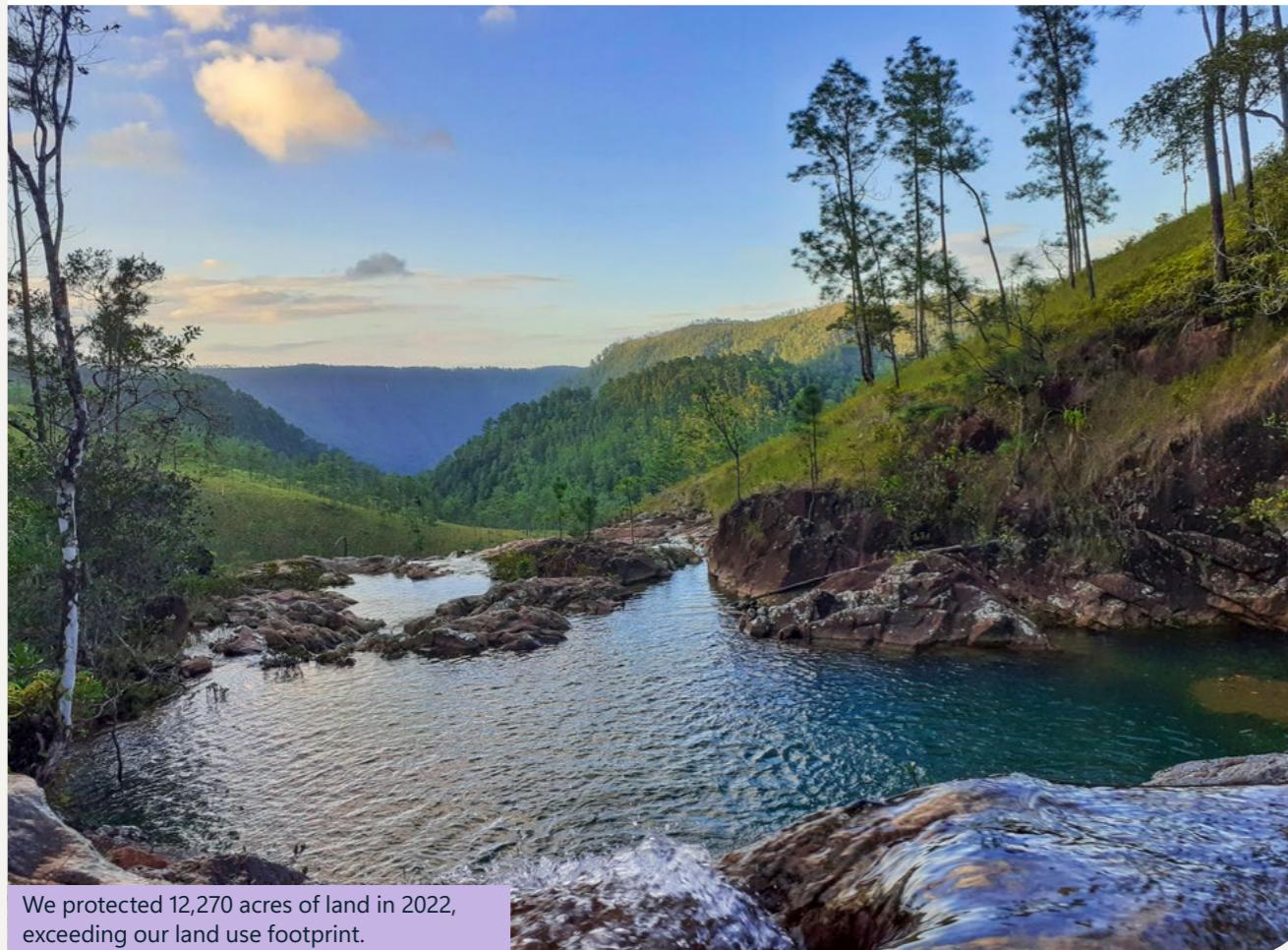


Commitments and progress

Our commitment

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

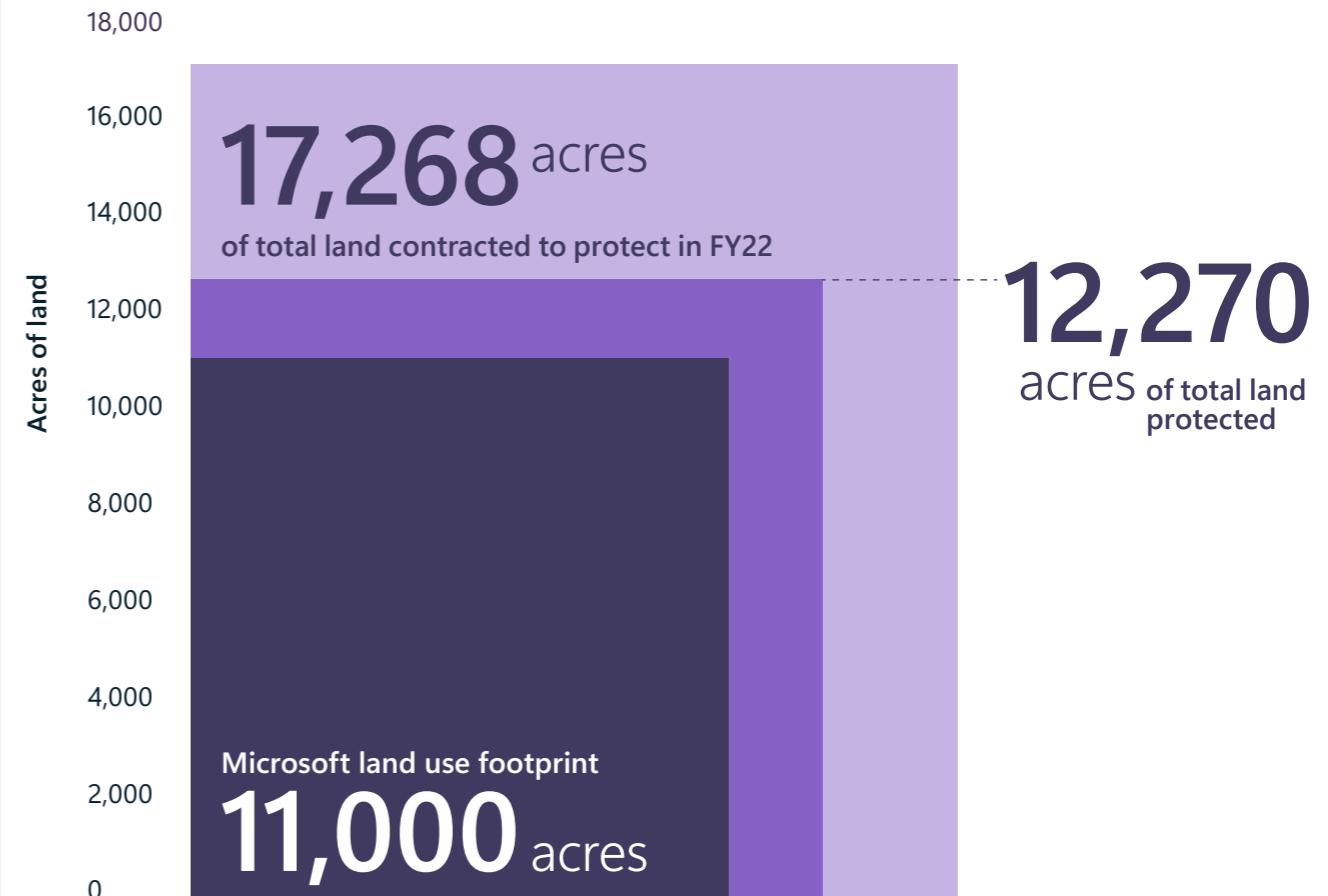
Protecting acres of land

In FY22, we protected 12,270 acres of land in Belize. Another 4,998 acres in the United States are contracted for protection in future years. We now have funded more land to be protected than the 11,000 acres of land that we use.

Ecosystems Chart 1

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

As of FY22, Microsoft has contracted to protect 17,268 acres of land, which is over 50 percent more than the land we use to operate, and 12,270 acres were designated as permanently protected.



 Learn more in the Environmental Data Fact Sheet

Taking responsibility for our land footprint

Since our commitment in 2020, Microsoft has partnered with the National Fish and Wildlife Foundation (NFWF) within the United States and The Nature Conservancy (TNC) globally to permanently protect more land than we use by 2025. We used a data-informed approach to invest in projects that are working to protect more than 17,000 acres of ecosystems most at risk. We are tracking each of these projects through the process of placing the land under a legal designation of protection, as well as ongoing conservation and management.

We used a data-informed approach to invest in projects that are working to protect more than 17,000 acres of ecosystems most at risk.

Protecting the Belize Maya Forest

Last year, we contributed to the TNC Belize Maya Forest Project (BMF) to protect an additional 236,000 acres in a global biodiversity hotspot. In December 2021, these acres were placed under declaration of trust by the Belizean government, putting nine percent of Belize's land under permanent protection.

The designation of land protection is just the first important step for the long-term conservation and management of BMF. The Belize Maya Forest Trust was established as a local nonprofit, trustee, and steward to create a globally recognized, locally relevant model of healthy, biodiverse forest protected for and by all Belizeans and to be a global benchmark for effective and lasting conservation. The following programs have been put in place:

Conservation Action Plan

With the University of Belize's Environmental Research Institute, the Trust developed a Conservation Action Plan that provides a strategic framework for management over the next five years. The forest and aquatic ecosystems, wild cats, critically endangered Central American river turtle, and Sacred Pools of Cara Blanca have been identified as the main conservation targets. Anti-poaching and fire protection measures will be implemented to address threats in the region.

Regenerative agriculture

BMF was acquired to halt the continued expansion of large-scale mechanized agriculture. TNC has committed to working with the Government of Belize to invest in regenerative agriculture in the buffer zones neighboring the BMF.

Local engagement

The Trust is working with communities in the area to build a strong local alliance to maintain the integrity of these vital forests and safeguard their biodiversity. They are building trust among community stakeholders by identifying issues of mutual interest such as water quality and availability, and determining critical gaps and needs of communities like education and livelihoods to further invest in.

Ranger program

To help legally enforce forest protection, there are currently 10 local rangers patrolling BMF. The Trust has also partnered with the British Army Training Support Unit Belize to resource more than 400 troops to assist with security and help train BMF rangers.

Investing in the NFWF Western Big Game Migration Program

Through the NFWF Western Big Game Migration Program, we invested in projects in the American West that are vital for preserving the migration corridors of endangered and at-risk species, including mountain lions, grizzly bears, and Canada lynx. We are continuing to monitor the progress of these projects in Montana, Colorado, New Mexico, and Nevada, which are on track to be protected through conservation easements by the end of 2023.



Taking responsibility for our land footprint (continued)

Being good stewards of the land we use

As we expand our footprint with new datacenters, we are measuring, designing, and piloting solutions that are regenerative. In nature, healthy ecosystems clean the air, filter the water, sequester carbon, and support biodiversity, among other benefits. Using the tools of biomimicry, we are assessing the impact of our datacenters and identifying opportunities to enhance the ecosystems around us.

This year, we launched our first pilot in North Holland. After researching how resilient landscapes function in an area, we identified a series of landscape solutions that could be incorporated into the existing datacenter campus. The first phase included the planting of 150 native trees and 2,300 square meters of shrubs, grasses, and groundcovers around the campus. As the landscape matures, the datacenter facility will begin to blend into the surrounding environment. As we roll out additional phases of this project, we will measure the impact on air quality, soil health, and biodiversity both on the direct campus and for the surrounding area.

As we look to incorporate these strategies across our footprint, we have assessed the ecosystem performance benchmark for several other datacenter regions and are developing tools to standardize and design to this measurement. Modeled results suggest that ecosystem performance can be restored to as much as 75 percent (where we are able to successfully recreate 75 percent of the function of the untouched ecosystem).

Going beyond our operations

Microsoft is committed to supporting strategic communities that host our datacenter operations and where our employees live and work. Through our Community Environmental Sustainability program, we partner with global and local organizations to identify priority environmental issues, and actively participate in sustainable solutions to protect and restore our communities' natural environments. We support localized nature-based solution projects with a flexible, multi-functional, and adaptable approach to simultaneously improve human well-being, social equity, and environmental health.

Over the past four years, we have launched over 40 community projects across our global portfolio of datacenter locations. This year, we supported several urban forestry projects, including holistic street, park, and school tree projects in locations including Sydney, Des Moines, Phoenix, and Santiago. Working with local communities and councils, these projects will provide much needed shade, habitats, and measurable stormwater benefits to heat-affected urban areas and vulnerable residents. We are also launching a suite of ecological restoration projects to assist in the recovery of ecosystems, contribute to increased biodiversity of native species, and improve green spaces for all.



40

Over the past four years, we have launched over 40 nature-based solution community projects across our global portfolio of datacenter locations.

Key trends

1 Taking a science-based approach to land protection

Microsoft is using the Last Chance Ecosystems framework to prioritize our selection of land protection projects and partner with the UN Biodiversity Lab and the Group on Earth Observations Biodiversity (GEO BON) on developing conservation management tools.



Resources

Maya Forest in Belize

Learn more about the project to protect the Belize Maya Forest, supported by Microsoft.

[Learn more](#)

NFWF land protection

Learn more about the Microsoft and NFWF partnership to protect natural habitats and sustain wildlife populations vital to maintaining biodiversity.

[Learn more](#)

Identify ecosystems to protect

Find out more about the tool that Microsoft used to make a science-based decision on the most important places to protect.

[Use the tool](#)

See the land where Microsoft directly operates

View an interactive map by biome.

[View map](#)

What's next

1 Protecting more land than we use by 2025

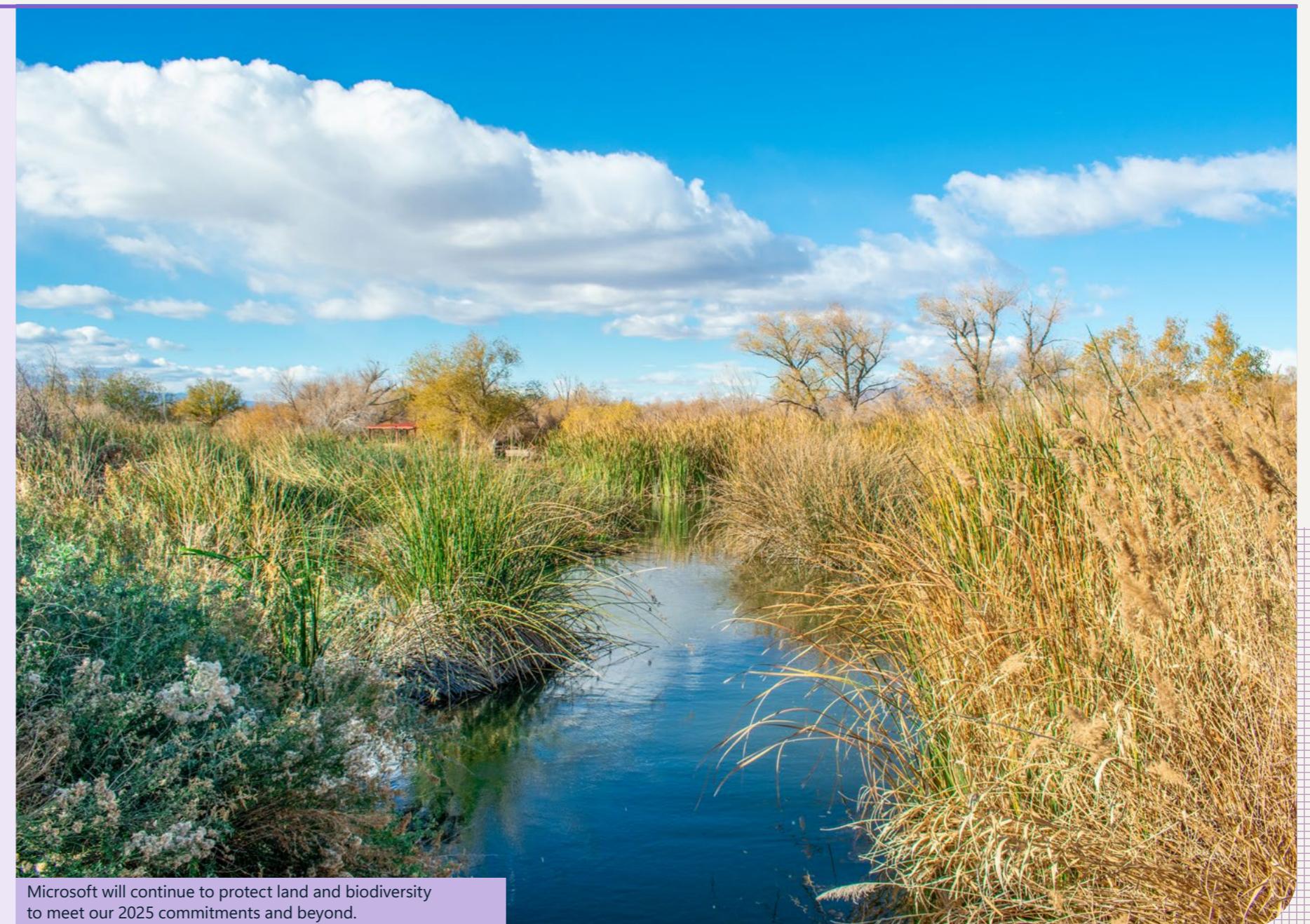
Microsoft will continue to monitor the progress of our remaining land protection investments. The NFWF projects we invested in are on track to be protected by the end of 2023. We will also track how much land Microsoft directly operates on, to ensure we are protecting more land than we use.

2 Being good stewards of the land we use

As we look to incorporate regenerative strategies across our footprint, we have assessed the ecosystem performance benchmark for several other datacenter regions and are developing tools to standardize and design to this measurement. Modeled results suggest that ecosystem performance can be restored to as much as 75 percent.

3 Centering environmental justice in our ecosystems work

We will support localized nature-based solution projects with a flexible, multi-functional, and adaptable approach to simultaneously improve human well-being, social equity, and environmental health for vulnerable communities.



Microsoft will continue to protect land and biodiversity to meet our 2025 commitments and beyond.

Customer sustainability

Delivering digital technology for net zero

Microsoft is committed to providing the digital technology needed to help build a more sustainable world. From managing environmental footprints with Microsoft Cloud for Sustainability to accelerating innovation for new climate technologies, we're working to empower our customers and partners across industries. We are advancing greener software and reducing carbon intensity to improve device sustainability, and helping organizations measure and manage the health of the planet's natural ecosystems by building a Planetary Computer.

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Commitments and progress

Customer sustainability

We are committed to providing the digital technology needed to help build a more sustainable world. We are delivering technology to help organizations measure and manage their environmental footprints and monitor the health of the planet's natural ecosystems.



Our commitment

Empowering customers and partners

We are working to help our customers, partners, and suppliers around the world to reduce their carbon footprints, understand water-related risks, and make environmental decisions through our learnings and with the power of data, AI, and digital technology.



Our progress

Expanding Microsoft Cloud for Sustainability

In 2022, we expanded the breadth of Microsoft Cloud for Sustainability capabilities beyond carbon emissions to include methods to centralize water data and added new functionality to Microsoft Sustainability Manager, including new Scope 3 calculation methodologies. We released the Emissions Impact Dashboard for Microsoft 365 and introduced Environmental Credit Service.

Improving device repairability and energy efficiency

Our latest products, including Surface Pro 9, Surface Laptop 5, Surface Laptop Go 2, and Surface Studio 2+ all feature a host of replaceable components serviceable by an expanding Authorized Service Provider and in-region repair network.

The Surface Pro 9 and Surface Laptop 5 are among Microsoft's most energy efficient Surface computers. Both devices are ENERGY STAR® Certified, consuming less than half the recommended energy limit set by the latest ENERGY STAR® computer specification.

Building a Planetary Computer

We are planning to aggregate environmental data from around the world and put it to work through computing and machine learning in a Planetary Computer.

Advancing climate aware software engineering

In 2022, we improved the efficiency of Microsoft Azure, decreased the carbon intensity of Microsoft 365 cloud services, and launched the world's first "carbon-aware" updates in a PC operating system in September as part of the Windows 11 launch. We also enabled Xbox games to be played on Samsung 2022 Smart TVs via the Xbox app, reducing the need for standalone hardware.

Delivering digital technology for climate action

As of 2022, the Planetary Computer has over 80 data sources containing over 50 petabytes of data.

In 2022, we expanded our AI for Good Lab into Egypt and Kenya to improve climate resilience and launched Global Renewables Watch, a first-of-its-kind living atlas aiming to map and measure all utility-scale solar and wind installations on Earth.

Microsoft Cloud for Sustainability

Empowering customers to manage their environmental footprints

Microsoft's work to meet our own sustainability goals made clear that there is an urgent need for better data and intelligence to enable organizations to track and report progress on sustainability pledges. Our learnings have informed the solutions we're building to help our customers. [Microsoft Cloud for Sustainability](#) enables organizations to manage their environmental footprint, embed sustainability through their organization and value chain, and make strategic business investments to help them meet their sustainability commitments.

Centralizing sustainability data

The [Microsoft Cloud for Sustainability data model](#) centralizes emissions data from disparate sources in a shared data language—streamlining data ingestion, integration, and calculations and enabling more accurate and reliable reporting. The data model is available for use across organizations and value chains.⁶ The Microsoft Cloud for Sustainability data model initially focused on carbon and was expanded in 2022 to include water data.

Enabling sustainability management and reporting

[Microsoft Sustainability Manager](#) unifies data intelligence and enables environmental sustainability management for organizations at any stage of their sustainability journey. It can be integrated with virtually any business system. It breaks down data silos using the Microsoft Cloud for Sustainability data model and increasingly automates data connections and calculations, reducing reliance on manual processes. Sustainability Manager allows organizations to gain continuous visibility into their emissions activities, report their impact and progress more reliably, and access the intelligence required to help reduce their environmental footprint and transform their business.

Microsoft Cloud for Sustainability enables organizations to manage their environmental footprint, embed sustainability through their organization, and make strategic business investments to help them meet their sustainability commitments.

Understanding emissions impact of cloud services and devices

The Microsoft [Emissions Impact Dashboard](#) applications for Azure and Microsoft 365 provide transparency into the emissions that Microsoft generates based on a customer's use of Microsoft cloud services, empowering organizations to more accurately report this aspect of their Scope 3 emissions.

The Emissions Impact Dashboard for Azure has been available since 2020. In 2022, we released the Emissions Impact Dashboard for Microsoft 365 to help Microsoft customers track datacenter emissions related to their use of Microsoft Exchange Online,

SharePoint, OneDrive, Teams, Word, Excel, PowerPoint, and Outlook. These applications estimate Microsoft's direct and indirect emissions related to a customer's cloud usage, as well as the emissions customers have avoided by running workloads in the cloud rather than on-premises.

The [Surface Emissions Estimator](#) enables commercial customers to gain insight into the carbon footprint of their entire Surface device fleets. The Estimator uses state-of-the-art carbon assessment technologies and lifecycle assessments to enable customers to get more accurate estimations of the carbon impact of the Surface devices they purchase from us.



Microsoft Cloud for Sustainability enables better sustainability data and intelligence.

Microsoft Cloud for Sustainability (continued)

Increasing transparency and promoting trust in environmental claims and credits

In October 2022, we introduced [Environmental Credit Services](#), delivering common, open-standards infrastructure and a shared process and data standard to help track the origination process for carbon credits and other environmental assets. The service provides transparency into the provenance and quality of environmental claims and credits by digitizing and streamlining the origination workflow for environmental project developers, claim verifiers, credit-issuing registries, and marketplaces. This can yield more credible, scalable credit offerings to support growing global demand.

Enabling partner solutions

Microsoft provides the technologies and platform to guide digital transformation. Our efforts are supported by our global ecosystem of partners, who provide a broad range of capabilities to unlock data and build industry-specific solutions to improve sustainability outcomes.

We have an ecosystem of global advisors and system integrators who are helping organizations plan, design, and implement strategies to enable sustainable growth. Our independent software vendor partners bridge gaps and add value to our technologies with a growing set of off-the-shelf and custom [sustainability solutions and services](#).

Customers

Transforming the energy industry

TerraPraxis is a nonprofit focused on actionable solutions for climate and prosperity. In 2022, TerraPraxis and Microsoft entered a strategic collaboration to repurpose over 2,400 coal-fired power plants around the world to run on carbon-free energy. TerraPraxis will combine its deep expertise in energy with Microsoft technology to build and deploy a set of tools to automate the design and regulatory approval process to decarbonize coal facilities with advanced small modular nuclear reactors (SMRs). The partnership will help to accelerate the transition of one of the world's largest sources of carbon to zero emissions. TerraPraxis and Microsoft will develop a software application to analyze the existing coal fleet to determine the best approach for the retrofit, saving coal plant owners time and money while giving the communities around them a new lease on life for decades to come. The partnership started with Microsoft's 2021 Hack for Sustainability when Microsoft employees worked with TerraPraxis to develop the winning project, "Beyond Coal."⁷

Supporting Australia's digital growth

In July 2022, Telstra and Microsoft expanded their long-term strategic partnership, which includes the intention to help advance sustainability in Australia and drive growth. Microsoft will support Telstra in achieving its own sustainability goals with Microsoft Cloud for Sustainability which will provide data insights into sustainability performance. The strategic partnership brings together the best strengths of the two organizations. In 2020, Telstra was certified carbon neutral in their operations, and both Microsoft and Telstra have ambitious climate targets and share a commitment to a net zero carbon future.⁷



Transparency and collaboration are driving global progress toward a more sustainable future.

>2,400

TerraPraxis and Microsoft entered a strategic collaboration to repurpose over 2,400 coal-fired power plants around the world to run on carbon-free energy.

Green software

Advancing greener software and reducing carbon intensity

Green software engineering is an emerging discipline at the intersection of climate science, software practices, architecture, electricity markets, hardware, and data-centered design. We are making ongoing investments to help reduce the carbon intensity of our applications in the cloud and on the edge.

25%

We are reducing idle power consumption of servers when they are not actively being used and expect up to a 25 percent reduction in energy usage for these unallocated servers.

Developing standards, tools, and best practices

We are committed to green software standards, tooling, and best practices, as defined by the [Green Software Foundation \(GSF\)](#). Microsoft is a founding member of GSF and contributes to several climate aware software tools and standards.

The [Software Carbon Intensity \(SCI\) Specification](#) provides an industry standard for calculating the rate of carbon emissions in a software system to help users and developers make informed choices about which tools, approaches, architectures, and services they use.

The [Carbon Aware SDK](#), an open-source tool co-developed by Microsoft and UBS and released by the GSF, provides recommendations on when and where to run workloads that take advantage of the lowest-carbon sources of energy possible. UBS is deploying the SDK in a time-shifting application to make a computationally-intensive risk modeling platform carbon-aware.

The [Green Software Principles](#) focus on energy reduction, hardware efficiencies, and carbon aware software. The GSF's Design Patterns catalog provides the latest patterns and best practices for building software that can enable energy efficiency and thereby reduce carbon emissions.

We are committed to advancing greener software to help reduce the carbon intensity of our applications in the cloud and on the edge.

Improving Azure efficiency

Azure efficiency requires a close collaboration between the platform and the workloads running on Azure.

Helping customers and partners optimize Azure workloads

Microsoft developed new technical guidance in partnership with the GSF to help customers and partners with optimizing Azure workloads with the [Well-Architected Framework \(WAF\)](#). The framework is part of a broader initiative to help customers plan for and meet evolving sustainability requirements and regulations in the development, deployment, and operations of IT.

Improving cloud energy efficiency

We are reducing idle power consumption of servers when they are not actively being used or hosting customer virtual machines. In these cases, server performance requirements are relaxed, enabling reduced power consumption with lower-power states. We expect up to a 25 percent reduction in energy usage for these unallocated servers, with a corresponding reduction in Scope 2 emissions. This capability has been deployed to a subset of general-purpose compute servers and will continue to expand across the Azure fleet.

Improving cloud resource utilization

We use resource oversubscription and harvesting techniques to optimize the utilization of energy-consuming cloud resources. We address oversubscription by using statistical analysis to predict when additional virtual machines can be deployed on underutilized hardware. Our approach to oversubscription is enabled by a technique called harvesting. It enables us to opportunistically create a new type of virtual machine to apply underutilized resources to oversubscribed situations. We are currently applying oversubscription and harvesting to Microsoft internal virtual machines for CPU resources, and will be expanding this capability into other energy-intensive resources such as memory, networking, and storage. This initiative has the potential to reduce datacenter hardware needs, and the associated embodied carbon, by more than 30 percent.

Developing sustainable Artificial Intelligence (AI)

AzureML and Microsoft Research partnered with researchers from Allen Institute for Artificial Intelligence, Huggingface, Carnegie Mellon, Hebrew University, and the University of Washington to publish a paper in the Association for Computing Machinery (ACM) Conference on Fairness, Accountability, and Transparency (FAccT). The [paper](#) uses the principles of carbon aware software and applies them to building carbon measurement baselines and reduction strategies for AI systems.

Green software (continued)

Decreasing the carbon intensity of Microsoft 365

Microsoft 365 applications are powered by Azure datacenters, so customers benefit from their significant energy and resource efficiencies. As disclosed in this white paper, we use the data powering the Emissions Impact Dashboard for Microsoft 365⁸ to estimate that the datacenter carbon intensity per gigabyte of data stored in SharePoint and OneDrive per month decreased by more than 30 percent⁹ over the course of FY22. We also estimate that the datacenter carbon intensity of a device joining a one-hour Teams call fell by a similar amount, even as Teams delivered new value like AI-based speech enhancements.¹⁰

Optimizing Azure Compute demand for Teams services

For online Teams meetings, the most critical datacenter resources are compute cores and main memory consumption. In 2021, the Teams product group transitioned services to run on optimized cores with approximately 50 percent lower memory requirements. This led to a reduction in total datacenter resources during a period of time in which the volume of Teams active users increased.

Optimizing peak CPU resource usage for Teams

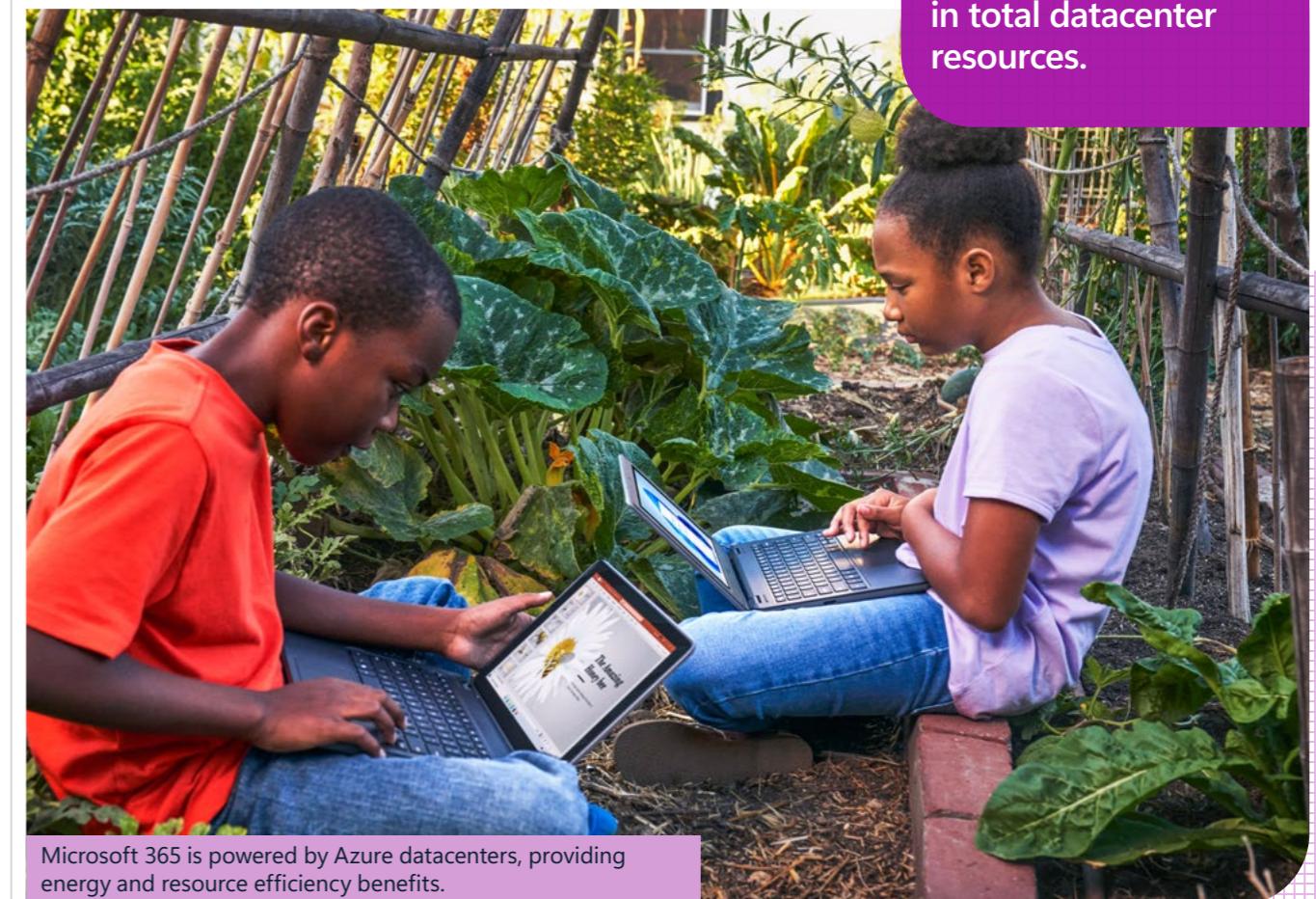
Today, cloud infrastructure capacity is planned based on our need to satisfy peak customer traffic. A service that has not optimized its peak utilization will increase the number of servers Microsoft has to procure. Net decreases in capacity purchases can directly lead to emissions avoidance. Over the past several years the Teams service improved peak utilization by more than 30 percent, leading to reductions in the volume of hardware needed to support growth in usage.

Customer experience prioritization for SharePoint and OneDrive

OneDrive and SharePoint implemented standardized headers that require first-party applications to tell the service if a given operation must be prioritized or can be deferred. This has allowed the team to run services at higher utilization while prioritizing customer-affecting operations, contributing to reductions in the number of servers required to support file editing and management workloads.

Optimizing performance of Microsoft 365 client-side applications

Microsoft Teams has optimized performance to achieve PC power usage declines of up to 50 percent between June 2020 and December 2021.



50%
Teams services were transitioned to optimized cores with approximately 50 percent lower memory requirements. This led to a reduction in total datacenter resources.

Green software (continued)

Reducing carbon intensity of devices and gaming

We are empowering users with options for managing their usage and developers with the tools to improve power performance in games.

Improving the carbon awareness of devices

With the Windows 11 2022 update, Windows Update is now more carbon aware. When devices are plugged in, turned on, and connected to the internet, and regional carbon intensity data is available, Windows Update will schedule installations at times of the day when a higher proportion of electricity is coming from lower-carbon sources on the electric grid. We also made changes to the default power setting for Sleep and Screen Off to help reduce carbon emissions when PCs are idle.

Reducing emissions with cloud-powered computing

It is estimated that by 2025, Microsoft Azure will run on 100 percent renewable energy. As such, cloud-based approaches to IT infrastructure, like Microsoft Windows 365, can reduce operating emissions by transitioning end-user computing workloads to Microsoft datacenters, increasingly powered by renewable energy.

In 2022, Microsoft launched our Xbox app on Samsung 2022 Smart TVs, enabling users to play hundreds of cloud-enabled Xbox Game Pass games like Halo Infinite, Forza Horizon 5, and Microsoft Flight Simulator without the need for a console, and soon benefiting from the impressive renewable energy commitments in Azure.

Empowering game developers to improve power performance

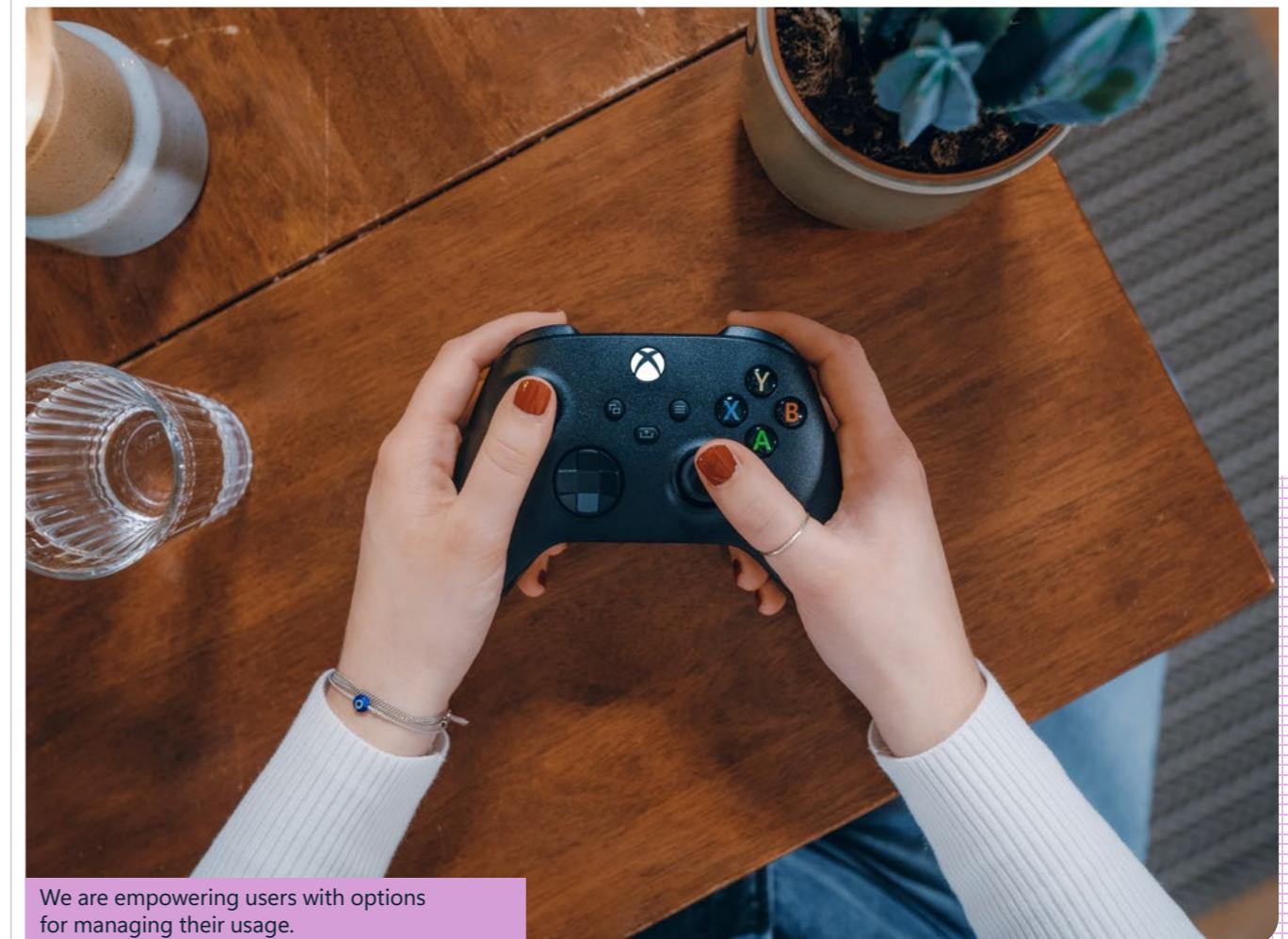
Gaming activity represents approximately half of the usage-based carbon footprint of Xbox devices. To support first and third-party publishers who design and build games for our Xbox platform, we launched new developer tooling in 2022 to monitor and reduce the power consumption of their games. Our goal is to support game publishers' sustainability goals as we build solutions to lower carbon intensity on console gaming.

- Xbox Series X developer kits now include real-time power performance feedback on front panel displays.
- Performance Investigator for Xbox (PIX), the go-to developer tool for Xbox game and app performance analysis, now includes power utilization counters.
- Xbox certification labs have started preliminary feedback to our publishing partners on power analysis in their test reports.

Gaming activity represents approximately half of the usage-based carbon footprint of Xbox devices. Our solutions empower game developers to improve power performance.

Digital design for sustainability in web experiences

We focus on the sustainability of web experiences that Microsoft delivers, including ads, search, maps, news, commerce, and more. We have enabled front-facing solutions to reduce the carbon footprint of our web services, including Sleeping Tabs and Efficiency Mode performance optimizations in Microsoft Edge browser.



Sustainable devices

Reducing environmental impact in our devices

Over the past year, Microsoft has continued our work to reduce environmental impacts of our devices by increasing circularity and reducing carbon intensity across the entire product lifecycle. For example, we have revamped our Surface product development process to define sustainability targets on our product roadmaps for every major future launch.

Hardware is only one piece of the story. Microsoft is in a unique position to promote sustainability improvements across the full devices stack: hardware, software, and games. Last year, we released Shutdown (energy saving) mode for Xbox, which became the default power experience in November 2021 and has been adopted by 39 percent of our consoles. In September 2022, Windows Update became carbon aware, making it easier for our devices to reduce carbon emissions. When devices are plugged in, turned on, and connected to the internet, and regional carbon intensity data is available, Windows Update will schedule installations at specific times of the day when doing so may result in lower carbon emissions because a higher proportion of electricity is coming from lower-carbon sources on the electric grid.

Designing for sustainability

Improving the sustainability of our devices starts with hardware design. Informed by lifecycle assessments (LCAs), we set explicit carbon and repairability targets during product design to ensure year-over-year improvement. Designing with circularity in mind—keeping materials and products in use longer—is key to achieving these goals. And we strive to meet rigorous third-party ecolabels and ecostandards—all of our newest laptops and tablets are registered EPEAT® Gold and are ENERGY STAR® Certified.

We continue to work to reduce environmental impacts of our devices by increasing circularity and reducing carbon intensity across the entire product lifecycle.

Building a data-driven carbon platform

Each device we sell is a complex amalgamation of new and recycled materials, manufacturing and assembly processes, distribution, lifetime product usage, and eventual disposition. We quantify the lifecycle environmental impacts of each product and publish summarized results from our LCAs in our product EcoProfiles.

We are building an advanced carbon data platform that combines advancements in LCA, product usage telemetry, and real-time distribution data to get the most representative emissions profile possible for our devices. This data will be used for reporting and to provide visibility into actionable and granular environmental impacts to continue improving decision-making at all levels. This year alone, we more than doubled the percentage of the total carbon footprint calculated based on suppliers' primary LCA data.

Testing lower-carbon, circular design

Our accessory devices have shorter development cycles, making them an ideal way to test new circular materials. We trial new materials in individual products, and if successful, we expand their use across our broader portfolio—such as in Windows Dev Kit 2023, an ARM-based developer kit featuring 20 percent recycled ocean plastic¹¹, a material first proven in our Ocean Plastic Mouse. Circular design must also account for a future in which products can easily be returned, repaired, refurbished, and resold.

Incorporating recycled materials in devices

Without compromising on our design and quality, we routinely evaluate opportunities for the use of recycled material content. For example, many of our PC accessories contain recycled plastic, including our new Adaptive Accessories and Audio Dock, which are both made with at least 30 percent post-consumer recycled plastic resin.



Sustainable devices (continued)

Designing for repairability

Repairability can offer significant carbon emissions and waste reduction benefits. Microsoft continues to invest in this important space and the findings will aid in our product design and plans for expanding device repair options for our customers that are safe, effective, and sustainable. Our latest computer products, including Surface Pro 9, Surface Laptop 5, Surface Laptop Go 2, and Surface Studio 2+, all feature a host of replaceable components.

Repairability goes beyond design. This year we piloted the sale of certain spare parts on Microsoft.com and began expanding our network of local Authorized Service Providers (ASPs) which are qualified to repair Microsoft devices. We are also improving our capability to deliver broader availability of spare parts for independent repairers and consumers, targeting the first half of 2023. We continue to make our Service Guides available at [Microsoft.com](#) and repair videos available online. Through the ASP network, we are able not only to reduce waste but also to save on GHG emissions by shortening the distance that a device travels to a repair center.

Microsoft has also spent the past several years investing in regional repair hubs in major geographies that are equipped to make same-unit repairs. We are onboarding authorized repair partners across Surface markets to expand our authorized repair network and bring repair options closer to our customers. Enabling these localized repair hubs has led to quantifiable reductions in reverse logistics emissions (over 10 percent in some cases).

Manufacturing

Microsoft devices suppliers' GHG emissions reduction amounted to approximately 90,000 mtCO₂e in FY22, roughly equivalent to 17,000 homes' average annual energy usage. This was achieved through supplier carbon reduction interventions, renewable energy alternatives, and manufacturing process improvements. These reductions resulted from 12 suppliers switching to renewable energy, with six converting to 100 percent renewable energy. You can find more detail and individual supplier case studies in the [Microsoft Responsible Sourcing Report](#).

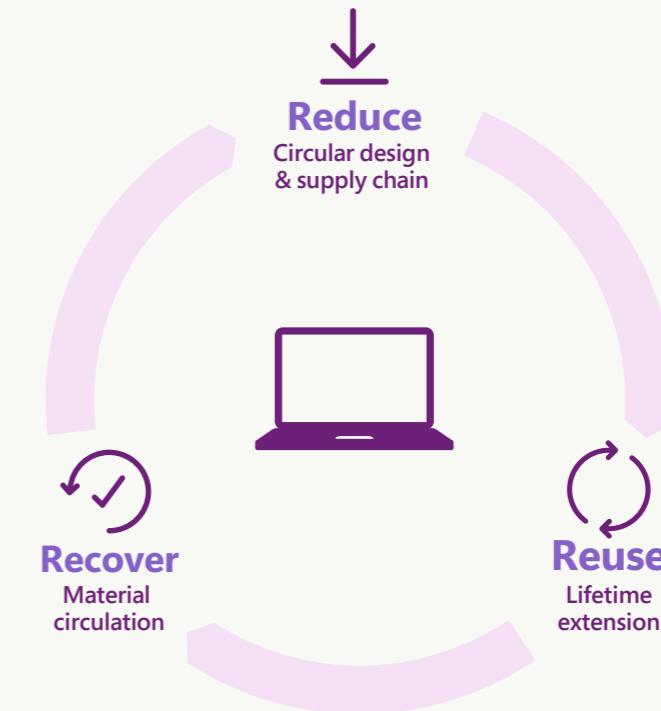
Empowering and financing decarbonization

Microsoft realizes that financing is a common barrier to decarbonization and has partnered with the International Finance Corporation (IFC), the private sector arm of the World Bank Group, to stand up a program for the IFC to offer financing solutions to eligible suppliers to support decarbonization efforts. IFC also offers eligible Microsoft suppliers its advisory services to identify technical solutions for reducing GHG emissions in the manufacturing process. Learn more about our [sustainability advisory and financing services](#).

Microsoft continues to invest in repairability. Our latest computer products all feature a host of replaceable components.

Circular product lifecycle

Improving the sustainability of our devices starts with hardware design. We set explicit carbon and repairability targets during product design to ensure year-over-year improvement. Designing with circularity in mind keeps materials and products in use longer and is key to achieving these targets.



Ensuring traceability of materials sustainability

Microsoft is a supporter and, as of the end of 2022, the only consumer electronics member in the Global Battery Alliance (GBA), a public-private platform organization founded to help establish sustainable battery materials throughout the supply chain. GBA is also leading the development and implementation of a battery passport that conforms to new EU regulations. We are also involved in partnerships such as IMEC with silicon manufacturers.

Innovating materials with suppliers

We are partnering with suppliers on more sustainable material innovations. For example, in our hardware supply chain, we are working on using 100 percent recycled tin solder paste and 100 percent recycled gold in our printed circuit boards. We are also working to reducing waste in our software supply chain by eliminating physical cards and enabling digital downloads for games, apps, and gift cards.

Sustainable devices (continued)

Advancing packaging, purchasing, and distribution

Once our products have been manufactured, Microsoft embeds sustainability goals into nearly every logistics step to get them to our customers. Our global logistics network is optimized to reduce carbon intensity. And we inform our customers about how they can achieve more sustainable purchase and use decisions when buying or using Microsoft products. Our packaging is also designed to minimize plastic waste.

Purchasing responsibly

Microsoft is committed to helping customers understand how to purchase devices that pose fewer environmental impacts. For example, we engaged with PC makers across the industry to drive sustainability best practices and provided guidance to channel partners and our sales team on how to select more sustainable PCs through our "Featured Devices" program.

We provide in-depth detail on Microsoft device sustainability and repairability through our [EcoProfiles](#) and [Repair Guides](#). We provide clarity to consumers on how to reduce their shipping emissions through ground shipping. And for commercial customers, we provide full-fleet visibility into the carbon impact of a purchase at point of sale through the Surface Emissions Estimator.

Reducing distribution footprint

In FY22, our devices supply chain organization engaged in key optimization projects, resulting in over 6,300 mtCO₂e avoidance from the global network. Key network adjustments enabled a shift to sea freight, resulting in 3,200 mtCO₂e savings. We optimized our inbound containerized freight processes to allow for increased container utilization. Outbound freight consolidations for one US retailer yielded 900 mtCO₂e and collaborated cross-functionally to reduce over 800 mtCO₂e within our customer network through order optimization and consolidation.

With investments in on-site solar generation, our key European and American distribution centers, which handle over half of all Microsoft devices sold, now produce over two million kWh of solar energy and are 100 percent powered by renewable energy. In Europe, our parcel deliveries are via electric or carbon neutral vehicles, where the capability is available. Less-than-truckload networks deliver via electric vehicles on the final mile transport with identified customers.

Our global logistics network is optimized to reduce carbon intensity. And we inform our customers about how they can achieve more sustainable purchase and use decisions when buying or using Microsoft products.

Increasing packaging sustainability

We are using innovation and design rigor to make progress on our journey to eliminate single-use plastic packaging by 2025. We introduced several 100 percent plastic-free packages in FY22, including the Surface Adaptive Kit and Microsoft Ocean Plastic mouse. This packaging is made from 100 percent renewable materials and fully recyclable. Our most recent wave of Surface Laptop 5 and Pro 9 retail packages use less than one percent plastic (by weight) and are over 99 percent recyclable. All virgin paper or fiber used for these packages is certified as FSC responsibly sourced.

We're also focused on eliminating single-use plastics beyond our 2025 commitment for product packaging. For example, we are implementing reuse for plastic shipping trays in our battery pack supply chain and will proliferate such improvements to other systems. Additionally, we're researching the potential use of lower-carbon footprint plastic alternatives for these trays.



100%
Our key European
and American
distribution centers
now produce over
two million kWh of
solar energy and are
100 percent powered
by renewable energy.

Sustainable devices (continued)

Reducing the impact of product usage

Reducing carbon emissions associated with the use stage of our devices presents a massive opportunity for carbon reduction. Microsoft starts by designing and engineering our devices to be more energy efficient and then uses software to further reduce emissions that may result from device usage.

Gaining insights from usage data

This year, we released a limited run of enhanced Xbox Series X|S consoles with power supply energy monitoring, which provides anonymized insights into console power consumption. This telemetry helps us gather additional insights across a wide range of user setups and usages in the field, such as power consumption from SSD, USB devices, networking, and power regulation efficiency losses. We are partnering with Carbon Trust and other global tech companies to develop a common methodology for tracking the usage emissions associated with connected devices.

Boosting efficiency through software

In addition to hardware, software (both our operating systems and the applications and games that run on top of them) and a shift towards more cloud computing have a major role to play in reducing use-phase emissions. See our section on [green software](#).

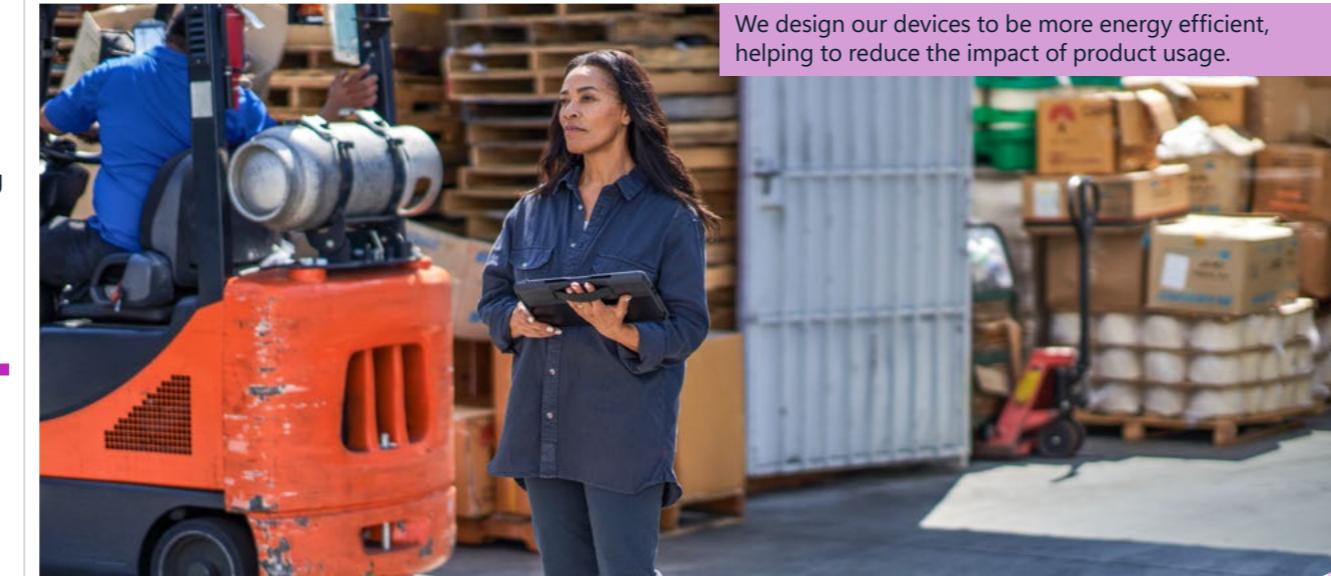
Telemetry helps us gather additional insights across a wide range of user setups and usages in the field.

Improving efficiency through hardware

The Surface Pro 9 and Surface Laptop 5 are among Microsoft's most energy efficient Surface computers. Both devices are ENERGY STAR® Certified, consuming less than half the recommended energy limit set by the latest ENERGY STAR® computer specification. In particular, Surface Pro 9 5G, powered by ARM technology, combines the energy efficiency of modern mobile devices with the computing power of a traditional computer.

Repurposing and recycling at end of life

Wherever possible, we look to reuse our hardware with new customers. We start with Microsoft Authorized Refurbisher and Trade-In programs. Where refurbishing and trade-in are not possible, we recycle as much of each device as possible as part of our commitment to achieve 100 percent recyclable devices by 2030.



Designing for recyclability

As we make progress towards our goal of 100 percent recyclability of Surface devices and Xbox consoles and accessories, we have engaged with the electronics recycling industry to learn about and improve how our products are recycled at end of life. Through research, we noticed a gap between the processes used at electronics recycling centers and the tools available for us to calculate the recyclability of our products. To address this, we are in the process of switching to a new methodology, consistent with the EN 45555 standard, to increase the accuracy of reporting the recyclability of our packaging and products.

This change helps to ensure that future assessments will be representative of the electronics recycling industry, backed by quality data, and repeatable through a step-by-step process, and will address both the qualitative and quantitative aspects of device recyclability. For transparency, we will recalculate the recyclability of products mentioned in previous sustainability reports.

We design our devices to be more energy efficient, helping to reduce the impact of product usage.

Partnering to remove consumer recycling barriers

In February 2022, Microsoft partnered with three original equipment manufacturers (OEMs)—Amazon, Dell, and Google—to launch a consumer electronics collection and [recycling pilot](#) in Denver, Colorado. The goal of this pilot, incubated through our participation in Corporate [Eco-Forum \(CEF\)](#), was to identify barriers that consumers face during the disposal of their end-of-life electronics—including nostalgia, lack of convenience, uncertainty around data security, and cost. Based on the pilot, the OEMs plan to take a data-driven approach to formulate strategies to overcome these barriers. Microsoft also participates in the Circular Electronics Partnership (CEP) to help drive industrywide improvements in circularity.

Closing the loop with customers

Microsoft offers multiple programs that repurpose or recycle used devices. Our Authorized Refurbisher Program gives millions of PCs a second life each year, including over three million devices in 2022. Our [Trade-In Program](#), expanded to 10 countries in 2022 and offers cash incentives for eligible older devices, which are then either reused or recycled responsibly. And the [consumer mail back recycling program](#) also allows customers to recycle their devices through Microsoft in 39 countries.

Planetary Computer and AI for Good

Delivering digital technology for climate action

Microsoft is committed to delivering digital technology that helps organizations around the world – from nonprofits to research institutions, NGOs, governments, and corporations – with environmental decision-making, which relies on a systematic understanding of the Earth's natural systems. Microsoft has deep expertise in aggregating and analyzing the data that can help organizations understand the planet's ever-changing ecosystems, and how to adapt to these changes. Through our Planetary Computer data platform and AI for Good Lab, we are using the power of data and AI for environmental good.

The Planetary Computer aggregates and stores spatiotemporal datasets, creating a fully indexed data estate for Earth's natural systems, using the power of data and AI for environmental good.

Building a Planetary Computer

We live in a new era of big data which includes an abundance of high-resolution satellite imagery and remote sensing (IoT) data. Millions of sensors provide near real-time updates on the state of Earth's natural ecosystems. One such data type is called spatiotemporal data, which includes the information collected about all the locations on Earth indexed in both space and time.

The [Planetary Computer](#) aggregates and stores spatiotemporal datasets, creating a fully indexed data estate for Earth's natural systems. This data enables predictive models to forecast the effects of changing climate. Examples include land use data that can detect changes in urbanization or forest biomass, demographic exposure data that shows where populations are most in need of climate adaptation, and biodiversity data that can help monitor the effectiveness of conservation efforts and support the sustainable use and management of natural resources.

The Planetary Computer contains over 50 petabytes (PB) of data in multiple cloud-optimized formats and based on open-source standards. With these rich datasets and the power of Azure we have enabled spatiotemporal analytics at scale, unlocking new insights and innovations.

Partnering on the Planetary Computer

Microsoft has been working with Esri, the global leader in geospatial analytics, to enable users to access up-to-date information from public satellite imagery programs for both the Planetary Computer and the [Esri Living Atlas](#). We are also jointly working towards empowering users of Esri's advanced geospatial analytic tools with data powered by the Planetary Computer.

Microsoft has also been working with [Impact Observatory](#), which utilizes the Planetary Computer as a primary data source for powering their AI to derive land use and land cover data. Their annual mosaic of land use and land cover data is available on the Planetary Computer for all users to better understand Earth's ever-changing landscape.

What's next for the Planetary Computer

Microsoft will continue to scale the Planetary Computer to provide access to all the world's most important spatiotemporal datasets. This will enable the Planetary Computer and the power of Azure to address the increasingly urgent adaptation needs across the globe. The Planetary Computer will provide a collaborative data storage and access system that uses open standards and enables open data. This approach is critical for integrating the growing community of collaborators from industry, governments, and academia as they look for new solutions to adapt to climate change.

Planetary Computer and AI for Good (continued)

Improving climate resilience with the AI for Good Lab

The Microsoft AI for Good Lab uses data from the Planetary Computer and other organizations around the globe with AI, machine learning and statistical modeling to improve climate resilience around the world. By offering the technology and expertise of the AI for Good Lab, we are helping to advance the local development of scalable solutions, including the following.

Bridging the climate data divide

At COP27, we announced that we have expanded our AI for Good Lab into Egypt and Kenya, building a new team of data scientists on the ground in Africa that will work to improve climate resilience. The work of these data labs will be informed by a new Africa AI Innovation Council comprised of representatives from leading African organizations.

The Global Renewables Watch (GRW) is a first-of-its-kind living atlas aiming to map and measure all utility-scale solar and wind installations on Earth using AI and satellite imagery, allowing users to evaluate clean energy transition progress and track trends over time.

Mapping the world's solar and wind energy

The Global Renewables Watch (GRW) is a first-of-its-kind living atlas aiming to map and measure all utility-scale solar and wind installations on Earth using AI and satellite imagery, allowing users to evaluate clean energy transition progress and track trends over time. It is being built as a publicly available renewable energy atlas with country-by-country insights into production progress and development trends. As of November 2022, mapping is complete for Germany, India, Brazil, and Egypt. The GRW aims to show a country's renewable energy capacity, bring new understanding to that capacity, and recognize patterns about the potential impact of the renewable energy in the landscape over time. The first full global inventory is expected to be completed in 2023 and will undergo both scientific and technical validation. The GRW is a joint program between Microsoft, Planet Labs PBC, and The Nature Conservancy.

Understanding the impact of weather patterns

Along with an AI for Humanitarian Action grant, Microsoft partnered with the Sustainable Environment and Ecological Development Society (SEEDS) to build an AI model that can forecast the impact of cyclones on the most vulnerable populations in India. The model utilizes high-resolution satellite imagery of areas likely to fall under a cyclone's path and applies advanced data analytics and machine learning to identify the most vulnerable houses. This enables SEEDS and its on-the-ground partners to pinpoint those at the highest risk of the cyclone and focus their outreach to those communities.



Global sustainability

Enabling a more sustainable world

Microsoft's actions alone will not solve the climate crisis. As a global technology leader, we are also committed to helping build the enabling societal conditions 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 enable a just energy transition.

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Commitments and progress

Global sustainability

We understand that our actions alone will not solve the climate crisis. As a global technology leader, we are also committed to helping build the enabling societal conditions that will support a net zero economy.

Our commitment

Using our voice on climate-related public policy issues

We will support new public policy initiatives to accelerate carbon reporting, reduction and removal, the transition to clean energy, water access and stress reduction, and the ability to measure, manage, and protect ecosystems.

Investing in climate innovation

We have created a \$1 billion Climate Innovation Fund to accelerate the global development of carbon reduction and removal technologies, as well as related climate solutions to reduce water and waste.

Driving collective action

We will partner with others to drive deeper engagement to help the world reach net zero, focused on rigorous and consistent carbon accounting and innovation, water access and stress reduction, and the circular economy.

Empowering our global workforce

We recognize that our employees are the most important asset and resource in advancing innovation in sustainability and are creating opportunities for them to contribute to our efforts.

Other progress

Catalyzed solutions through sustainability science and research

We launched AI4Science and the Microsoft Climate Research Initiative (MCRI) to advance the computational foundations, partnerships, and tools needed to achieve a carbon negative future globally.

Our progress

Advanced policy

To support our policy work, we published several briefs on carbon and electricity policy to share the priorities and principles that guide Microsoft's policy advocacy work around the world.

Invested >\$600M in climate innovation

Since its inception, Microsoft has allocated over \$600 million impact investment capital from our Climate Innovation Fund into a global portfolio of investments, featuring sustainable solutions in energy, industrial, and natural systems.

Drove collective action

In 2022, we supported broad global action towards net zero by joining several coalitions including the Carbon Call, the First Movers Coalition, the IMEC Sustainable Semiconductor Technology and Systems, and WASH4Work.

Focused on the sustainability skills gap

To better understand how to close the sustainability skills gap, Microsoft published the Closing the Sustainability Skills Gap report and LinkedIn published the Green Skills Report to provide insights into the demand and supply of talent with green skills.

Science and research

Catalyzing solutions through science and research

The goals of our sustainability science and research programs are to help us achieve our own sustainability commitments, help our partners and customers achieve theirs, and catalyze solutions to key global sustainability problems. In collaboration with global experts in science and policy, we identify critical sustainability problems and mobilize the worldwide scientific community to address them.

We develop advanced computational techniques and tools to accelerate breakthroughs on fundamental scientific bottlenecks that exist within complex, long-term technological and industry transformations required to address climate change. We use approaches from our global [AI4Science](#) team, launched in June 2022, to advance the state-of-the-art in scientific discovery by using simulations of natural phenomena to produce training data for large-scale AI models. These advances have greatly sped up the discovery of solutions to critical scientific problems, such as predicting where undersea hydrates will form—a critical factor in safe long-term carbon storage—1,000 times faster than before. These and other computational approaches feed into our programs on sustainability research with industry and academic partners, including Research for Industry and the Microsoft Climate Research Initiative.

Enabling industry breakthroughs

Microsoft ensures that all our work is grounded in science, and we extend this approach to our work with customers and partners. As sustainability has become a pressing concern across all industries, our Research for Industry (RFI) program uses our advanced data platforms and technologies for cloud and edge processing, Internet of Things (IoT) connectivity, robotics, and AI to contribute to new solutions in multiple industries, including agri-food, energy, retail, and financial services.

Enabling more sustainable decision making in agriculture

Data-driven and precision agriculture solutions enable more sustainable decision making for farmers. To inspire the research and data science community in this domain, we made [FarmVibes.AI](#) available as an open source toolkit. FarmVibes.AI brings the power of AI to heterogeneous data combined from multiple sources, including satellites and ground sensors. This approach enables lower-cost and higher-accuracy predictions of soil carbon dynamics by automatically generating inputs to common prediction models, such as [COMET](#) and [DNDC](#), instead of relying on sometimes faulty and costly-to-obtain historical records. The result is a “what if” analysis tool that can help to estimate how different farming practices will affect the amount of carbon sequestered in the soil, potentially creating new opportunities for farmers to participate in carbon markets.

Predicting microclimates

Regions of the world have multiple microclimates, and accurately predicting the behaviors of these microclimates leads to better sustainability outcomes. We are now able to fuse historical weather forecasts with local sensor data to more accurately predict weather parameters in a specific microclimate. We originally developed this technology to help farmers make better operational decisions, such as when to plant or spray, especially in the face of changing weather patterns. This technology is included in [FarmVibes.AI](#), but is broadly applicable to other industries that must adapt to climate change. For example, logistics and supply chains can be affected by hyperlocal weather events, causing ripple effects throughout many industries, such as retail, manufacturing, and transport. Renewable energy production forecasts are also highly dependent on local weather, affecting renewable energy operators as well as managers of electricity grids.

Modeling carbon flow

Carbon capture and storage (CCS) involves extracting carbon dioxide from sources like industrial emissions, then liquefying and storing it underground or undersea. CCS relies on equation-based models that predict the suitability of a storage site, such as its storage capacity and risk of leakage. Using traditional numerical simulation to maximize storage capacity and minimize leakage is time-consuming and costly. Reducing the cost of these simulations can help realize the full potential of CCS. Using Fourier Neural Operators with a 4D deep learning (AI) model, we built a carbon flow surrogate model that produces good approximations from 1,000 to 10,000 times faster than traditional simulators, enabling solutions to problems that would otherwise be prohibitively costly to solve, such as storage capacity maximization. We have validated our simulator with industry partners, including Northern Lights and Schlumberger, and made it available as open source software for use by other researchers.



Science and research (continued)

Advancing sustainability initiatives with partners

Partnerships with external experts are critical to catalyzing Microsoft's work to address key global sustainability problems. We partner with sustainability experts, scientists, and academics around the globe to advance our sustainability work.

Pursuing climate solutions through computational foundations

The Microsoft Climate Research Initiative (MCRI), launched in June 2022, aims to advance the computational foundations, partnerships, and tools needed to achieve a carbon negative future globally. Together with external sustainability experts, Microsoft scientists identified fundamental bottlenecks to mitigating and adapting to the climate crisis. To pursue solutions, researchers then narrowed their focus to bottlenecks for which computational approaches, such as those pursued by AI4Science, could be transformative. From this analysis, researchers selected three priority focus areas: reliable accounting of carbon emissions, materials engineering for carbon removal and reduction, and climate risk assessment. MCRI now supports projects in these three areas with collaboration between Microsoft researchers and external academics and is establishing a global community of research partners to complement Microsoft's internal computational expertise and infrastructure. A complete list of MCRI projects is available [on our website](#).

Improving carbon accounting

Microsoft convened a global team of experts to identify and overcome the biggest constraints to reliable carbon accounting. The results were published in *Nature*. One key issue identified is the difficulty of accurately assessing the effects of decarbonization policies and investments. In many parts of the world, monitoring the effect of carbon reduction policies is hampered by the lack of real-time, localized carbon emissions measurements. Last year, we reported on our university collaboration that used neural networks (AI models) to develop more accurate and significantly faster simulations of the complex, nonlinear relationship from historical carbon emissions to atmospheric carbon concentrations. With funding from MCRI, we have expanded these efforts to make the data and technology improvements needed to develop an AI model to predict localized carbon emissions from abundant data on atmospheric carbon concentrations. This AI-based inverse method reduces computation time from weeks to hours, while still maintaining accuracy.

The Microsoft Climate Research Initiative aims to advance the computational foundations, partnerships, and tools needed to achieve a carbon negative future globally.



We partner with experts, scientists, and academics around the globe to advance sustainability initiatives.

Science and research (continued)

Engineering materials for carbon removal and reduction

Direct capture of carbon from ambient air is a technology with great promise, but scaling it requires efficiency and cost improvements. We're using AI to identify materials that can lead to such improvements. Metal-organic frameworks are a class of materials that can balance the tradeoff between adsorbing significant amounts of carbon dioxide from the atmosphere and the energy required to release the adsorbed molecules for cost-effective storage or reuse. Researchers at Microsoft and the University of California, Berkeley are collaborating to use AI methods to find optimal metal-organic materials that balance this tradeoff and offer other properties required for economic and safe carbon removal.



Strengthening nature-based solutions for climate

Restoring and protecting nature is vital to reaching net zero, while building resilience to climate change is already underway. However, it can be difficult to properly measure and account for the climate benefit of investments in nature. We are collaborating with scientists and research institutions around the world to improve measurement and accounting methods for nature's contribution to climate solutions. For example, through collaborations with researchers at Concordia and Simon Fraser universities, we demonstrated that temporary carbon stored in nature can lead to permanent climate benefits by reducing peak warming, as long as it is pursued as a complement to emissions reductions. This work was published in [Nature's Communications Earth and Environment journal](#).

We are collaborating with scientists and research institutions around the world to improve measurement and accounting methods for climate solutions.

Assessing climate risk

Most climate risk assessments today do not adequately reflect the true exposure of society and businesses to climate-related risk, as explained by Microsoft and global experts in a [Nature Communications](#) paper. The development and applications of emerging science and technologies can help drive a step change in climate risk assessments. We have partnered with the UK Met Office to build the world's most powerful supercomputer for weather and climate, and with CSIRO to build a science-based climate intelligence platform for Australia. We are also partnering with climate researchers to use AI to improve the assessment and management of climate risks. We have advanced subseasonal forecasting by incorporating machine learning, which we are also using to better understand the cause-and-effect relationships between physical and societal risks. Researchers at Microsoft, the Universitat de Valencia, and the University of Reading are collaborating to demonstrate the usefulness of causal machine learning methods for climate risk assessment, in the context of food security in Africa. The project plans to blend expert domain knowledge from NGOs working in the Horn of Africa with advances in causal machine learning techniques and tools, such as the [CAUSEME](#) web platform and the [EconML](#) software package, to better understand the impact of humanitarian interventions on food security in this region.

Climate Innovation Fund

Investing in climate innovation

Microsoft is investing to accelerate climate innovation through our \$1 billion Climate Innovation Fund (CIF). In 2021, we also made a \$100 million grant to Breakthrough Energy's Catalyst platform. With the CIF, we invest in innovative technologies and business models that have the potential for meaningful, measurable climate impact by 2030.

Our investments are more than a financial transaction. We help to unlock the financial bottlenecks holding back climate entrepreneurs from achieving significant scale at a price point that can compete with more carbon intense alternatives. Our flexible investment approach allows us to fund climate innovators through a variety of investment vehicles, matching the type of capital that is most suitable to a given technology and stage of maturity. We also work across Microsoft to identify operational partnerships, such as procurement contracts, that drive commercial traction and growth.

Microsoft has allocated over \$600 million into a global portfolio of more than 50 investments, including sustainable solutions in energy, industrial, and natural systems. Our investments are selected based on four principles: the technology's potential for climate impact, the company's inclusion in an otherwise underfunded market, the investment's impact on climate equity, and the investment's alignment with Microsoft's own operational needs.

We think broadly about the impact of our CIF investments. We invest to help Microsoft achieve our own operational needs, accelerate the development of technologies that will help our customers and partners, and rapidly increase the scale of the global sustainability market. Microsoft has a unique perspective in the market for climate technologies. In addition to investments made through CIF, we are also a buyer in carbon, water, and waste solutions, and a donor of grant capital. We have enabled a portfolio of climate innovations that have a collective potential for climate impact that we believe is far greater than any individual approach can achieve by itself.

Investing in water and resilience

Every community deserves an opportunity to prosper in this new world, and many of the negative effects of climate change will be a result of water scarcity. That's why we've invested in [SOURCE Global, PBC](#) to help scale its hydropanel water system, which works entirely off the grid and provides clean drinking water in a variety of climates and conditions, including arid, remote locations.

For example, in Navajo Nation, 40 percent of homes have no running water. To date, Navajo Nation leaders have installed SOURCE Hydropanels on more than 540 homes, bringing these families clean, safe drinking water, often for the first time.⁷

Investing to scale carbon and renewable energy markets

Scaling carbon removal

We are investing in the development and growth of carbon markets. Our investment in [Heirloom](#) will support the deployment of durable, scalable carbon removal, which combines the advantages of carbon mineralization and direct air capture. We have also selected Heirloom as part of our portfolio of carbon removal purchases. With the combination of investment and purchasing, we're enabling Heirloom to scale its ability to sequester tens of millions of tons of carbon by the end of the decade.⁷

Verifying carbon-free energy consumption

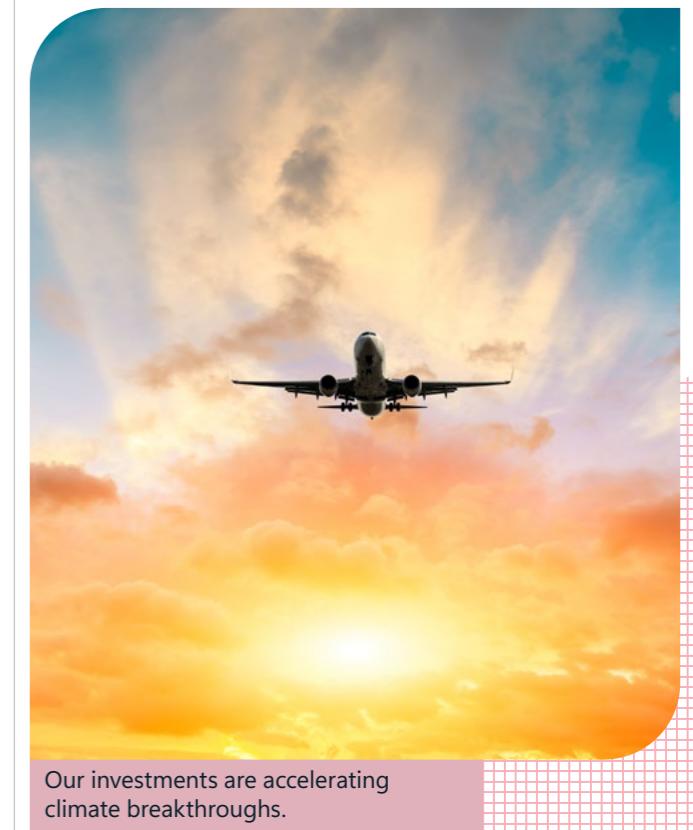
We have invested in [FlexiDAO](#) to reliably track and verify carbon-free energy consumption. Its tool traces electricity and its carbon footprint every hour of the day, providing the transparency customers need. FlexiDAO will also accelerate Microsoft's ability to reach our 100/100/0 clean energy commitment by enabling us to transparently verify granular carbon-free energy consumption for datacenters. FlexiDAO is currently tracking around 1.5 million tons of carbon dioxide equivalents per year across 14 customers in Europe, North America, and South America.⁷

Advancing carbon transformation

This year, we announced a partnership with Alaska Airlines and [Twelve](#) in which our travel procurement team will use Twelve's sustainable aviation fuel (SAF) to reduce carbon emissions from Microsoft business travel. The partnership follows our investment in Twelve last year to develop new carbon transformation pathways for SAF production.⁷

Supporting commercialization with blended capital

Our commitment to climate innovation extends through our \$100 million grant to the [Breakthrough Energy Catalyst platform](#). Catalyst both funds large demonstration projects and invests in first-of-their-kind projects that use key emerging climate technologies, such as clean hydrogen, direct air capture, long duration energy storage, sustainable aviation fuel, and manufacturing to decarbonize cement, steel, and plastics. The focus is on accelerating the scale-up of these technologies which will be required for an economywide net zero transition.⁷



Climate Innovation Fund (continued)

Our 2022 learnings

Blended capital partnerships unlock new markets

Microsoft's approach to investing in blended capital instruments, such as the Eversource Capital managed Green Growth Equity Fund in India, has enabled us to effectively deploy capital in emerging markets alongside both public and private sector capital providers.

Early adoption catalyzes a virtuous cycle

Combined capital and demand during the early commercialization stages of innovation trigger a positive feedback loop of scale and cost reduction. As both an investor and a buyer of sustainable products, Microsoft is advancing climate solutions along the commercialization curve to make them affordable and scalable for others.

Innovation spans geographies

The collective action of technology developers, capital providers, policymakers, and enterprise customers offers a path to international prosperity in decarbonization.

What's next

As we continue to invest in the innovative technologies and businesses to scale carbon reduction and removal globally, we are particularly interested in investment opportunities which expand our geographic focus and ensure underserved markets and communities benefit from climate solutions. Our investing themes will continue to evolve to address the rapidly changing challenges of climate change.



Expanding our geographic focus can ensure that climate solutions benefit underserved communities and markets.

Policy and advocacy

Using our voice to advocate for net zero

We believe that Microsoft and the broader private sector have an important role to play in advocating for effective and innovative sustainability policies. When we announced our commitment in 2020 to become carbon negative by 2030, we pledged to use our voice on public policy issues to help advance global decarbonization efforts.

We understand that public policies will play a critical role, both in creating signals to spur the economic and social transition required to address climate change and in building the foundations of markets to develop and deliver innovative goods, services, and skills to achieve that transition. However, there is a growing gap between the pace of desired policy outcomes and economic and scientific indicators that show accelerating climate impacts. To help close this gap and support communities and companies in their efforts to achieve their climate pledges, governments around the world need to accelerate policy action.

Key projects

Advocating for robust policy in carbon, electricity, water, waste, and ecosystems

Over the past year we have deepened our policy engagement on carbon, electricity, waste, and ecosystems.

In the United States, we advocated for climate and energy investments as part of the recent US infrastructure and climate laws, including the Infrastructure Investment and Jobs Act and the Inflation Reduction Act. In addition, we shared our support for a robust and consistent framework for climate disclosure requirements by the US Securities and Exchange Commission and provided comments to the requests for information climate disclosure for US federal procurement. Microsoft continued to encourage tree planting and reforestation efforts through our support of the Trillion Trees Act, as well as efforts to improve the health of old-growth forests by supporting the Save Our Sequoias Act. At the state level, we supported legislative and regulatory efforts to accelerate the clean energy transition by encouraging the integration of zero-emission generation and improving the resilience of the electric grid.

We continue to use our voice on public policy issues to help advance global decarbonization efforts.

In the European Union, we supported a comprehensive decarbonization plan with ambitious measures to scale uptake of renewable energy, and informed Europe's emergency measures to face the energy crisis. We actively engaged in the development of the regulatory framework for the certification of carbon removals, calling for strict standards for high-quality, accountable, and long-lasting carbon removals. As Europe leads the way on upgraded transparency and disclosure of environmental, social, and governance information across global value chains, we have endorsed the buildup of a level playing field for corporate sustainability reporting. We have also engaged and supported the drive to increase

the circularity of devices, boost transparency and efficiency in waste management policies, and empower consumers with better information.

Globally, Microsoft advocated for public policies to accelerate climate action; invest in mitigation, adaptation, and a just transition; and align international climate reporting and disclosure rules. At COP27, Microsoft called on countries to remain committed to the target of limiting global warming to 1.5°C.

In response to the UN Secretary-General's call to action to develop early warning systems for all within the next five years, Microsoft joined global leaders in support of this initiative while highlighting the fundamental role that technology can play in these efforts.



Policy and advocacy (continued)

Sharing principles that guide our policy work in carbon and electricity

To support our policy work, we published briefs on carbon and electricity policy to share the priorities and principles that guide Microsoft's policy advocacy work around the world. The principles we set forth are grounded in our focus on achieving tangible results, enabling a flexible rather than one-size-fits-all approach, and recognizing the important role that digital technologies will play as we expand market opportunities for all. We developed these two policy briefs together to underscore the integral and complementary role that electricity policy plays in addressing climate change. We also recognize that there are critical energy issues that go beyond climate change such as the availability of electricity for all, affordability, and environmental justice. Similarly, there are carbon issues that go beyond energy. As we tackle these issues in parallel, we are mindful that our policy work will need to expand in the future and consider these policy briefs as foundations for future work on issues like water and waste.

Making green jobs, skills, and entrepreneurship central to climate action

Using its Economic Graph insights, LinkedIn embarked on a major research initiative focused on the rise and proliferation of green skills throughout the labor market. The [2022 Global Green Skills Report](#) brings this research into focus through two key findings: 1) demand for green skills is on track to outpace supply, and 2) not only are green jobs growing, but also green skills are becoming increasingly common across existing jobs that are not traditionally thought of as green. At COP26, LinkedIn announced it would be one of the founding partners on the U.S. State Department's Connecting Climate Entrepreneurs initiative, through which the US government will catalyze resources to support job growth by climate entrepreneurs in the global south.

LinkedIn embarked on a major research initiative focused on the rise and proliferation of green skills throughout the labor market.



As a founding member of the Connecting Climate Entrepreneurs initiative, we are helping to grow green jobs.

Strategic partnerships

Driving deeper engagement on climate action

Getting to net zero is going to take more than investments, technology, and commitments. We'll need to use all those together in multiple sectoral and stakeholder organizations that drive full ecosystem change. Microsoft spearheads and participates in many of these efforts.

Microsoft is a founding member and participating organization of the Carbon Call, a multiple stakeholder initiative focused on advancing more reliable and interoperable global carbon accounting.

Carbon Call

Microsoft is a founding member and participating organization of the [Carbon Call](#), a multiple stakeholder initiative focused on advancing more reliable and interoperable global carbon accounting. The initiative accelerates work to improve measurement, reporting, and verification of GHG emissions and removal. It uncovers and addresses gaps in existing carbon accounting systems, focusing on carbon removal and land sector, methane, and indirect emissions.

First Movers Coalition

Microsoft is supporting development of new markets for high-quality durable carbon dioxide removal through participation in the [First Movers Coalition](#). The coalition is a global initiative harnessing the purchasing power of companies, along with innovative carbon removal technologies, to decarbonize seven "hard to abate" industrial sectors that currently account for 30 percent of global emissions: aluminum, aviation, chemicals, concrete, shipping, steel, and trucking.

Transform to Net Zero (TONZ)

Microsoft is a founding member of [TONZ](#), a cross-sector initiative to accelerate the transition to an inclusive net zero global economy. The group's 2025 goal is for the world's largest 1,000 companies to have targets backed up by transformation plans to achieve net zero no later than 2050. The initiative develops and delivers research, guidance, and implementable roadmaps to enable all businesses to achieve net zero emissions.

Green Software Foundation

Microsoft is a founding member of the [Green Software Foundation](#), which is focused on building a trusted ecosystem of people, standards, tooling, and best practices for building carbon aware software. The foundation is creating carbon aware software industry standards, driving awareness, growing advocacy, and accelerating innovation to enable developers to reduce the carbon emissions of the software platforms that they build.

IMEC Sustainable Semiconductor Technology and Systems (SSTS)

In 2022, Microsoft joined the [SSTS initiative](#) to tackle one of the largest contributors to Microsoft's Scope 3 carbon emissions—the silicon chips that power our Windows PCs, Xbox devices, and datacenter servers. SSTS is an industrywide initiative aimed at creating a detailed emissions profile of the semiconductor fabrication process, which will deliver insights about the electricity, materials, and water required to manufacture each chip that we purchase. This in-depth look at chip manufacturing will allow us to identify the biggest sources of emissions, not only at the fabrication facilities, but deeper in the supply chain, helping us target reductions where it matters most. We will also incorporate this data into our lifecycle assessment frameworks, ensuring that every hardware project at Microsoft can make the right tradeoffs to maximize sustainability.

Playing for the Planet

Xbox is a founding partner of [Playing for the Planet](#), a UN Environment Programme facilitated initiative focused on reducing the impact of the gaming ecosystem on the environment through better carbon accounting and educating gamers everywhere on sustainable causes.

Green activation in games

Microsoft believes that we have the responsibility to inspire generations about sustainability through green activation in our games. Some highlights include partnering with Ubisoft to deliver Project Rebirth, the Riders Republic in-game tree-planting campaign and climate march. Mojang Studios provides free educational Minecraft content for players and schools globally, created with partners including the Nobel Peace Center, UK Environment Agency, and C40 Cities. The team launched a series of Minecraft maps with BBC Earth based on the new documentary series Frozen Planet II to teach players about the impacts of climate change. Minecraft added mangroves and created the "Rooted Together" campaign with documentary videos about mangroves, a free map, and charity livestreams that with the company donation raised \$227,000 for The Nature Conservancy.

Strategic partnerships (continued)

CEO Water Mandate and Water Resilience Coalition

Acknowledging the importance of collective action and collaboration to solve shared water challenges, Microsoft has endorsed the [United Nations Global Compact CEO Water Mandate](#), an initiative in co-secretariat with the Pacific Institute, since 2018. In 2020, Microsoft and six other companies, together with the UN Global Compact CEO Water Mandate, spearheaded the establishment of the industry-driven Water Resilience Coalition (WRC). Microsoft serves as a coalition leader and has pledged its commitment to collective action, net positive water impact, resilient value chain, and global leadership.

WRI Aqueduct

World Resources Institute's Aqueduct is preparing new projections on water stress, demand, and supply, expected by early 2023, supported by inaugural Aqueduct Pro Sponsors Microsoft. These will be among the first water projections using the latest CMIP6 climate forcings from the [IPCC Climate Change 2022: Impacts, Adaptation and Vulnerability report](#). Microsoft Azure was used in every step of the project from hydrologic modeling to data processing to indicator visualization. The future projections will equip Aqueduct users with the best available information on climate-related water risks that they can then factor into internal water strategies, sustainable water management plans, ESG ratings, and contextual water targets.

WASH4Work

Recognizing the importance of quantifying the volumetric water benefits of WASH investments, Microsoft is a member of [WASH4Work](#) and an active participant in developing an accounting method to measure WASH activities. This work is organized through WASH4Work, a UN initiative facilitated by the Pacific Institute in collaboration with LimnoTech and Water.org. The new volumetric water benefit accounting (VWBA) for WASH will more effectively account for a variety of different types of water access and sanitation projects (ranging from well restoration to toilet installation).

Ellen MacArthur Foundation

Microsoft is a Network Partner of the [Ellen MacArthur Foundation](#), which is focused on developing and promoting the idea of a circular economy. We are elevating opportunities for Microsoft employees to learn and engage on topics of the circular economy through community platforms, workshops, events, courses, and collaborative projects.

Capital Equipment Coalition North America

Microsoft is a founding member of the [Capital Equipment Coalition North America](#). We continue to work with the coalition to support the capital equipment industry's acceleration to a closed loop model that preserves and recovers the value of materials across a product's lifecycle, leading to reduced waste and carbon emissions. As a group, we're working towards circularity standards and methodology that measures the environmental impacts of "X as a Service" models compared to traditional ownership models.

Circular Electronics Partnership (CEP)

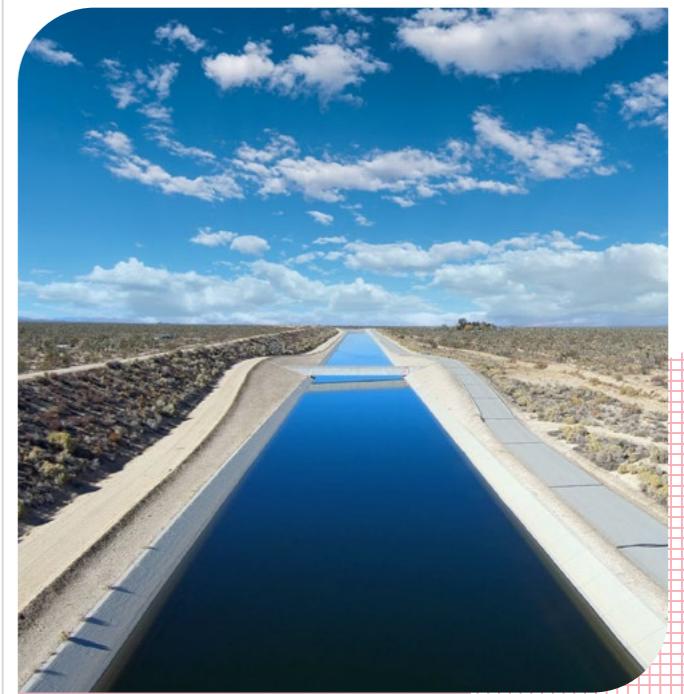
CEP unites leaders in technology, consumer goods and waste management, to identify how to improve circularity. CEP aims to reimagine the value of electrical products and materials using a lifecycle approach, reducing waste from the design stage through to product use and recycling. As a member, Microsoft contributed to the development of CEP's Roadmap, which provides clear action pathways in the form of key interventions. Acting as a guide, the Roadmap identifies vital players such as industry leaders, partner organizations, research institutes, and NGOs, and suggests how to overcome challenges and enable scalable circularity.

Group on Earth Observations Biodiversity Observation Network (GEO BON)

Fostering global connections and collaboration will be critical to address biodiversity change and the action required to protect and restore ecosystems. In the past year, Microsoft broadened our work with GEO BON to connect with a worldwide network of scientists to enable a scalable approach to expand the global network of biodiversity observation networks and the use of essential biodiversity variables to support access to robust biodiversity information and insights.

CSIRO

Last year the Healthy Country AI Digital Training program was launched in collaboration with North Australian Indigenous Land and Sea Management Alliance (NAILSMA), CSIRO, the Australian government's National Environmental Science Program (NESP) Resilient Landscapes Hub, Women in STEM and Entrepreneurship program, Charles Darwin University, the Telstra Foundation, and Microsoft. With a focus on Indigenous digital inclusion, the Indigenous-led and co-designed program aims to provide on-ground digital skills that will deliver environmental, cultural, and economic benefits for local Indigenous communities and Indigenous land and sea management practitioners in remote regions of northern Australia.



Strategic partnerships are critical to accelerating climate action.

Employee engagement and green skilling

Scaling impact through employees and green skilling

The world is at a tipping point of a global transition to focus on environmental sustainability. Microsoft recognizes that our employees play a critical role in advancing our climate innovation. To support our own work in sustainability and the needs of businesses around the globe, we see the need to dramatically change the landscape of green jobs and skilling across industries.

Employee engagement

Microsoft employees around the world, not just those with jobs focused on environmental sustainability, are core to our sustainability mission and we are committed to helping our global workforce integrate sustainability into their roles. We do this by providing learning opportunities and creating channels for them to actively contribute to our sustainability work.

Fostering our employee community

Since 2018, Microsoft employees have self-organized into a volunteer-led sustainability community, the [Sustainability Connected Community \(SCC\)](#), and found creative ways to take advantage of their diverse experience, skills, and passion to help the company achieve its sustainability commitments. The SCC's mission is to make sustainability part of everybody's job. The SCC now totals more than 9,000 employees with 37 local chapters and counting.

This year, our SCC chapters across the globe hosted dozens of volunteer events to drive upskilling and community involvement. Employees partnered with local stakeholders to improve waste management in offices, ran Hackathons to protect and preserve Indigenous languages, and donated time and money to local nonprofits, all while working to ensure environmental justice was factored into the work we do every day. Our LinkedIn community kicked off the fiscal year with a refresh of the Go Green program and onboarded 30 new leads across the globe.

Microsoft employees around the world are core to our sustainability mission.

Enabling learning for our employees

In 2021, we launched a Microsoft all-employee training effort, the Sustainability in Action badge. As of July 2022, more than 13,500 employees around the world completed this foundational training. This year, we launched role-specific sustainability training that provides more targeted content. For Earth Day 2022, hundreds of SCC members contributed to a crowd-sourced "Employee's Guide to Sustainability," with recommendations employees can use to make sustainability part of their jobs.

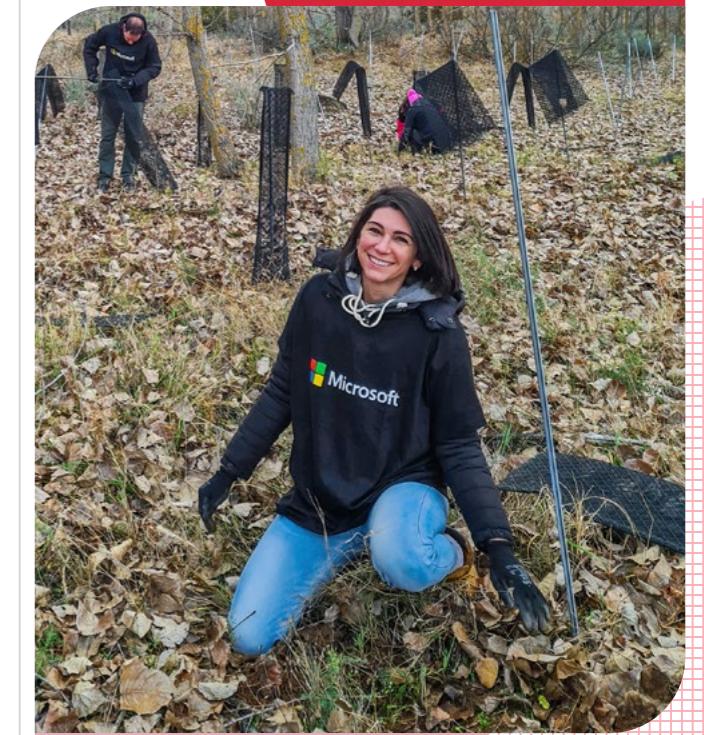
Empowering employees to innovate

We tap into the ingenuity of our employees by sponsoring a Hack for Sustainability during our annual Microsoft Global Hackathon. In 2021, 787 hackers worked on 143 different sustainability projects. The winning team worked with the nonprofit organization, TerraPraxis, which has since evolved into a strategic partnership with Microsoft. TerraPraxis launched the [Repowering Coal EVALUATE](#) solution at COP27.

In 2022, we saw a 50 percent increase in participation with 1,185 participants, who worked on 206 projects. These projects include providing tools for web developers to use more environmentally conscious engineering practices and creating a tool to generate heat maps for any location, which is critical for protecting vulnerable populations in extreme heat events. The winning project improves the recyclability of hard disk drives by automating the disassembly process and sorting each component for recycle or reuse.

9,000

The Sustainability Connected Community now totals more than 9,000 Microsoft employees worldwide who volunteer their time for sustainability initiatives.



The Microsoft SCC has 37 local chapters and counting.

Employee engagement and green skilling (continued)

Green jobs and skilling

The gravity of climate change has led more than 3,900 companies, including Microsoft, to announce climate pledges. As we work internally and with other companies, it's clear that the impact on business will be significant and will require a workforce equipped to work on a broad range of sustainability projects. The International Labour Organization (ILO) estimates 18 million net-new jobs will be created by 2030 as a result of meeting the goals of the Paris Agreement.

To better understand how to close the sustainability skills gap, Microsoft and Boston Consulting Group studied the work of 15 companies at the forefront of sustainability innovation and change—including across Microsoft itself. Our teams interviewed and surveyed nearly 250 employees whose jobs have sustainability commitments incorporated into their role. We identified new jobs that have emerged, studied the impact on jobs that already exist, and identified in-demand knowledge and skills.

To meet these sustainability commitments, a vital effort is needed to equip companies and employees with a broad range of new skills needed for sustainability transformation. We published the [Closing the Sustainability Skills Gap](#) report to share what we have learned.

Our LinkedIn team is already providing critical actionable insights into the demand and supply of talent with green skills via the LinkedIn Economic Graph. LinkedIn Learning also offers a growing catalog of sustainability skills. This year, LinkedIn's Economic Graph team published the [Global Green Skills Report](#), including interactive data and a related LinkedIn Learning course, "[Closing the Green Skill Gap to Power a Greener Economy](#)", featuring key insights from the report for policymakers and corporate leaders. To act on the learnings from the reports, we are engaged in the following programs.

Delivering sustainability training

LinkedIn Learning delivered 11 new courses for members to build in-demand sustainability skills over the past year: Closing the Green Skills Gap to Power a Greener Economy and Drive Sustainability; 34 Things to Know About Carbon and Climate; Green Jobs for Sustainable Careers; Sustainability as an Innovation Opportunity; Daily Habits to Live Sustainably; Introduction to ESG: Environmental, Social, and Governance; Including Sustainability in Your Cloud Strategy; Corporate Finance: Environmental, Social, and Governance; AWS Well-Architected Framework: Sustainability Pillar; Sustainable and ESG Supply Chains; How Tech Drives Sustainability.

Linking green jobseekers to employers

The LinkedIn platform links green jobseekers to employers looking for green talent. For Earth Month 2022, LinkedIn featured [equitable access to green jobs](#) and a new [green jobs collection](#) to make it easy for green jobseekers and employers looking for green talent to connect on the LinkedIn platform.



Appendix

Appendix A – How we report

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Appendix B – Endnotes

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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 presented 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, 2022 (FY22). 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.

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 to CDP Climate Change since 2004, and for the last 10 years have made it into the A-list leadership group by earning the highest score band of A for our responses. Additionally, we have reported to CDP Water Security since 2011, and since 2016 have earned A and A- scores for our responses. On climate-related issues, we are committed to fully aligning with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) and in FY22 we published our first TCFD report.

Working together with stakeholders

We know that the decisions we make affect our employees, customers, partners, shareholders, suppliers, and communities, and we take their voices into account. 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 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 materiality

Our ESG reporting describes the topics we consider to be the most important to stakeholders when evaluating environmental, social, and governance issues at Microsoft. Therefore, ESG materiality in our reporting does not directly correspond to the concept of materiality used in securities law. A listing of what we currently identify and categorize as our top ESG issues can be found on our website. In 2020, Microsoft conducted a materiality assessment focused on environmental sustainability, which can be accessed in the [2020 Microsoft Sustainability Report](#).

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 commitments. During at least one meeting each year and on an as-needed basis, our President and Vice Chair and our Chief Environmental 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," "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 cause actual results to differ materially. 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.

Appendix B

Endnotes

1. The market-based method includes consideration of contractual arrangements under which Microsoft procures power from specific suppliers or sources, such as renewable energy.
2. Reported emissions for FY20 and FY21 have been recalculated for improved accuracy in accordance with our internal recalculation policy. We were able to disaggregate and identify previously unreported electricity for some of our leased datacenters due to improvements in our ability to capture such data.
3. The market-based method includes consideration of contractual arrangements under which Microsoft procures power from specific suppliers or sources, such as renewable energy. Management's criteria represents criteria selected or developed by Microsoft which provide an objective basis for measuring and reporting metrics as specified in section 1.10 of our Environmental Data Fact Sheet.
4. ENERGY STAR® estimated annual energy consumption.
5. To align with definitions in emerging circular economy regulations and more accurately describe the steps we are taking operationally to meet our commitment, in 2022, we adjusted our terminology to "reuse and recycling". The operational scope, strategy, and metric has not changed.
6. Microsoft Dataverse is required to use the publicly available Microsoft Cloud for Sustainability data model.
7. This information has been self-reported by the organization and has not been verified by Microsoft.
8. The underlying methodologies and emissions findings generated from the Emissions Impact Dashboard (EID) for Microsoft 365 differ from those reflected elsewhere in this corporate disclosure. The figures reported here could change in the future due to better data reporting calculation methodologies or because of enhancements to the Emissions Impact Dashboard. The calculations are limited to Microsoft's datacenter emissions associated with commercial customer usage of Microsoft 365 applications; they do not include usage associated with national cloud deployments such as Microsoft US Government clouds and Office 365 operated by 21Vianet.
9. This carbon intensity estimate was calculated by dividing the monthly datacenter emissions associated with usage of SharePoint and OneDrive (including compute, bandwidth, and storage) for each month in Microsoft's 2022 fiscal year by the volume of data stored in these tools as of the end of each month.
10. Our internal term for this is a "Teams meeting device hour," which represents a specific device joining a Teams call for an hour. This means that if a given individual dials into a one-hour Teams meeting via their phone for audio and simultaneously via their laptop for screensharing, their participation adds up to two Teams meeting device hours.
11. Recycled ocean plastic is made from plastic waste that is recovered from oceans and waterways, cleaned, and processed into recycled plastic resin pellets.



Stay up to date on our progress

Learn more about our [sustainability journey](#) and [sign up](#) for news and updates.

