Microsoft

# 2021 Environmental Sustainability Report

From pledges to progress

# Contents



For the best experience, we recommend using the free software Adobe Reader, or iBooks if viewing on an Apple mobile device. Interactive functionality may be limited when viewed in a web browser.

This report is part of the Microsoft CSR and sustainability reporting suite.

Visit the Microsoft reports hub

**2.5M**
metric tons of carbon removal contracted in FY21 and FY22

**1.3M**
cubic meters of water replenishment projects funded in FY21

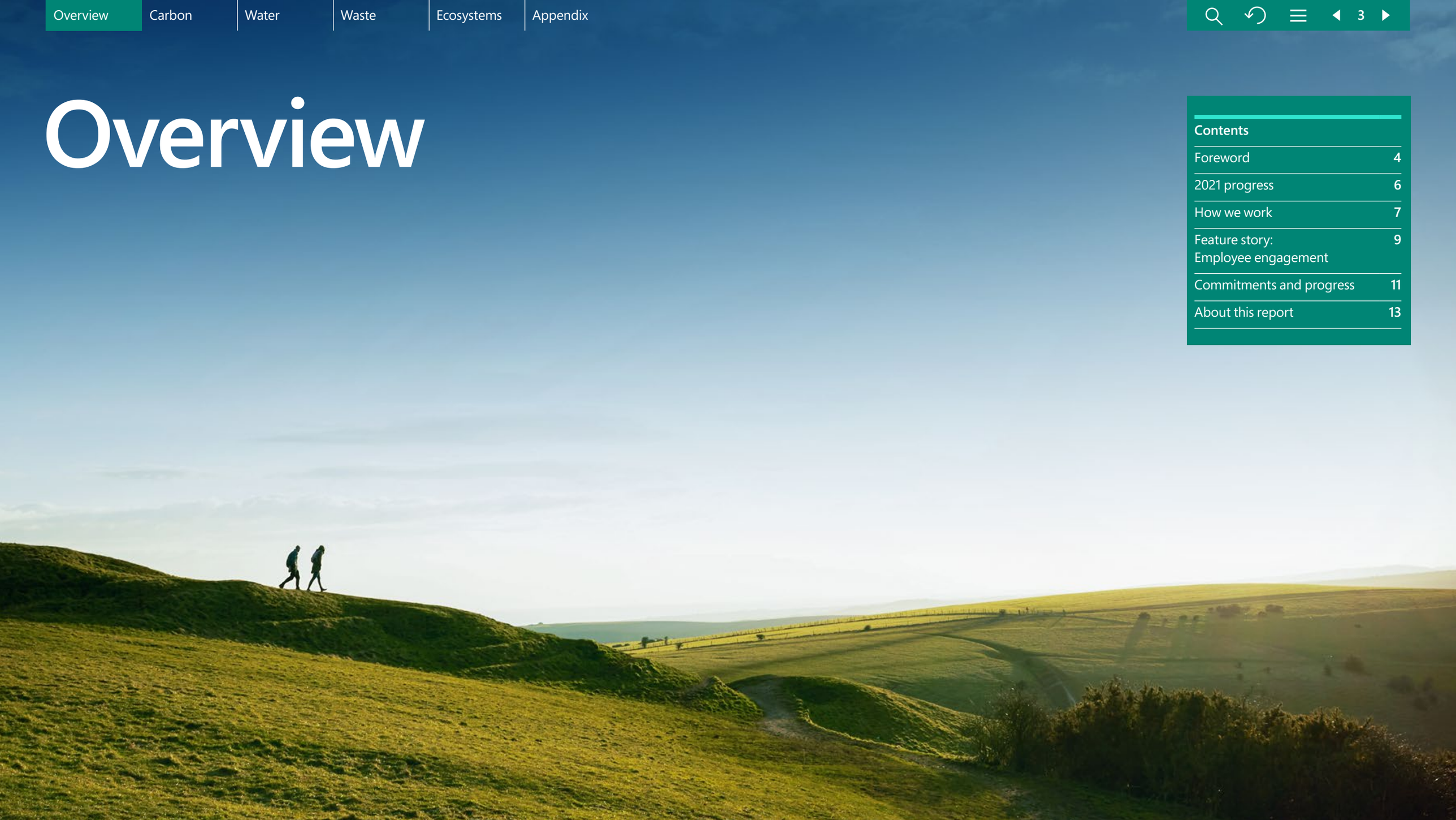
**15.2K**
metric tons of waste diverted from landfills

**24**
petabytes of environmental data now available

# Overview

Contents





# Foreword

## Microsoft's sustainability commitments: two years into our ten-year journey

**By Brad Smith, President and Vice Chair and Dr. Lucas Joppa, Chief Environmental Officer**

As we look towards 2030, the world will need all the ingenuity it can muster. Because as significant as COVID-19 is, it's not the only challenge our world faces. Climate change presents environmental, social, and economic crises on a whole new level. For nearly two millennia humans have been carbonizing our planet and we need to act together to decarbonize.

Our first annual sustainability report, released in January 2021, showed early progress on our commitments to become a carbon negative, water positive, zero waste company by 2030 and protect ecosystems by building a Planetary Computer.

2021 was a year of both successes and challenges. While we continued to make progress on several of our goals, with an overall reduction in Scope 1 and Scope 2 emissions, our Scope 3 emissions increased year over year, due in substantial part to significant global datacenter expansions and the growth in Xbox sales and usage as a result of the pandemic.

## A closer look at 2021

During our most recent fiscal year, we grew business revenue by 20 percent while continuing to reduce our operational emissions, as represented by Scope 1 and 2 combined, with a decrease of approximately 17 percent through our purchasing of renewable energy.

However, as our business has grown and we've seen increased use of our devices and cloud services, our total Scope 3 emissions (comprising the company's entire value chain) have increased by about 23 percent year-over-year. These emissions include, among other things, the carbon emitted from electricity generation to power devices at home or at work and for producing the concrete and steel we use in construction.

We work to limit these emissions when we design and manufacture our products, and work with our suppliers to report and reduce their emissions—but still saw an increase. This serves as an important reminder that Scope 3 emissions are the most difficult to control and reduce. This year has highlighted the challenges of reducing Scope 3 emissions and we're committed to sharing our learnings to help other organizations who are wrestling with these same challenges.

One Scope 3 category that saw an annual increase was capital equipment. This category includes the emissions to produce equipment we bought this year (and will use for a long time) as well as the carbon emissions associated with the construction of new buildings including both datacenters and office space. For example, as the Microsoft Cloud business expands, construction of new datacenters and new server equipment is needed to support growing customer demand. The emissions associated with the capital equipment category accounted for about 30 percent of our Scope 3 total this year.

Another Scope 3 category that saw an increase was the use of our products, specifically the estimated emissions associated with powering products we sold including Xbox and Surface devices. This category accounted for about 29 percent of our Scope 3 total this year.

Around the world, the electricity used to power devices today largely comes from grids reliant on carbon-intensive sources such as coal or gas, so Microsoft must account for that carbon for the lifetime of our devices to accurately track our Scope 3 emissions. And, because every part of the world has a different mix of electricity generation sources, we calculate a device's climate impact based on where the device was sold.

## The journey to net zero

Despite these Scope 3 increases, we remain dedicated to building a world better than the one we found, and to helping our customers and partners achieve the same. The impact of this work will not all be felt immediately, and our experience this year highlights a few takeaways relevant to many organizations executing against their sustainability commitments.

1. **Progress won't always be linear.** The rate at which we can implement emissions reductions is dependent on many factors that can fluctuate over time, ranging from our own business growth and supplier mix to the rate of growth of green infrastructure, such as the supply of and transition speed to renewable energy. Additionally, different sources of emissions will be addressed on different time frames as climate technologies and renewable alternatives advance. And as measurement methodologies improve and new standards emerge, companies like ours may see emissions rise or fall year-over-year.

   Nonetheless, the challenge remains: we must continuously improve on our efforts to decouple our emissions from our growth until we reach our carbon negative commitment in 2030. Some of this will happen through the completion of specific goals such as our shift to a 100 percent electric campus vehicle fleet, our move away from diesel fuel as a backup energy source for our datacenters, and the carbon benefits of our waste reduction improvements due to our expanding fleet of Circular Centers. Other progress will happen through the expansion of our renewable energy purchasing program to cover the energy consumption of our consumer devices, through advances by our suppliers in reducing their own emissions, and through increased purchasing of new materials as they enter the markets, including green steel, low carbon concrete, and other infrastructure components of a future net zero carbon economy.

# Foreword (continued)

2. **Progress relies on us all counting carbon consistently.** There are several external factors or bugs in the world's net zero carbon program that if addressed will help us all make greater progress toward our net zero goals. The world lacks a common meaning of the term *net zero* and a common unit of measurement for assessing the climate impact of various net zero approaches, and we must all focus on maturing the markets needed to achieve a net zero carbon economy by 2050. We explored these topics in greater detail through the lens of our work on carbon removal.

We will continue to innovate and invest to meet our ambitious commitments and we'll do so in a principled way. We will also continue to be transparent about our progress, our challenges, and our learnings to help others on their journey. As we look to the future we are committed to:

- Counting everything, including challenging Scope 3 emissions. We are putting programs in place to help lower them, from working with our suppliers to help them decarbonize to continuing to innovate with our company-wide internal carbon tax to incentivize emissions reduction and continuing to invest in carbon removal.
- Only investing in carbon removal offsets instead of traditional avoided emissions offsets because removal is an underdeveloped and critical tool to solve the world's climate challenge. You can only get to net zero when you've reduced all that you can and your remaining carbon emissions are completely balanced by long-term carbon removal. Last year, we made the world's largest purchase of carbon removal at 1.4 million metric tons and in this fiscal year we are on track to top that by procuring 1.5 million metric tons.

## From pledges to progress

While 2021 presented us with some new learnings, we've also made some great progress that we share in more detail in this report. A few examples that illuminate the diversity of our work include the following.

- Four datacenters are Zero Waste certified, with new certifications for the San Antonio, Texas and Quincy, Washington datacenters and renewed certifications for our Boydton, Virginia and Dublin, Ireland locations.
- We announced the Microsoft Cloud for Sustainability to provide comprehensive, integrated, and automated sustainability management for organizations at any stage of the sustainability journey.
- Through an investment from our Climate Innovation Fund, we're helping LanzaJet complete their sustainable fuels plant in Georgia—a move that will help decarbonize our datacenters as well as the airline industry.
- While overall device emissions grew because of higher sales and usage, we reduced the carbon footprint for several of our products. Surface Pro 8 is one of the most energy efficient Surface Pros ever and we introduced Energy Saver, a new low-power standby mode for Xbox consoles.
- We granted $100 million to Breakthrough Energy Catalyst to accelerate the development of climate solutions the world needs to reach net-zero across four key areas: direct air capture, green hydrogen, long duration energy storage, and sustainable aviation fuel.


We are committed to becoming a carbon negative, water positive, zero waste company by 2030.

With net zero becoming the new normal—more than 1,500 companies with total net revenue of $11.4 trillion have pledged that they will become carbon neutral or net zero—the world must move from climate pledges to climate progress.

As a leading technology provider of sustainable solutions, Microsoft stands ready to support our customers, partners, and the world in the move towards a net zero, environmentally sustainable future. And while the shape of what the future holds is unknown, we will continue to build the foundations needed today and do the work that needs to be done to deliver on our commitments.

It's what the world needs us all to do.

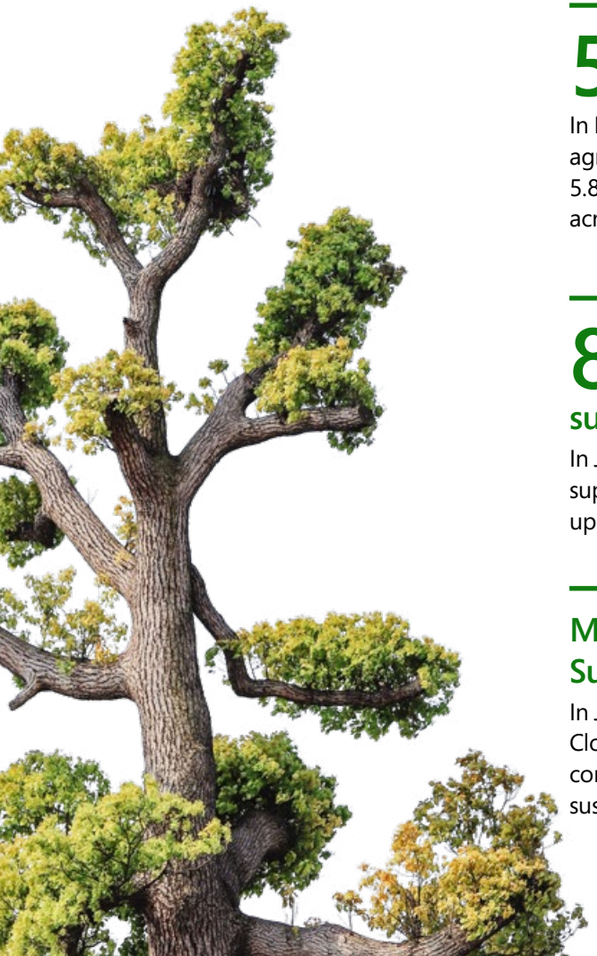
**Brad Smith**
President and Vice Chair

**Dr. Lucas Joppa**
Chief Environmental Officer

# 2021 progress

## $571M

Allocated $471 million to date via our Climate Innovation Fund to accelerate our carbon goals, as well as water and waste. We also donated $100 million to Breakthrough Energy's Catalyst initiative.



## Carbon

### 2.5M tons

In FY21 and FY22, Microsoft successfully contracted to remove 2.5 million $mtCO_2$, meeting our cumulative two-year goal.

### 5.8 GW

In FY21, we signed new power purchase agreements (PPAs) for approximately 5.8 gigawatts (GW) of renewable energy across 10 countries around the globe.

### 87%

**supplier reporting**

In July 2021, 87 percent of our in-scope suppliers reported their emissions to CDP, up 12 percent from 2020.

### Microsoft Cloud for Sustainability

In July 2021, we launched the Microsoft Cloud for Sustainability to provide comprehensive, integrated, and automated sustainability management.

## Water

### 1.3M $m^3$

In FY21, Microsoft invested in replenishment projects that are expected to generate over 1.3 million cubic meters of volumetric benefits.

### 670M

Our programs with Water.org account for over 670 million liters[9] of water benefit per year.

### >95K people

Through our partnership with Water.org, we provided more than 95,000[10] people with access to safe water or sanitation.

### U.S. Water Prize

In 2021, Microsoft was awarded the U.S. Water Prize for Outstanding Private Sector Organization for adopting our water positive program and committing to being water positive by 2030.

## Waste

### Circular Centers

We have planned five Circular Centers, with Amsterdam open, construction underway in Boydton, Virginia, and three more to be added in 2022.

### >15,200 tons

In FY21, we diverted more than 15,200 metric tons of solid waste otherwise headed to landfills and incinerators.

### Zero Waste

Four datacenters are Zero Waste certified, with new certifications for the San Antonio, Texas and Quincy.

### 18% reduction

We reduced single-use plastics in our Microsoft product packaging by 18 percent.

## Ecosystems

### >17,000 acres

In FY21, we contracted to protect more than 17,000 acres of land.

### >500 users

The Planetary Computer private preview released as planned in April 2021, with more than 500 users signed up and using the APIs and scalable compute.

### 24 petabytes

We have made available 24 petabytes of data with more than 30 key environmental and Earth observation datasets to Azure in consistent, analysis-ready format that is freely available for use by anyone.

### 850+ grants

Since its inception in 2017, our AI for Earth program has provided more than 850 grants to organizations working in 110 countries around the world, granting more than $20 million in Azure credits.

# How we work


## Microsoft's commitments to become carbon negative, water positive, and zero waste by 2030 while building a Planetary Computer are well known.

To guide the progress across the company on those goals, we have changed the way our sustainability strategy and accountabilities are set and how progress is evaluated. In the interest of transparency and also to help other organizations get started, we are sharing how we work first, prior to our commitments and progress on them—sustainable digital transformations require both strategic frameworks and cultural buy-in to be successful.

## Set ambitions based on the science

The best available science and policy indicate that every organization needs to do even more in far less time than previously thought. As we saw the science in 2019, it was clear that our carbon neutral goal was not what the world needed—the world needs to reach net zero by or before 2050. That meant we needed to set goals aligned to the science and language of the science, and we needed to be more ambitious. In 2020, we made a series of environmental sustainability commitments, including being carbon negative, water positive, and zero waste by 2030.

## Scale strategy to achieve ambitions by using the "whole of the business"

At Microsoft, we think about the positions of influence that we can use. We start by taking accountability for our operations as a company, but we expand this significantly as we think about the different roles that we play as a customer, supplier, investor, employer, policy advocate, and partner in innovation to customers, organizations, and institutions around the world. The challenge is to find where our organization can have the most impact across our positions of influence.

Microsoft looked at our commitments based on our operational footprint across carbon, water, waste, and ecosystems, the technology that we provide to our customers and partners to power their sustainability initiatives, and larger influence that we can have on the world with research, investments, strategic partnerships, and policy and advocacy.

## Set the tone from the top

Sustainability is no longer just a corporate social responsibility (CSR) function or a way to mitigate risk—it must be mainstreamed into every part of the business. That starts with making sustainability part of the brand commitment and embraced by all leaders.
At the heart of our culture is the understanding that for Microsoft to do well, we need the world to do well and that we are a company that pursues profit by solving the problems of people and the planet. This belief is deeply held by the leadership of Microsoft—the CEO, CFO, and President—the entire company sees the commitment and it sets the tone across the company that sustainability is at the core of our business.

## Make it central to the business while making it relevant at business group levels

Corporate commitments give your company a north star, but you need to embed the strategy and build operational commitments across your business.
At Microsoft, we knew we needed a way to implement and execute on our strategy across the entire company, in every business group. For each focus area (carbon, water, waste, and ecosystems), we set commitments in each business group and developed roadmaps to reach these commitments. We are also committed to enabling our suppliers with capacity-building tools and resources, as well as sustainable supply chain financing.

# How we work (continued)

## Hold everyone accountable for progress and a governance structure to track progress in real time

Governance and accountability are critical to ensuring alignment and prioritization across your business. At Microsoft, we hold our business groups accountable for their carbon emissions via an internal carbon fee of $15 per metric ton. In January 2021, we expanded the carbon fee so that it includes Scope 3 emissions from our supply and value chain, in addition to Scope 1 and Scope 2. We set measurements and scorecards for each business group's sustainability commitments across the company and review progress twice a year. We have established a Climate Council that includes senior business leaders from every business group to provide sustainability advice, collaborate, drive alignment, prioritize resources and funding, and review progress on our commitments. We also tie a portion of our executive incentive plan to our carbon reduction goals.

## Take steps to accelerate markets, ecosystems, and global progress

If the world is going to meet net zero goals by 2050, companies need to use their entire ecosystem and all of their positions of influence. In addition to taking accountability for our operational footprint across carbon, water, waste, and ecosystems, Microsoft is deploying capital, supporting innovation, and advocating for larger policy change. We led the largest corporate carbon removal RFP last year, spending our dollars to drive the carbon removal market forward and to address our own needs.

Our $1 billion Climate Innovation Fund is investing in organizations across our areas of commitment to build a larger, more robust ecosystem of effective companies and solutions. Our sponsorship at COP26 and numerous engagements with governments at the city, regional, state, and national levels are aimed at creating policy environments that further accelerate the impact of this work and the transition to net zero.

## Report on everything, not just progress

Transparency is both embedded in each step and a specific commitment. In this report, as well as other white papers, methodology papers, and speaking engagements, Microsoft is committed to sharing our learnings with the world. When things go well, we will share that as well as the playbooks to follow to achieve similar results outside our organization. And if things go less well, we will share that too so we can all learn and grow together. We are also delivering innovative technology and services to help our customers and partners power environmental sustainability. And we go beyond that with our biggest bets in policy, investment, catalytic partnerships, and research and development.

Sustainable digital transformations require both strategic frameworks and cultural buy-in to be successful.

# Employee engagement

Feature story

## 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.**

Empowering our global workforce is the center of our sustainability strategy.

At Microsoft, empowering our global workforce is the center of our sustainability strategy. Both Microsoft and LinkedIn have employee communities who drive bottom-up sustainability initiatives to educate, inspire, and activate every employee to advance the company's sustainability goals. The Microsoft Sustainability Connected Community is an employee-led group of 5,000 members and 32 regional chapters whose mission is to make sustainability part of everybody's job. The LinkedIn Go Green sustainability engagement program includes one out of every eight employees and its 26 chapters are focused on empowering employees to take green action at home, in the office, and in their communities. Both groups engage employees on our sustainability commitments while using Microsoft and LinkedIn technology to innovate real-world solutions to the climate crisis through the following activities.

### Ecochallenges

Microsoft and LinkedIn employees participated in virtual Ecochallenges for three weeks around Earth Day 2021 to gamify personal sustainability. Seven thousand people prepared 31,000 meatless or vegan meals, saved 197,000 pounds of $CO_2$, diverted 227,000 plastic containers and bottles from landfill, saved 392,000 gallons of water, and spent 239,000 minutes learning about sustainability.

Run an ecochallenge to give your employees the opportunity to learn and practice habits that support them on their personal sustainability journey.

Find out more at Ecochallenge.org

### Hack for sustainability

Microsoft employees self-organize into working groups all year long and "hack for sustainability" by partnering with each other to create innovative solutions to real-world environmental challenges. In 2020, Microsoft had 125 projects with 879 participants, and 93 percent of participants indicated their interest in continuing the work beyond the Hackathon. One award-winning project from the Microsoft Global Hackathon, Soil as a Service, created a way to lower the cost of measuring organic carbon in soil using a sensor hooked up to Microsoft Azure IoT. This innovative solution lowers the cost of measurement significantly, incentivizing farmers to change their land management practices and helping nascent carbon marketplaces to quantify their impact. The project has been picked up by a business group for further research and exploration.

### Ongoing sustainability ideating and hacking

The Microsoft Garage provides a platform for hackathons and ideathons all year long, including our month-long Sustainability Ideathon for Earth Day 2021 and the year-round Sustainability program using our HackBox platform for employees to collect ideas, share concepts, create projects, form teams, and inspire colleagues globally to participate in Microsoft's sustainability journey.

### Employee-led sustainability projects

Employees from every facet of Microsoft and LinkedIn are empowered to lead collaborative cross-company sustainability projects at any time. This year, our platform has facilitated 200 projects from more than 1,000 employee "hackers," with projects ranging from digital foresting, to smart bird feeders, to building software that will help retrofit the world's coal power plant fleet with modular nuclear reactors.

# Employee engagement (continued)

## Sustainable disposition of IT assets

The Sustainability Community not only helps Microsoft lower its own operational carbon and waste footprint, but also creates a way to share these best practices with external organizations so they can do the same. A Microsoft employee noticed a gap in our internal processes: as customers migrate from on-premises IT assets to the cloud (Azure), the on-premises hardware, like servers and racks, becomes e-waste, which can create serious environmental hazards if it's not properly disposed of. The issue was raised to the Azure leadership through the community, and a new resource was developed to guide customers on how to ensure the sustainable, secure, and compliant disposition of IT assets. This guide is being used by our Azure Migrate & Modernize Program (AMMP) customers, through which 20,000 virtual machines and 2,000 databases have been migrated.

Learn more about the IT Asset Disposition Guide

## Sustainability training

In October 2021, we launched the Sustainability in Action badge. This is the first all-employee learning course focused on sustainability, with four hours of content on carbon, water, waste, and ecosystems. Within the first two months, more than 3,000 employees completed the course, and can serve as sustainability champions in their daily work as well as personal lives.

## Employee-led education

In April 2021, to celebrate the 51st anniversary of Earth Day, the Microsoft Sustainability Community organized three days of learning sessions to educate, inspire, and activate employees on the importance of sustainability. Volunteers coordinated more than 40 sessions and generated 30 hours of evergreen learning content covering topics from green software engineering to how to live a zero waste lifestyle at home. More than 3,600 people from 56 countries participated. LinkedIn celebrated Earth Day with over 61 global experiences and participation from nearly 2,900 employees at the virtual events.

Our employee communities drive bottom-up sustainability initiatives to educate, inspire, and activate employees.


**3,000**

3,000 employees completed Sustainability in Action training within the first two months.

# Commitments and progress

## Carbon negative

Microsoft is committed to be a carbon negative company by 2030. To achieve this, we are improving efficiency in our operations, devices, and supply chain; we are delivering technology to help our customers measure and manage their carbon emissions more effectively; and we are breaking new ground with carbon removal purchases and investments to help develop the crucial, nascent carbon reduction market.

Find out more here

### Our commitments

**Carbon negative**
By 2030, we will be carbon negative, and by 2050, we will remove our historical emissions since we were founded in 1975.

**Reduce direct emissions**
We will reduce our Scope 1 and 2 emissions to near zero by 2025 through energy efficiency work and by reaching 100 percent renewable energy.

**Replace 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.

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

**Remove the rest of our emissions**
By 2030, we will remove more carbon than we emit. By 2050, we'll remove an equivalent amount of carbon to all our historical emissions.

### Our progress

**2.5M tons**
Contracted for 2.5M metric tons of carbon removal in FY21 and FY22

**New tools**
Launched the Microsoft Cloud for Sustainability

**5.8 GW**
Signed new PPAs for 5.8 GW of renewable energy in FY21

**87%**
87% of in-scope suppliers reported emissions to CDP

## Water positive

Microsoft is committed to be a water positive company by 2030. To achieve this, we will continue our water stewardship work across our operations, building on the steps taken to reduce the water consumption in our datacenters and campuses over the past decade. In addition to reductions, we aim to become water positive through expanding access to clean water and replenishment projects.

Find out more here

### Our commitments

**Water positive**
By 2030, we will replenish more water than we use. We will reduce the water intensity of our direct operations and replenish in water-stressed regions where we work.

**Reduce water waste in datacenter operations**
By 2024, we will reduce water waste in our datacenter operations by 95 percent.

**Increase access to water**
We will provide 1.5 million more people with access to clean water and sanitization services.

### Our progress

**1.3M $m^3$**
Invested in replenishment projects expected to generate 1.3M cubic meters of water benefits

**U.S. Water Prize**
Awarded U.S. Water Prize for Outstanding Private Sector Organization

**>95K**
Provided 95K people with access to water via our partnership with Water.org

**670M**
Delivered 670M liters of water benefits per year via programs with Water.org

# Commitments and progress (continued)

## Zero waste

Microsoft is committed to become a zero waste company by 2030. We are taking an increasingly circular approach to materials management to reduce waste and carbon emissions. Our approach includes design and material selection, responsibly sourcing materials for our operations, products, and packaging, and increasing the use of recycled content. We keep products and materials in use longer through reuse, repair, and recycling programs.

Find out more here

### Our commitments

**Zero waste**
By 2030, we will be zero waste across our direct business.

**Increase reuse of servers and components through Circular Centers**
By 2025, 90 percent of servers and components within our regional datacenter networks will be reused.

**Eliminate 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.

**Make fully recyclable products and packaging**
By 2030, we will design Surface devices, Xbox products and accessories, and all Microsoft product packaging to be 100 percent recyclable in OECD countries.

**Drive to zero waste operations**
By 2030, we will achieve 90 percent diversion of operational waste at datacenters and campuses and 75 percent diversion for all construction and deconstruction projects.

### Our progress

**Circular Centers**
Planned 5 Circular Centers in FY22

**18%**
Reduced single-use plastics in product packaging by 18% in FY21

**>15K tons**
Diverted more than 15,200 metric tons of solid waste across direct operations in FY21

**Zero Waste**
Certified four datacenters as Zero Waste with new certifications

## Ecosystems

Microsoft is committed to protect more land than we use by 2025 while also building a Planetary Computer. We need a strong, efficient, scalable way to monitor, understand, measure, and ultimately manage the impact of our actions or inactions on ecosystems—both globally and locally. Microsoft is well on our way to providing access to the world's critical environmental datasets and delivering a computing platform to measure, monitor, model, and manage healthy ecosystems.

Find out more here

### Our commitments

**Build a Planetary Computer**
We will aggregate environmental data from around the world and put it to work through computing and machine learning in a new Planetary Computer.

**Take 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

**>17K acres**
Invested to protect more than 17,000 acres of land in FY21

**>500 users**
Released the Planetary Computer and have over 500 users signed up

**24 petabytes**
Made available 24 petabytes of data available in the Planetary Computer

**850+ grants**
Our AI for Earth program has provided more than 850 grants since 2017

# About this report

# 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 Appendix D. Deloitte & Touche LLP performed a review relating to specified information within Section 1 of Appendix D. We continue our work to provide leading transparency, visibility, and reliability in our non-financial reporting.

▶ Read about how we report in Appendix A

▶ Read about our environmental data in Appendix D

## How we think about sustainability

### Layers of increasing impact

We think about Microsoft's approach to sustainability in layers of increasing impact and have structured this report accordingly in chapters across our commitments in carbon, water, waste, and ecosystems. Each chapter follows this approach, as outlined here and on the following page.

### Operations

We start with taking accountability for our own operational footprint, which is relatively small. For example, we account for less than .03 percent of carbon emissions globally.

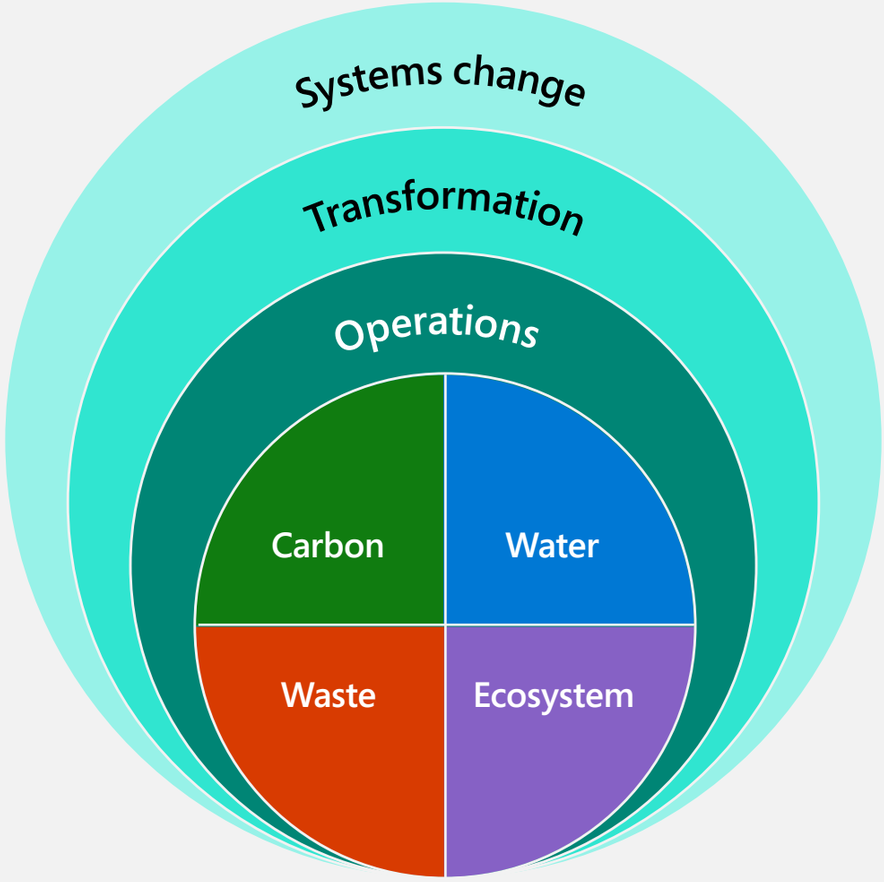
### Transformation

We then look at how Microsoft technology can help our customers and partners power their environmental sustainability.

### Systems change

We also look at Microsoft's biggest bets in policy, investments, catalytic partnerships, and research and development.

*Endnotes are used throughout the report; all references are hyperlinked and a full text explanation of all endnotes can be found in Appendix C.*



# About this report (continued)

## How to read this report


An explanation of why this program is a focus, what our commitments are, and what our progress and accomplishments were for the past year.

A look at our approach to reduce, replace, or remove our footprint across how our products and facilities are sourced, manufactured, operated, and managed at end of life.

A review of the latest innovations from Microsoft to help our customers and partners power environmental sustainability through our learnings, technology, and services.

A look at how we're driving global change with our biggest bets in policy, investment, catalytic partnerships, and research and development.

A recap of key trends we've observed this year, what's coming next for Microsoft, and resources for organizations on their sustainability journeys.

### Campuses and datacenters

In each building at every campus and datacenter, sustainability is a key priority for Microsoft across all phases of a project—from site selection to design and construction to operations and decommissioning.


- Reducing Scope 1 & 2 emissions see page 21
- Reducing Scope 3 emissions see page 25
- Reducing our water footprint see page 48
- Getting to zero waste see page 65
- Ecosystems—Taking responsibility for our land footprint see page 81


### Devices

Sustainability in our devices means looking at the impact that we have on our planet as we design, manufacture, and ship our devices, software, games, and operating systems, as well as product usage and end of life.

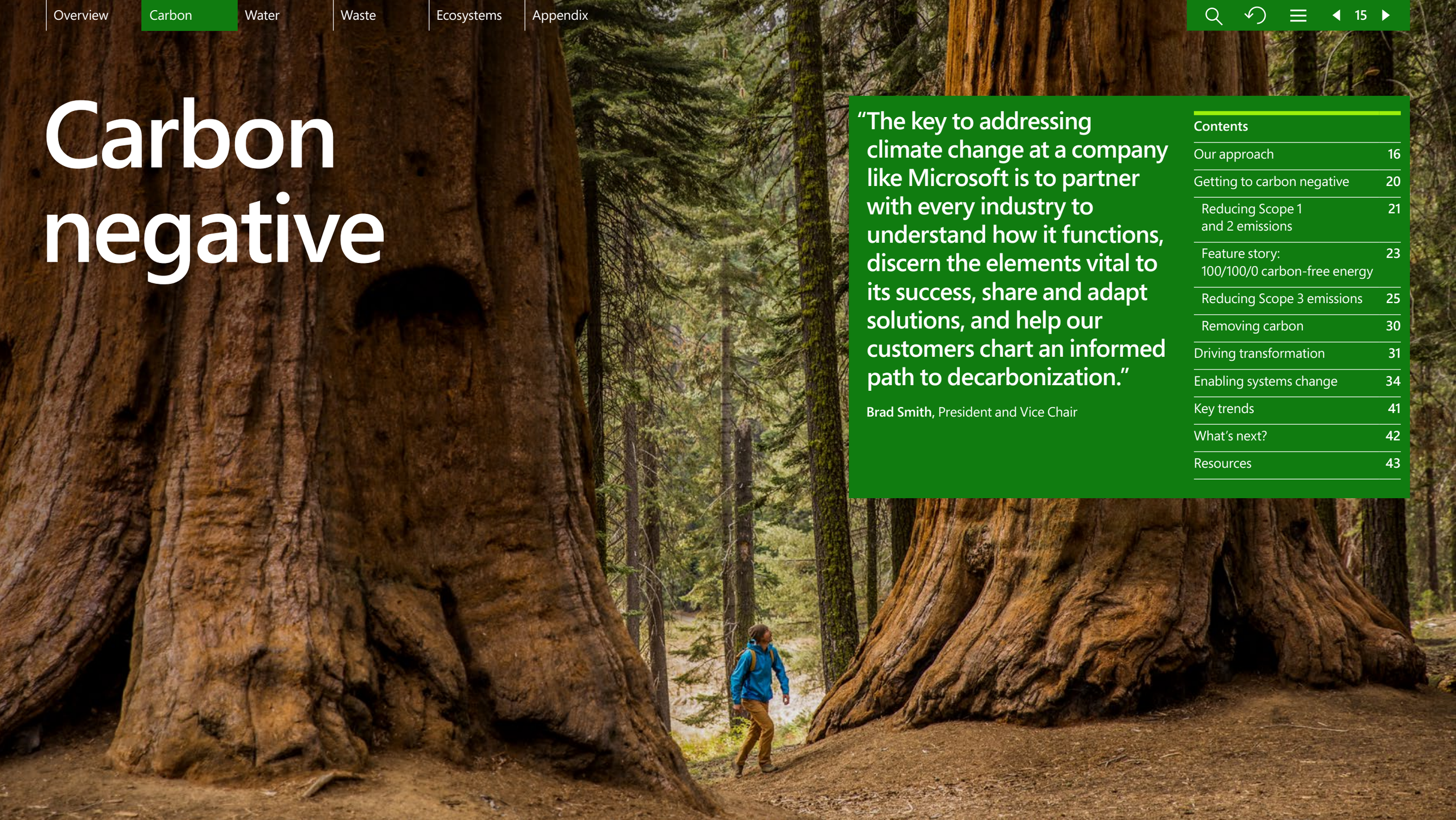

- Reducing Scope 3 emissions see page 27
- Getting to zero waste see page 67


### Supply chain

Our operational commitments extend into our supply chain. We work with our suppliers to report their emissions, design plans and new approaches to reduce their emissions, and track progress over time.


- Reducing Scope 3 emissions see page 29

# Carbon negative



"The key to addressing climate change at a company like Microsoft is to partner with every industry to understand how it functions, discern the elements vital to its success, share and adapt solutions, and help our customers chart an informed path to decarbonization."

**Brad Smith**, President and Vice Chair

Contents

## Our approach

# A commitment to a carbon negative future

### The context

The consequences of climate change are increasingly apparent, from wildfires to devastating flooding. The scientific reality of climate change is more accepted than ever before—to avert the worst effects of the rapidly changing climate, the world needs to transition to a net zero carbon emissions economy by 2050. But we still lack key strategies to avoid catastrophic climate change.

The world needs agreement on the meaning of global net zero emissions, measurement to track our progress toward net zero, and mature markets for carbon reduction and removal that are necessary to get us there. Through our operations, technology, and advocacy, Microsoft is addressing these three areas to help drive the change that society needs.

Our strategy to reach carbon negative by 2030 is relatively simple—we will reduce our Scope 1 and 2 emissions to near zero by improving efficiency, adopting new solutions, and purchasing zero carbon energy.[1] We are engaging suppliers and our business groups to cut our Scope 3 emissions by more than 50 percent and we'll rely on carbon removal to reach carbon negative.

This year, we took strides forward on zero carbon energy, continued progress on carbon removal, and improved our methodologies and measurement of emissions data across the company. We will continue to further refine how we measure and approach these categories as we move forward. We also took new steps to accelerate the work of others via the launch of a new solution, the Microsoft Cloud for Sustainability, to help our customers measure their carbon emissions more effectively, and created resources to help decarbonize our supply chain.

## Our commitment: carbon negative by 2030

and by 2050 to 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.

### Reducing direct emissions

We will reduce our Scope 1 and 2 emissions to near zero by the middle of the decade through energy efficiency work and reaching 100 percent renewable energy by 2025.

### Empowering customers and partners

We will help our suppliers, customers, and partners around the world to reduce their carbon footprints through our learnings and with the power of data, AI, and digital technology.

### 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.

### Using our voice on carbon-related public policy issues

We will support new public policy initiatives to accelerate carbon reduction and removal opportunities.

### Reducing value chain emissions

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

### Investing in the future

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.

### Removing the rest of our emissions

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

# Our approach (continued)

## Our progress

### Reduced Scope 1 and 2 by 16.9%

We reduced our Scope 1 and 2 (market-based) emissions by 58,654 metric tons of carbon dioxide equivalents ($mtCO_2$) in FY21. Scope 3 emissions increased by 22.7 percent.

### 5.8 GW of renewable energy

In FY21, we signed new power purchase agreements (PPAs) for approximately 5.8 gigawatts (GW) of renewable energy across 10 countries around the globe, totaling more than 8 GW of renewable energy via PPAs or long-term contracts.

### Supplier reporting tools

We released a set of in-depth capacity-building tools and resources, developed in partnership with ENGIE Impact, WSP, and CDP to help companies, especially our suppliers, report their greenhouse gas (GHG) emissions and set strategies to reduce emissions from electricity.

### 87% supplier reporting

In July 2021, 87 percent of our in-scope suppliers reported their emissions to CDP, up 12 percent from 2020. This data informs suppliers' baselines for reduction targets and gives Microsoft a more accurate picture of its Scope 3 emissions. Following the CDP cycle, Microsoft built out action plans with suppliers to assess and report emission reductions through 2030.

### 2.5M tons carbon removal

In FY21 and FY22, Microsoft successfully contracted to remove 2.5 million $mtCO_2$, meeting our cumulative two-year goal. This includes 1.4 million $mtCO_2$[2] contracted in FY21 and 1.1 million $mtCO_2$ contracted to date in FY22, on path to meet our goal of 1.5 million $mtCO_2$ in FY22.

### $571M

Allocated $471 million to date via our Climate Innovation Fund to accelerate our carbon goals, as well as water and waste. We also donated $100 million to Breakthrough Energy's Catalyst initiative.

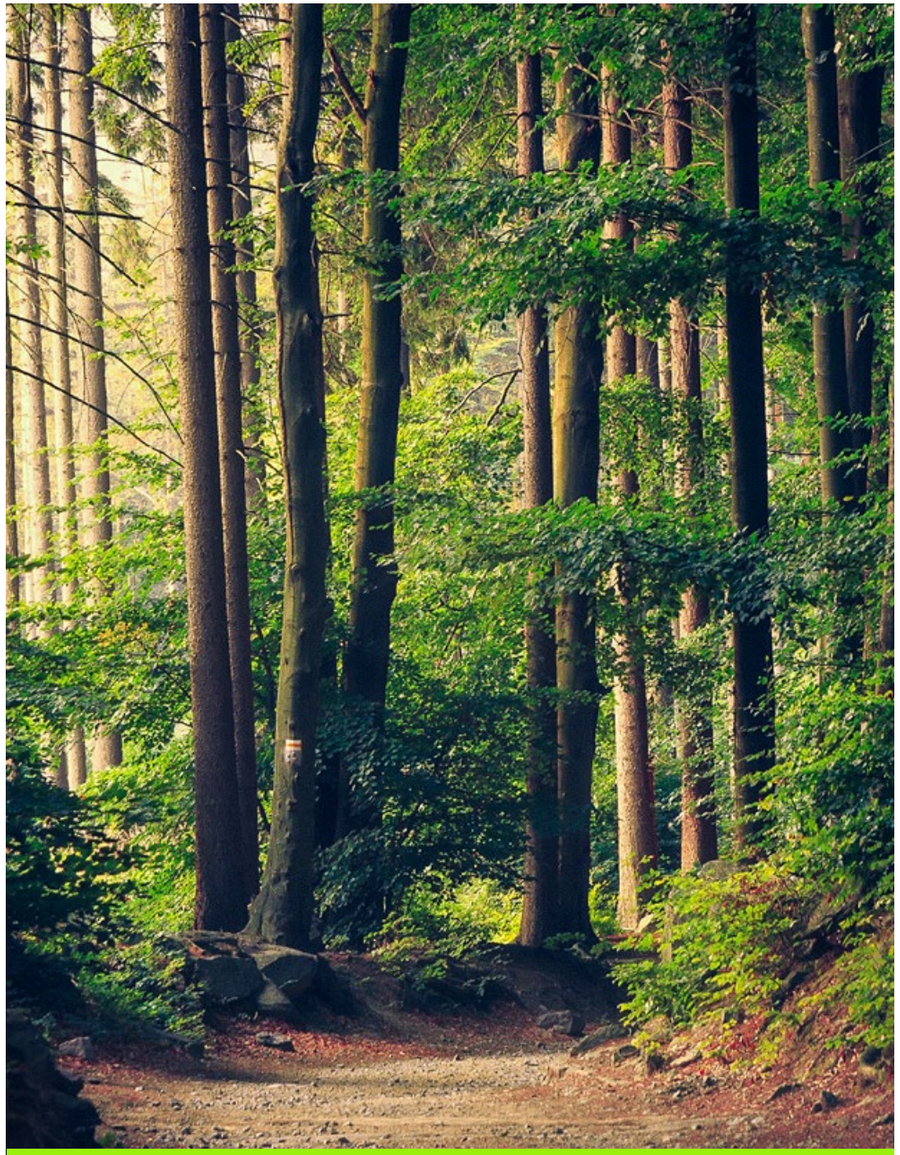
### Launched the Microsoft Cloud for Sustainability

In July 2021, we launched the Microsoft Cloud for Sustainability to provide comprehensive, integrated, and automated sustainability management for organizations at any stage of the sustainability journey.

### Improved device efficiency

While overall device and console use phase emissions grew as a result of higher sales and usage during the pandemic, we reduced the carbon footprint for several products and usage scenarios:

- Surface Pro 8 is one of the most energy efficient Surface Pro devices ever.
- The new Surface Laptop Studio has a 30 percent smaller carbon footprint than its predecessor, the Surface Book 3 13".[3]
- Energy-saving mode, a new low-power standby mode for Xbox consoles, uses as little as 0.5W.



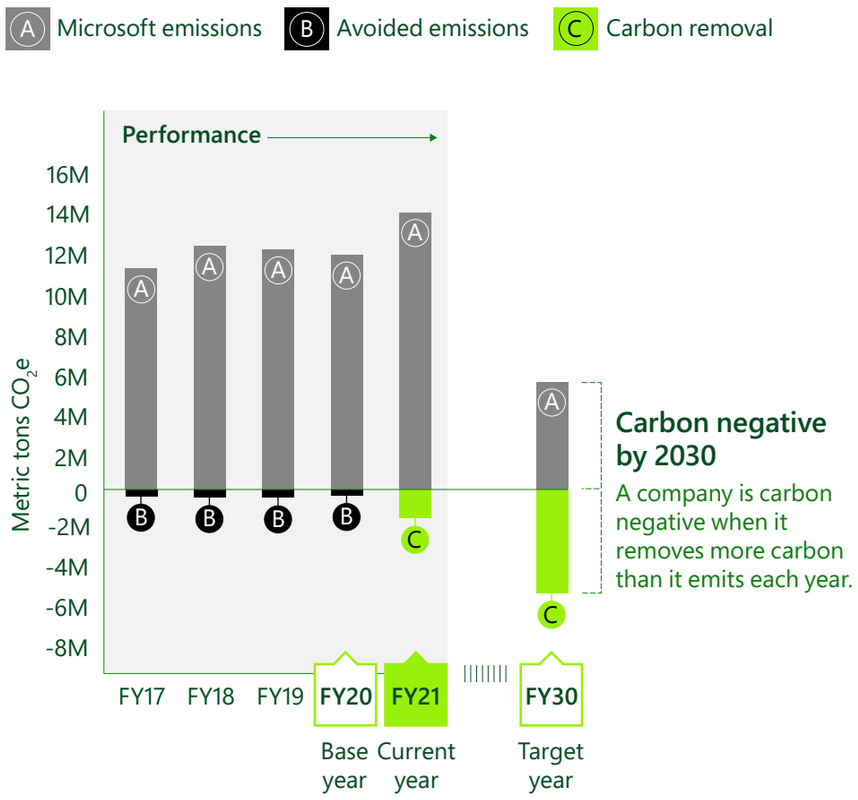
A year of progress and impact to get to carbon negative by 2030.

# Our approach (continued)

Carbon Table 1

## Tracking our yearly progress toward carbon negative by 2030

In FY21 we procured the removal of 1.4 million metric tons of carbon as one of our initial steps towards achieving our 2030 commitment.



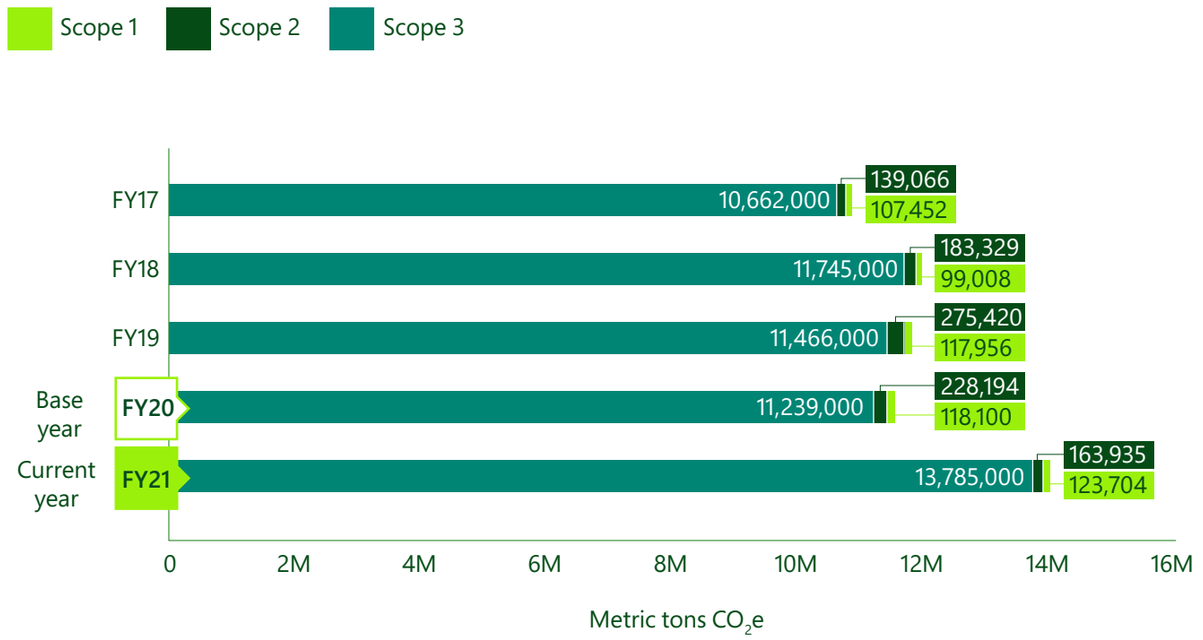

a. Chart has been updated to reflect latest actual values which incorporate latest methodology and structural change adjustments. A portion of the 1.4 million metric tons of removal will apply to future years.

b. Overall increase in emissions is driven mainly by the growth of our cloud services business and an increase in sales and usage of our devices.

Carbon Table 2

## Tracking our yearly emissions across Scopes 1, 2, and 3

In FY21, we reduced our Scope 1 and 2 (market-based) emissions by 16.9 percent. We saw an increase in Scope 3 emissions driven by growth of our cloud services business and an increase in sales and usage of our devices.



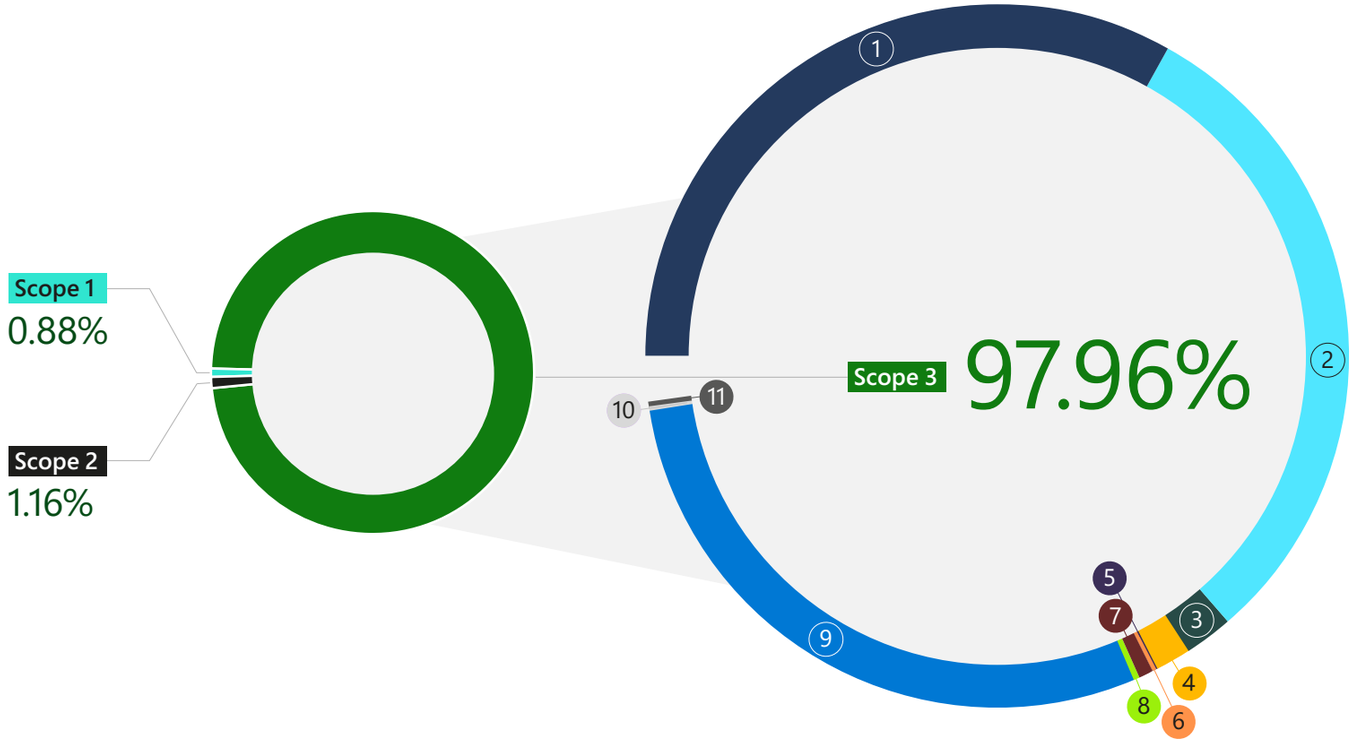

a. Scope 2 and 3 values are market-based.

# Our approach (continued)

Carbon Table 3

## Breaking down of our FY21 Scope 3 emissions by source

Scope 3 represents the majority of Microsoft's emissions, and we are committed to reducing these emissions by more than 50 percent by 2030. Tracking and reporting against this category of emissions is critical for net zero progress.




### Scope 3 Categories

| | | |
|---|---|---|
| 1 | Purchased Goods & Services | 35.03% |
| 2 | Capital Goods | 29.70% |
| 3 | Fuel- and Energy-Related Activities (Market-Based) | 2.20% |
| 4 | Upstream Transportation | 1.60% |
| 5 | Waste | 0.04% |
| 6 | Business Travel | 0.16% |
| 7 | Employee Commuting | 0.57% |
| 8 | Downstream Transportation | 0.32% |
| 9 | Use of Sold Products | 28.07% |
| 10 | End of Life of Sold Products | 0.14% |
| 11 | Downstream Leased Assets | 0.13% |

See appendix for more data on our carbon emissions

a. Scope 2 and 3 values are market-based.
b. Overall increase in emissions is driven mainly by the growth in the categories of purchased goods and services, capital goods, and use of sold products.

## 5.8 GW

In FY21, we signed new PPAs for approximately 5.8 GW of renewable energy across 10 countries around the globe, totaling more than 8 GW of renewable energy via PPAs or long-term contracts.

# Getting to carbon negative

It is critical that companies take a rigorous approach to achieving net zero. This begins with recording and reporting emissions with better data collection and automation, reducing emissions as much as possible, replacing electricity consumption with renewables, and removing the remaining emissions.

In January 2020, Microsoft announced its intention to be carbon negative, which will see us cut our greenhouse gas (GHG) emissions across our operations to nearly zero and by over half by 2030 across our value chain with improvements in energy efficiency, replacing with renewable energy for Scope 2, and removing the remainder of emissions. We will also remove the equivalent amount of our historical carbon emissions by 2050.

Implementing these commitments is a journey. At Microsoft, we have come to see this as a "5-R Journey" that begins with **recording** and **reporting** emissions with better data collection and automation, then **reducing** as much as possible with that data-informed roadmap first, then **replacing** fossil fuels in our electricity consumption with renewables, and finally **removing** what remains.

Our total company emissions (market-based) in 2021 were approximately 14 million $mtCO_2$. Of this total, about 120,000 $mtCO_2$ were Scope 1 emissions at Microsoft datacenters and campuses. Taking into account our renewable energy purchases, our Scope 2 emissions were approximately 160,000 $mtCO_2$. The bulk of our emissions—more than 97 percent—are in Scope 3, which includes emissions from our supply chain, the lifecycle of our hardware products and devices, travel, and other indirect sources.

While our combined Scope 1 and 2 emissions decreased this year, we did see an increase in Scope 3 emissions, driven mainly by the growth of our cloud services business and an increase in sales and usage of our devices.

It is critical that companies take a rigorous approach to achieving net zero. We have come to see this as a "5-R Journey".

**>50%**

We are committed to cutting our GHG emissions by over half by 2030 across our value chain, removing the residual emissions, and removing the equivalent amount of our historical carbon emissions by 2050.

# Getting to carbon negative (continued)

## Reducing Scope 1 and 2 emissions across our operations

In each building at every campus and datacenter, sustainability is a key priority for Microsoft across all phases of a project—from site selection to design and construction to operations and decommissioning. By the middle of the decade, we are committed to reducing our Scope 1 and 2 emissions to near zero.

### Reducing carbon emissions with efficiency solutions

Ensuring our campuses and datacenters are energy efficient is a key first step in reducing our emissions. We are changing the way we build and operate facilities, using all-electric efficient system designs like the use of geothermal energy and thermal energy recovery, and improving the efficiency of our cloud.

## Scopes explained

### Scope 1

Direct emissions created by your activities

Examples include the exhaust that comes from the vehicles on your campus, natural gas that your buildings directly consume, and the generators you might run.

### Scope 2

Indirect emissions from the consumption of the electricity or heat you use

Examples include energy sources that power your office buildings or your home.

### Scope 3

Indirect emissions from all other activities in which you're engaged

This is by far the largest category of emissions and covers all parts of your value chain (upstream and downstream). Upstream examples include supply chain, materials in buildings, business travel, and manufacturing. Downstream examples include the electricity customers consume using your products.

Scope 3 measurement poses a significant opportunity for improvement.

### Building for Zero Carbon and LEED certifications

We are pursuing Zero Carbon certification for our Silicon Valley campus and Redmond campus modernization project with International Living Futures Institute. We have committed to certifying our Microsoft datacenters and major offices to LEED Gold or Platinum—with a focus on the categories of energy and atmosphere, water efficiency, materials and waste, location and transportation, sustainable sites, and indoor environmental conditions. Four of our datacenters are LEED Gold certified and 74 projects are going through certification.

### Deploying AI to improve energy efficiency

Microsoft is using Bonsai, a low-code AI platform that is part of the Autonomous Systems suite from Microsoft, to improve the efficiency of its Redmond campus chiller plants. These chiller plants provide the air conditioning within an HVAC system and typically represent a substantial portion of the energy footprint of buildings. We have seen a 12 percent increase in median efficiency based on energy estimates and plan to implement Bonsai in the 12 remaining chiller plants this fiscal year. In the past, energy conservation measures (ECM) projects took more than 12 months. Bonsai enabled us to build a model and test recommendations in two to four weeks with comparable results.

### Designing and operating highly efficient datacenters

All future datacenters will be LEED Gold certified with emphasis on water and energy conservation. All lighting is high-efficiency LED with motion detection to minimize use of space light. Cooling systems are integrated with the servers, providing cooling only when the servers require it.

### Avoiding emissions with kinetic energy for backup power

At the Bengaluru Cosmo office site, we installed an uninterruptible power supply (UPS) with flywheel to store kinetic energy to provide backup power without the need for lead acid batteries typically used in conventional UPS. The UPS flywheel has the additional benefit of avoiding thousands of metric tons of carbon emissions over its 20-year lifecycle and avoiding 1,500 lead acid batteries treated as hazardous waste at end-of-life.

### Increasing carbon awareness and lowering carbon in cloud operations

We are piloting new approaches that lower the carbon footprint of our code as well as large-scale workloads for Microsoft and our customers' benefit. We piloted a new feature called Start/Stop VMs, which can automatically turn off VMs during idle hours. Our engineers have also created more transparency inside Azure Machine Learning, displaying resource metrics (including GPU energy, utilization, and computational cost) to help data practitioners assess and mitigate the hidden costs of their machine learning workloads, and partnered with the Allen Institute for AI to develop a set of best practices and tools in this space. We developed the Carbon Aware Core, which helps schedule workloads in times and regions with the lowest carbon footprint, which is being piloted by Microsoft 365 and Microsoft Research and will be provided as an open-source toolkit through the Green Software Foundation. Engineers are also testing and deploying novel approaches like Kubernetes Scheduler to take advantage of grid-level fluctuations in carbon intensity to minimize carbon.

# Getting to carbon negative (continued)

## Transitioning to 100 percent renewable energy

By 2025, we expect to power our datacenters and facilities with 100 percent additional, new renewable energy generation that matches our electricity consumption on an annual basis.

Already, we've contracted for more than 8 GW of renewable energy. In addition to these purchases, we're using our campuses as living laboratories for energy innovation.

See our full approach to renewable energy on the next page.

### On-site zero carbon energy solutions

We have installed on-site renewables at select campuses as well. At our Silicon Valley campus, a solar panel system will offset energy consumption up to 15 percent. Our Beijing and Shanghai Zizhu campuses have made similar efforts, installing photovoltaic (PV) solar panels on empty roof space in FY20 which are expected to generate 15,450 MWh of electricity over the next 25 years to power the campus. LinkedIn's new campus in Omaha features an on-site solar array over the parking structure. The system has an estimated annual output of approximately 750,000 kWh/year of electricity, equivalent to about 15 percent of all site energy usage, and is being integrated with on-site battery storage to help reduce peak demand and address any intermittent excess solar generation produced by the array.

### Harnessing thermal energy to halve energy consumption on campus

In 2021, we unveiled our plans for a new, hyper-efficient thermal energy center for our Puget Sound campus, which utilizes geothermal wells to heat and cool our buildings—resulting in a 50 percent reduction in energy usage compared to the typical utility plant. In our Silicon Valley campus, thermal energy storage tanks will support the closed loop water system that provides all heating and cooling needs for the campus.

## Removing fossil fuels from our campuses and datacenters

We are leaving no stones unturned in our quest to reach net zero. We are eliminating our dependency on diesel fuel at our datacenters, electrifying our campus fleet, and moving to all electric kitchens.

### Eliminating diesel fuel in datacenters

Cloud providers around the world rely on diesel-powered generators for backup power to support continuous datacenter operations. Microsoft has committed to be diesel-free by 2030. Innovations include the following.

**Renewable fuels:** Our datacenter region in Sweden will be one of Microsoft's first sites to use lower-carbon renewable fuel for backup power. The datacenter's generators run on Preem Evolution Diesel Plus, the world's first Nordic Eco-labelled fuel, which contains at least 50 percent renewable raw material, and nearly an equivalent reduction in net carbon dioxide emissions compared with standard fossil diesel blends. This solution is being expanded to other datacenters across the world with other suppliers.

**Batteries as backup power:** We are assessing the long-term feasibility of deploying large batteries as backup power for critical infrastructure via our strategic collaboration with TOTAL and are continuing research and development in this area. We are also implementing an extended battery solution for datacenters that operate on highly reliable grids. Our Swedish campuses are slated to pilot a battery energy storage system (BESS) solution to remove reliance on generators.

**Hydrogen fuel cells:** We are also piloting hydrogen fuel cells as viable green energy for backup power at our datacenters. We announced a worldwide first in 2020—hydrogen fuel cells powering a row of datacenter servers for 48 consecutive hours. This successful pilot provided a proof of concept for supporting backup power needs that could be implemented once batteries reach their capacity. Our primary power supply to an operating datacenter is now a hydrogen fuel cell.

### Electrifying our fleet

We are committed to fully electrifying our global campus operations vehicle fleet of over 1,800 vehicles by 2030. Since announcing this target, we have spent the last year developing regionally specific implementation strategies, analyzing the vehicles, and determining the infrastructure needed to support operations. In the coming year, we will launch a series of pilots appropriate to each region to keep us on track to goal.

### Powering all electric kitchens with renewable energy

In our Puget Sound campus modernization project, we have removed natural gas from campus, including cooking over 15,000 meals a day with only renewable electricity. LinkedIn's updated design and build guidelines call for all-electric kitchens powered by renewable energy, designed to cook over 5,000 meals a day on clean power.

**1,800**

We are committed to electrifying our global campus vehicle fleet of 1,800 vehicles by 2030.

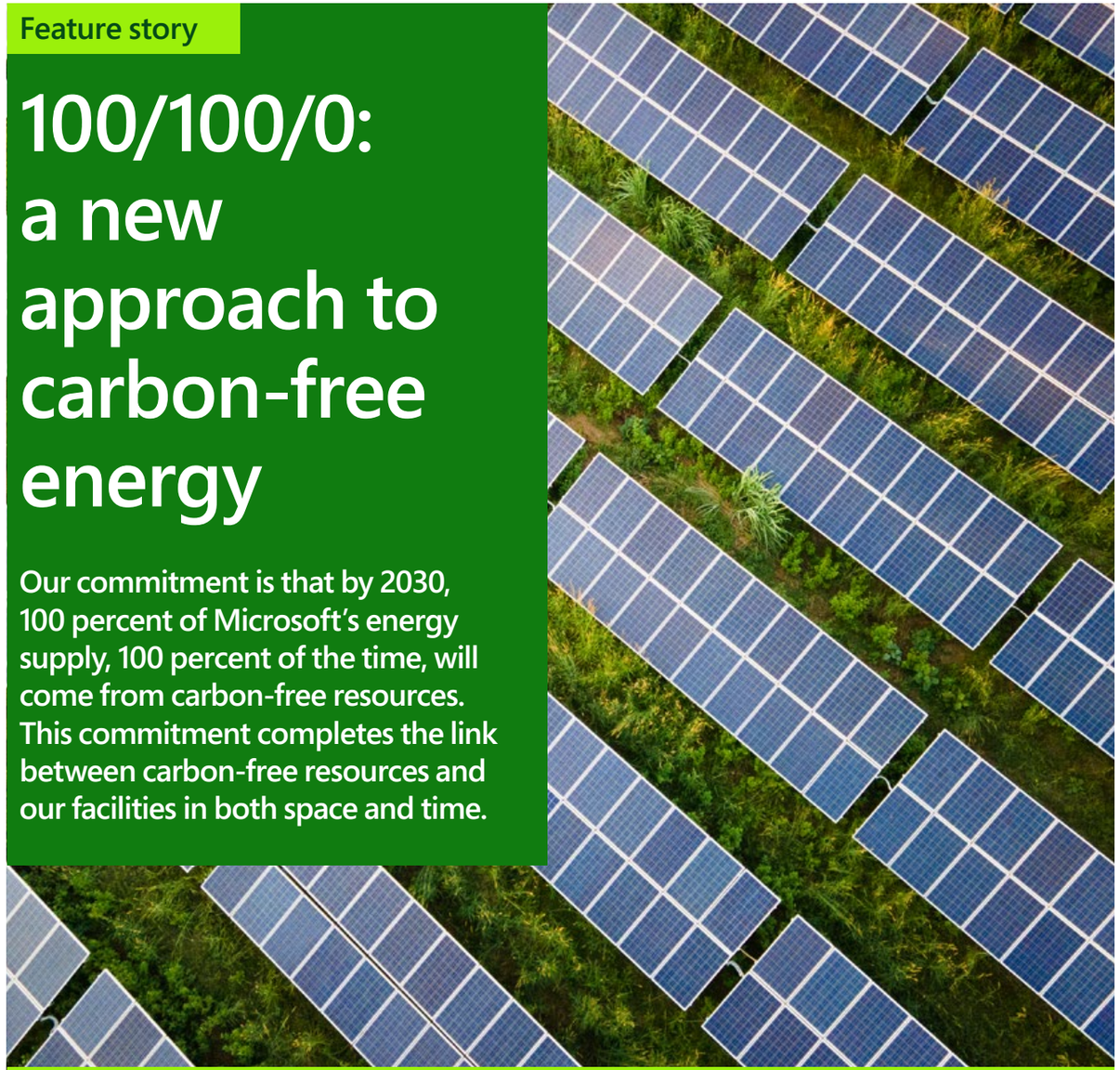

Electrifying our global campus operations vehicle fleet.

# Getting to carbon negative (continued)

Feature story

## 100/100/0: a new approach to carbon-free energy

**Our commitment is that by 2030, 100 percent of Microsoft's energy supply, 100 percent of the time, will come from carbon-free resources. This commitment completes the link between carbon-free resources and our facilities in both space and time.**



Hourly renewable supply and demand matching strategies can help lay the groundwork for a decarbonized grid.

### A path to carbon negative via energy

The vast majority of Microsoft's direct carbon emissions footprint comes from electricity, and as such, our work on carbon reduction has centered on using less of it, while at the same time ensuring we support the adoption of more carbon-free energy in the grids where we operate. While our goal has remained consistent—to get to an energy supply that is entirely carbon-free—our approach has evolved as the supply of renewable energy has increased, markets have matured, and data has become more granular.

### A journey towards 100 percent

Our initial commitment, set in 2012, was to cover 100 percent of our energy consumption with renewable energy certificates (RECs). We achieved our goal that same year by purchasing enough RECs to cover our annual energy consumption. However, a REC purchase is not always a direct contract with new renewable generation and does not always mean that the renewable generation is on the same grid as where we are consuming electrons. Put simply, pursuing "unbundled" RECs de-linked energy production and consumption in both geography and time, reducing the overall impact.

Recognizing the importance of linking our renewable purchases to new impactful and additional renewable energy projects, Microsoft began engaging in renewable energy procurement through power purchase agreements (PPAs). PPAs are a direct contractual relationship between a purchaser and a supplier for new renewable energy via a project or several projects; that is, the execution of the PPA provides the necessary revenue stream for new renewable energy projects to be built. The direct contract establishes greater investor confidence in renewable projects and paves the way for more renewable generation on the grid.

We formalized our commitment to procuring energy from new impactful renewable energy projects in 2016 and updated it in 2020. In 2016, Microsoft announced a commitment to increasing proportion of PPA purchases, on a path towards 100 percent renewable energy. We pledged to procure enough renewable energy to offset 50 percent of our energy consumption by 2018 and 60 percent in the next decade, and further specified that we'd aim to secure new renewable energy in the geography where our offices and datacenters are, bringing a stronger geographic connection between our contracted renewables and our electricity consumption. In 2020, as part of our carbon negative announcements, we committed to bring our commitment up to 100 percent by 2025. Like our earlier commitments, this was on an annual basis, requiring us to sign renewable energy offtake agreements to cover our energy needs; simply put, we will match every electron we consume on an annual basis with renewable energy.

### Moving beyond 100 percent to 100/100/0

While we are proud of this progress, the global shift to net zero carbon energy is not happening quickly enough. The International Energy Agency (IEA) suggests that the path to net zero emissions is very narrow and will require the deployment of all available clean energy technologies between now and 2030. For solar power, it is equivalent to installing the world's largest solar park roughly every day.[4] This reality is due to the fact that most electrons flowing onto grids today come from carbon-intensive sources, requiring large-scale replacement to meet our energy needs. Currently, energy storage is not deployed at scale, and the grid infrastructure of today is old and inadequate to meet the balancing needs of new renewable energy resources and the integration of net zero carbon resources, nor to the increasing consumption demands of a rapidly electrifying society.

# Getting to carbon negative (continued)

That is why we set a new 100/100/0 goal in 2021. Our commitment is that by 2030, 100 percent of Microsoft's energy supply, 100 percent of the time, will come from zero carbon resources on grids where we operate. The 100/100/0 commitment completes the link between zero carbon resources and our facilities in both space and time.

Our 100/100/0 commitment provides a vision and roadmap to pair our operational goals with our research, technologies, and investments to drive global change. We are bringing new research to bear, including a white paper authored by RMI that highlights the potential for hourly energy monitoring tools to provide transparency into supply and demand for zero carbon energy. The paper illustrates that hourly renewable supply and demand matching strategies can help lay the groundwork for a decarbonized grid.

The impact of our 100/100/0 commitment will be significant. Matching zero carbon resources in both space and time will reduce Microsoft's emissions to zero at all times and also bring benefits to the broader grid since the zero carbon resources we contract for will also be available to serve the grid when our consumption is lower or zero carbon energy output is higher. Moreover, we will be driving early deployment of advanced resources like hydrogen and long-duration storage to fill in the gaps when renewable energy sources are not generating. And finally, the energy transition will affect all and needs to benefit all, which is why we have built climate equity into our purchasing commitments.

## Our impact to date

Our renewable and zero carbon commitments to date are having real-world impact. Microsoft is one of the largest purchasers of renewable energy in the world. Across 2020 and the first part of 2021, Microsoft signed new purchase agreements for approximately 6 GW of renewable energy across 10 countries around the globe. This includes over 35 individual deals, with 15 of those deals in Europe spanning Denmark, Sweden, Spain, the United Kingdom, and Ireland. This latest procurement brings our operating and contracted renewable energy projects to 7.8 GW globally and we are positioned to continue to grow our renewable resource portfolio. In addition to these PPAs, Microsoft partnered with Volt Energy, the only national African American owned solar development company, for a 250-MW portfolio of solar projects with the intent to create new opportunities for under-resourced communities and to help support a more diverse renewable energy industry. This builds on our progress on our community purchasing and skilling work with Sol Systems, which began a year ago.

We're also taking our learnings from our operational work and building new products to help accelerate global decarbonization. For example, our research led to the co-creation and adoption of the first commercial round-the-clock hourly energy-matching solution with our utility partner Vattenfall. Building on this work, we're announcing a new around-the-clock pilot in the Netherlands with energy provider Eneco and FlexiDAO, a technology supplier, which will match one of our Amsterdam datacenter's hourly energy consumption with the Dutch offshore windfarm Borssele.

We know that our actions alone will not decarbonize the grids, but we are committed to taking ambitious action to drive market demand signals that will influence the speed and scale at which the transformation happens. As Microsoft builds the tools and markets to meet our zero carbon commitments, we are mindful of the need for products, purchases, and policy that will enable a carbon-free energy system for all.

"Every net zero scenario shares a common, and essential, element: a massive increase in electrification. Electricity holds the promise of wiping out vast sections of the global emissions portfolio, but this only happens if the electrons supplying the electricity are generated from zero carbon energy sources."

**Dr. Lucas Joppa**
Chief Environmental Officer

Our Sweden datacenter will be fully supplied with hourly energy consumption with an offshore windfarm.

# Getting to carbon negative (continued)

## Reducing Scope 3 emissions

We are committed to reducing our Scope 3 emissions by more than half by 2030. While we do not have direct control over most emissions in the Scope 3 category because they are generated by third parties, they represent more than 97 percent of our total emissions. Our carbon negative commitment includes reducing these emissions and removing what we cannot reduce, which we do through a reduction strategy in campuses and datacenters, rethinking the design of our devices, and engaging with our supply chain. This year, we saw an increase in Scope 3 emissions, driven mainly by the growth of our cloud services business and an increase in the sales and usage of our devices.

## Campuses and datacenters

Changing the way we work begins with measuring our impact on the planet. This includes looking at embodied carbon in each material that goes into our buildings, as well as the future of how we work, travel, and think about events.

### Designing embodied carbon out of our buildings

We're committed to reducing not just operational carbon but also embodied carbon—the carbon emitted during the manufacture and transport of building materials—which accounts for at least 11 percent of global emissions and has historically been harder to track and reduce. We have taken a number of steps to address and lower our carbon footprint.

We are committed to reducing our Scope 3 emissions by more than half by 2030. We will achieve this through reduction strategies in campuses and datacenters, rethinking design of our devices, and engaging with our supply chain.

Our Silicon Valley campus includes the largest mass timber building in the United States.

### Data-driven decision-making and emissions tracking

Microsoft partnered with other industry leaders to create a new open-source, Azure-hosted tool, the Embodied Carbon in Construction Calculator (EC3), to track the embodied carbon of the raw building materials. We used the EC3 tool in designing 17 new buildings (3 million square feet) in our Puget Sound campus modernization project, where we are on track to reduce embodied carbon emissions by at least 30 percent. We are now using the EC3 tool around the world in both our campuses and our datacenters to track and reduce embodied carbon and have found opportunities to reduce concrete and steel embodied carbon by 30 to 60 percent in our datacenters.[5]

### Understanding construction emissions to reduce them

Microsoft and our general contractors are creating a baseline for construction process emissions, which include transportation of materials to the construction site and construction installation. To date, there has been little data and no established, industry-consistent methodology for creating a baseline, making it difficult for design teams to know if their emissions are better or worse than a typical construction project. We piloted the tracking of construction activity emissions in our Puget Sound campus modernization project, starting with the demolition phase (including site excavation), as well as how much water we used.

# Getting to carbon negative (continued)

### Leading the way on low-carbon building materials

We are innovating and investing in low-carbon building materials across our global campuses and datacenters with the aim to achieve net zero embodied carbon, including the following.

**Mass timber:** At our Silicon Valley campus, we are using mass timber, resulting in the largest mass timber building in the United States. In addition to using this lower carbon building material, we elected to keep two of the existing buildings on the site, providing 36 percent of the new campus footprint and accounting for a 28.6 percent reduction in total embodied carbon.[5] With two floors of mass timber, the embodied carbon savings increases to approximately 36 percent with an estimated total of 372 kg $CO_2e$ per square meter.[5] With over 345,000 square feet, or 2,400 tons, of 100 percent Forest Stewardship Council (FSC) certified mass timber, the wood reflects biophilic principles and a reduced carbon mission. We continue to incorporate mass timber on our campuses and are now testing the suitability of mass timber in datacenter environments and investigating sites to pilot these new materials.

**Cement:** Cement accounts for approximately 8 percent of global emissions. We are testing and piloting low-GHG cement innovations like CarbonCure to reduce the carbon footprint of our buildings. LinkedIn is using low-carbon and carbon-sequestering concrete mixes for our new Silicon Valley headquarters and is now using these materials in our LinkedIn Dublin campus. In our datacenters, we are reducing how much cement we use by utilizing longer 56-day cure times in lieu of typical 28-day cure times. We are also specifying the use of cement replacement products such as fly ash and slag that reduce the carbon footprint of concrete.

**Low-carbon materials:** We also completed research on low-carbon materials in collaboration with Carbon Leadership Forum (CLF), a nonprofit industry academic organization at the University of Washington. The research explores six low-carbon materials—earthen slabs, non-Portland cement concrete slabs, algae-grown bricks/panels, mycelium (mushroom) structural tubes, purpose-grown fiber, and agricultural waste panels—that can help reduce carbon emissions and change the climate profile of building constructions. We are piloting the use of these materials for our datacenters.

We are innovating and investing in low-carbon building materials across our global campuses and datacenters with the aim to achieve net zero embodied carbon.

This year, we became a founding member in SABA.

### Rethinking how we travel

Although emissions related to business travel represented less than 5 percent of our total emissions, we know that we can have a larger impact with our investments and partnerships. We have made two investments in SAF with airline partners KLM and Alaska. This year, we expanded this work by becoming a founding member in the Sustainable Aviation Buyers Alliance (SABA) and participating in the World Economic Forum's "Clean Skies for Tomorrow." We are actively supporting the development of an SAF certificate which will set GHG accounting standards for the use of SAF to reduce emissions by both customers and airlines in the future. We are also looking to reduce emissions in other areas where our learnings in SAF can be applied, from freight and logistics to the fuel used in our datacenter backup generators.

# Getting to carbon negative (continued)

## Devices

Over the past year, devices became even more essential as they kept us connected, working, and learning through the pandemic. This year, higher-than-anticipated demand translated to higher sales and greater usage, which caused our absolute emissions to grow. We are committed to reducing the carbon intensity of our devices and our efforts have also grown this year. We have made significant investments to expand our data-driven lifecycle assessment (LCA) and telemetry approach to better measure, inform, and prioritize top reduction opportunities to reduce our device carbon intensity across the full lifecycle of our devices.

These efforts include carbon-conscious design, reducing supply chain emissions, innovating energy-efficient hardware and software in use, and enabling product repairability, reusability, and recyclability. This will allow us to deliver the best product experience with lower carbon intensity, while also partnering with our users to minimize carbon footprint when using our products.

## Building a data-driven platform for product design

In 2020, we began working on a platform to allow engineers to make real-time design and material selection decisions based on carbon impact, a key enabler in modeling and reducing our future device emissions. To generate our device carbon footprints, we conduct LCAs in accordance with ISO 14040 and ISO 14044 which enable us to estimate emissions from manufacturing our devices down to the individual component level. Further, we are upgrading our audit management sourcing tool to ensure supplier carbon reduction initiatives are fully reflected in these product carbon footprints. We pair this with improved product usage and distribution data. For example, the most recent iterations of the Xbox Series X|S have improved our awareness of full ecosystem energy usage from consoles, information which is critical to future energy efficiency improvements and emissions reductions. These investments allow us more control over our product emissions across their full lifecycle.

## Experimenting with lower carbon design

As informed by our LCAs, a significant lever in product development is the engineering of low-carbon design alternatives, such as using recycled materials and designing for a smaller manufacturing footprint.

### Reduced waste

We designed our Surface Laptop Studio to allow for "stamping," a lower-waste manufacturing technique that reduced our aluminum scrap rate for the product's base by at least 25 percent, a key contributor to an overall product carbon reduction of 30 percent versus its predecessor, the Surface Book 3 13".[6]

### Metals

We are developing opportunities to reuse manufacturing scrap in aluminum production, allowing us to use lower-carbon, 100 percent post-industrial recycled closed loop aluminum for future Surface computer housings. For neodymium in magnets, a rare earth material, we are also exploring post-industrial scrap as a manufacturing feedstock, enabling us to produce 100 percent recycled neodymium in magnets for future products.

### Circuit boards

In our labs, we are working to engineer a lower-carbon and reduced-waste flax-based wiring board and experimenting with 3D printing; we have started to explore 100 percent post-industrial recycled tin in our soldering paste; and we are aiming to reduce overall materials needed through new spacing guidelines that can shrink our circuit boards in size by up to 25 percent.

**30%**

Reduction in total carbon emissions of 30 percent for Surface Laptop Studio versus its predecessor, Surface Book 3 13".

### Sustainable Product Lifecycle

# Getting to carbon negative (continued)

Surface Pro 8 running Windows 11.

**17%**

Total energy consumption for the Surface Pro 8 is 17 percent smaller than Pro 7.

**>80%**

Energy-saving mode can reduce Xbox power usage in standby mode by over 80 percent.

## Reducing the footprint of distribution

Microsoft is an active member in the Global Logistics Emissions Council (GLEC), an industry collaboration through Smart Freight Centre, committing to reducing logistics emissions through sustainable freight initiatives. Microsoft uses this framework to calculate and measure the carbon impact of its Scope 3 transportation emissions.[7]

For shipping, we have an intelligent platform to measure our emissions impact down to individual shipments, and a carbon emissions budget has been developed utilizing the same methodology. In our distribution network, this year we finished a complete conversion of our primary distribution center in Europe to 100 percent renewable energy. This facility now generates 1.3 million kWh from solar energy and avoids 690 $mtCO_2$ annually. Through FY22 we will plan to convert our US distribution centers to 100 percent renewable energy through solar panel installations and using green renewable sources.

We are also building more sustainable shipping options, such as the delivery option launched in December 2021 to avoid higher-carbon air freight, to give customers a choice of more sustainable options when ordering from Microsoft.

## Boosting efficiency of devices in use

For Microsoft devices, energy efficiency is a balance of hardware and software innovation. This year, overall device and console use phase emissions grew as a result of higher sales and usage from customers reliant on these products during the pandemic. That being said, several of our newest products launched in 2021 were designed to be the most energy efficient devices in their product lines, including the Surface Pro 8 and Surface Laptop 4 running Windows 11. The most recent iterations of the Xbox Series X|S have improved our awareness of full ecosystem energy usage from consoles, information which is critical to future energy efficiency improvements and emissions reductions.

Software design can also increase efficiency. We are focused on offering low-emissions usage options such as Energy-saving mode on Xbox, which can reduce power usage during standby mode from 15 W down to 0.5–2 W, as well as Xbox Cloud Gaming, which will be powered by Azure datacenters running on 100% renewable energy by 2025. With the release of energy-saving mode, we are updating the initial bootup experience for users to provide clear messaging to enable user understanding of power modes, while encouraging them to implement energy-saving mode on their consoles. This will be paired with a reduction in idle and shutdown timers to continue to improve power consumption during console idle periods.

## Providing transparency for customers

To increase transparency for customers and stakeholders, we publish LCA results for our Xbox consoles and Surface devices. The LCA results are contained in our Ecoprofiles, along with information about the product's material composition, energy consumption, packaging, ecolabels, product recycling, and other environmental attributes.

We have also developed a new, dynamic way for commercial customers to gain insight into the carbon footprint of their entire Surface device fleets. The Microsoft Surface Emissions Estimator enables sellers to work with customers and estimate the carbon impact of the Surface devices and key accessories they purchase from us.

# Getting to carbon negative (continued)

## Supply chain

In July 2020, Microsoft added additional sustainability requirements to its Supplier Code of Conduct to support the company's bold carbon ambitions. This new language requires suppliers to disclose their own carbon footprints and develop plans to reduce them. Microsoft has spent the past year rolling out these requirements to a subset of its suppliers and building a program to support them.

### Engaging with suppliers on reduction roadmaps

In July 2021, 87 percent of Microsoft's in-scope suppliers reported their emissions to CDP, up 12 percent from 2020. Following the closure of the CDP cycle, we worked with suppliers to build action plans of emission reduction activities leading up to 2030. This included educational webinars and one-on-one meetings with suppliers to dive into their individual footprints and discuss relevant reduction levers. Microsoft also provided suppliers with resources to aid in their reduction efforts. We continue to believe that for Microsoft to reach our reduction goals, collaboration with suppliers is fundamental and we look forward to continuing the journey together.

In 2021, we released a set of in-depth capacity-building tools and resources to help our suppliers report their GHG emissions, develop clean energy strategies, and reduce their energy-related emissions.

### Providing new tools and training for supplier reporting

When Microsoft rolled out emission reporting and reduction requirements in our Supplier Code of Conduct, the top feedback from suppliers was the need for simple yet comprehensive resources to walk them through the carbon accounting process. In response, we released a set of in-depth capacity-building tools and resources, developed in partnership with ENGIE Impact, WSP, and CDP to help companies, and particularly our suppliers, report their GHG emissions, develop clean energy strategies, and reduce their energy-related emissions. In September 2021, LinkedIn released a new course, Fundamentals of Sustainable Supply Chain Management, to help organizations and professionals more effectively engage with their suppliers.

### Building new forms of financing for suppliers

Based on our engagements with suppliers, we knew more technical resources were necessary but insufficient to drive change. Our suppliers need access to new forms of finance to invest in new solutions. This year, we launched a new partnership with the International Finance Corporation (IFC), a member of the World Bank Group. IFC will work with designated Microsoft suppliers in emerging markets, starting in Asia, to identify technical solutions reducing GHG emissions, provide implementation assistance, and offer financing solutions to help them make investments in more efficient and low-carbon operations.

### Reimagining circularity in our supply chain

We have taken a first-of-a-kind approach towards designing and implementing Circular Centers in our datacenter campuses, aligning our end-of-life dispositioning processes with an integrated plan across the entire supply chain. From sustainable design at the start of an asset lifecycle to sustainable sourcing, manufacturing, delivery, and use, towards a diversified approach after decommissioning, this integrated plan ensures that assets are dispositioned to optimize value, security, compliance, and sustainability. Over the past year, we have engaged with new suppliers who are able to remanufacture assets and components, effectively enabling new lifecycles for our assets. We have successfully demonstrated takeback/buyback models with our original asset suppliers, closing the loop on assets and enabling suppliers to repurpose or reuse assets and components, resulting in significant sustainability outcomes for emissions reduction and material recovery. Our Circular Center program will enable 90 percent reuse of datacenter computing assets, significantly contributing to our goal of reducing emissions by more than 50 percent by 2030. In FY21, our overall reuse of assets was 78 percent.

### Using lifecycle assessments for targeted hardware improvements

As we outline in Chapter 4 of our Responsible Sourcing 2021 Report, we are executing an ambitious plan to empower all strategic device suppliers to commit to science-based carbon reduction activities specifically targeted to reduce emissions associated with hardware manufacturing. We have used LCAs to prioritize supplier categories that contribute the greatest emissions as well as the types of actions suppliers can take to make the biggest shifts in decarbonization, including powering their operations with renewable energy, increasing process and energy efficiencies, and reducing material use and waste onsite.

To learn more, see Chapter 4 of the Responsible Sourcing 2021 Report

# Getting to carbon negative (continued)

## Removing carbon

In January 2021, Microsoft announced that we had made the world's largest purchase of carbon removal in history. Our focus on removals instead of avoided emissions offsets is aligned to our carbon negative commitment but is also motivated by what climate science tells us is needed to reach net zero—specifically the IPCC's projection that the planet could need as much as 10 gigatons of carbon dioxide removal by mid-century, depending on the scale and pace of decarbonization. With our purchases as well as our investments, we are working to help build this new market with integrity and quality.

It hasn't been easy. As we documented in our September 2021 Nature article, high-quality carbon removal is scarce for three reasons. First, there is not a clear common definition of net zero and the role that removals play in net zero goals. Second, removals are not well accounted for in the practice of carbon measurement, which itself is still evolving. And third, the removal market is very young, especially for truly permanent carbon removal, which is prohibitively expensive.

We know that we're among the early entities to do homework on this topic, and that's why we are committed to sharing lessons learned, as documented in our 2021 white paper and high-quality removal criteria. We are actively working with our Climate Innovation Fund to invest in promising carbon removal companies. We have contributed comments to policy frameworks that set the standards for carbon removal, such as a carbon removal certification program by the European Commission, and efforts by the United States federal government (both the Department of Agriculture and the Department of Energy) to specify high-quality removal. And we continue to evolve our own removal portfolio mix to be a balance of low-durability and high-durability volumes.

## Carbon removal projects

In our first year, we chose projects that will help meet our commitment while supporting innovation in the market, including the following.

### Community-based reforestation

Taking Root's CommuniTree reforestation in Nicaragua—the largest such project in the country—partners with farming families to help develop sustainable livelihoods by growing native tree species on marginal farmland. The United Nations and the European Union have used this project as a model for reforestation.

### Biochar

We invested in a portfolio from Puro.earth Oy, including from Carbon Cycle, Carbofex, and ECHO2, small operations in Germany, Finland, and Australia that use biomass residue (for example, wood chips and forest waste) to sequester carbon dioxide in biochar for use in soil amendment and other products.

### Direct air capture

We are actively working with our Climate Innovation Fund to invest in promising carbon removal companies and projects. Climeworks' Orca direct air capture plant in Iceland removes carbon dioxide from the atmosphere and stores it permanently underground using a mineralization technology developed by the Icelandic company Carbfix.

Our FY22 aspiration was even larger, aiming for 1.5 million $mtCO_2$. We launched a new request for proposals in July 2021, seeking the highest quality of projects on the market, both nature-based and engineered. We are on a path to fulfilling that goal, with 1.1 million $mtCO_2$ contracted to date in FY22.

**1.1M $mtCO_2$**

removal contracted to date in FY22.

Looking ahead, we know that the market needs to improve the quality of carbon removal accounting, and that we need to have a clearer line of sight to affordable supply. That's why in 2021 we undertook the following projects.

- In partnership with Carbon Direct, we published our carbon dioxide removal guidance. These criteria are our minimal viable specifications for the most common project types that we will consider for procurement. We will continue to expand on our criteria as the market adapts and see this as part of our market development work.
- We funded research by CarbonPlan to produce their lessons learned and analysis from a systematic review of 14 protocols for soil carbon offsets for buyers from projects in the voluntary market today.
- We commissioned a report from Lawrence Livermore National Laboratory on likely carbon removal supply and cost projections for 2030, which will be available in Q1 of 2022.
- We collaborated with researchers from the University of Vermont, University of Minnesota, Concordia University, and Simon Fraser University to develop and explore the climate implications of temporary carbon storage in nature as a means to inform our carbon removal strategies.
- We co-founded the Business Alliance for Scaling Climate Solutions and the carbon removal workgroup of the World Economic Forum's Alliance of CEO Climate Leaders.

# Driving transformation

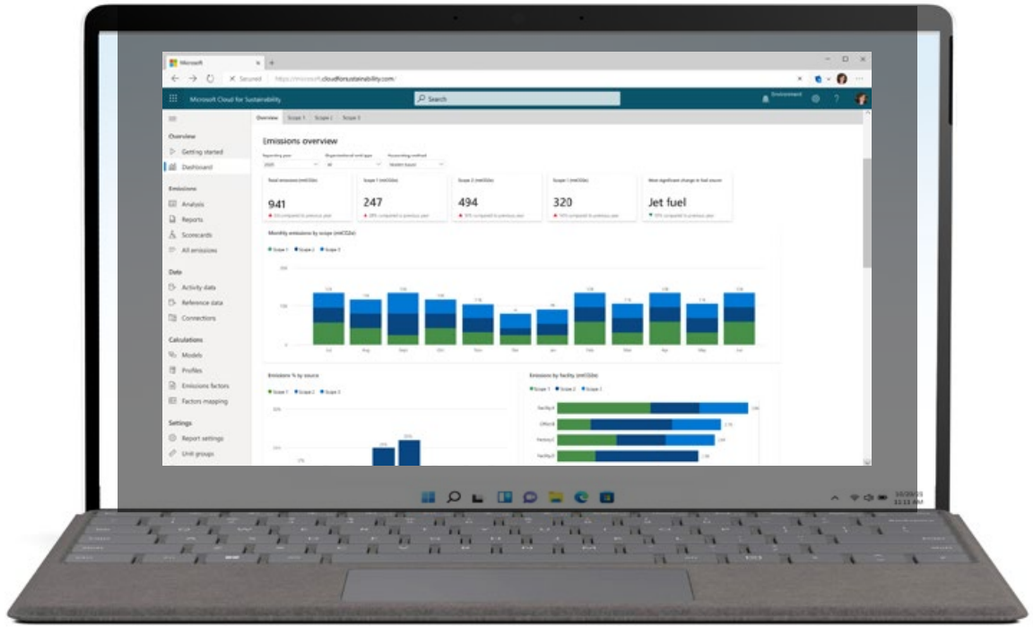
Microsoft and our partners have been investing in technologies across every industry and region to help companies face new and shifting market conditions. The rapid pace of this transformation has the potential to change the world for the better.

The world's climate experts agree that people, companies, industries, and nations must take urgent action to reduce carbon emissions. Reducing carbon emissions and addressing environmental equity require collective measures to understand and mitigate environmental impacts.

Organizations need to be able to record their environmental footprint, report to stakeholders, reduce their resource usage, remove their footprint through carbon offsets or recycling, and replace high-footprint resources with low-footprint ones.

## Product

Microsoft is leading new product innovations for the benefit of our planet. With new offerings ranging from providing transparency on the footprint of our devices and services, to digital supply chains that improve business processes and reduce carbon footprints, to IoT sensors streaming real-time telemetry for predictive analytics, there is no shortage of examples of how technology can enable ambitious sustainability outcomes.




The Microsoft Cloud for Sustainability enables companies to record, report, and reduce emissions.

## Microsoft Cloud for Sustainability

Microsoft launched the Microsoft Cloud for Sustainability in July 2021. The Microsoft Cloud for Sustainability provides comprehensive, integrated, and automated sustainability management for organizations at any stage of the sustainability journey. It is designed to streamline the process for organizations to collect data, analyze data, and turn data into insights. Companies can more effectively record, report, and reduce emissions on a path to net zero, and we plan to support water and waste tracking in the future. Since the announcement, we've brought the Microsoft Cloud for Sustainability into a public preview period, with several customers using it to guide their sustainability strategies. Microsoft is also serving as "customer one," shaping product requirements and beginning to adopt this for our own emissions reporting.

# Driving transformation (continued)

## Delivering transparency on Microsoft product emissions

While the Microsoft Cloud for Sustainability may be the first standalone sustainability-focused product at Microsoft, it's not our first work on emissions tracking and reporting. For more than two years, we have pioneered tools and features to provide a close to real-time view of our products' footprint, and we continue to deliver more transparency to customers.

**The Azure Emissions Impact Dashboard** provides customers with transparency into their carbon emissions resulting from their cloud usage, making Microsoft the only cloud provider to provide full transparency to customers across all three scopes of emissions. Using AI and advanced analytics, the Emissions Impact Dashboard shows reduction trends for customer cloud usage over time, providing the ability to forecast cloud emissions and simplify carbon reporting. It uses consistent and accurate carbon accounting to quantify the impact of Microsoft cloud services on customers' environmental footprint and can compile the information into reports for voluntary or statutory reporting requirements. This solution became generally available in Q3 2021.

Find out more on the Emissions Impact Dashboard

**The Microsoft Surface Emissions Estimator** is a new, dynamic way for 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 to enable customers to get more accurate estimations of the carbon impact of the Surface devices they purchase from us. Taking the customer on a journey through a Surface product's lifecycle, the Estimator provides a visual indication of improvements over previous product models, highlights some of the changes made to reduce carbon emissions, and estimates carbon reductions associated with deployments of new Surface models. Customers can learn more about the impact of Surface products on their Scope 2 and 3 emissions from the Microsoft support team, who started to use the Estimator to provide reports to commercial customers in late 2021.

**The Microsoft Teams Carbon Avoidance Screen** posts a remote meeting summary of avoided carbon based on the distance between the organizer and the participant. The goal is to encourage people to use Teams' remote capabilities rather than travel for meetings. This will pilot with a few select customers in 2022.

For **Windows energy usage**, we are co-innovating with third parties to help inform customers about the carbon footprint associated with their computing. One partner, elow (formerly CSN Energy), was able to reduce use-phase carbon emissions up to 6 percent through a co-innovated elow Carbon App by providing guidance to users to charge their computers based on the real-time carbon intensity of the electric grid. Another, AVOB, provides more accurate energy consumption data to office workstations as well as automated mechanisms to optimize energy consumption, enabling up to a 50 percent reduction in energy usage while increasing performance and computer lifespan.

Reflective of the innovation we continually pursue, some of these tools have more advanced methodologies than Microsoft currently uses for its corporate carbon disclosure.

## Providing solutions for specific sustainability challenges

We have found new opportunities to use Microsoft solutions to more sustainably manage operations. We started with our own operations and are expanding their use beyond our direct business activities.

### Managing buildings and spaces

Microsoft is accelerating sustainability through Smart Places, with IoT and AI to optimize the way buildings, campuses, and cities consume and deliver resources and create efficiencies. Based on Azure IoT, Smart Places include data-driven technologies for monitoring and managing carbon, water, and waste in buildings to turn inefficiencies into opportunities to reduce environmental impact. Organizations can optimize energy management and reduce carbon emissions by using predictive monitoring to help manage equipment performance and energy consumption and to explore grid-interactive efficient buildings and infrastructure.

### Providing visibility across supply chain

Microsoft Dynamics 365 Supply Chain Insights breaks down data silos by connecting and taking inputs from enterprise resource planning and supply chain systems across an organization. Using industry data models and AI-powered weather and environmental risk signals from Bing and third-party sources, operations can get a better view of climate-related risk to build a more resilient supply chain.

For more than two years, we have pioneered tools and features to provide a close to real-time view of our products' footprint, and we continue to deliver more transparency to customers.

# Driving transformation (continued)

## Customers and partners

### Matching the supply and demand of carbon sequestration with AI and machine learning

Project Acorn, developed by Rabobank, is a global, transparent, and technology-enabled marketplace and ecosystem for carbon sequestration. The proposition facilitates agroforestry projects among smallholder farmers in developing countries that sequester carbon in biomass through tree growth; the carbon removal units that result from this represent actual sequestration. To make small-size projects on an individual farmer level economically viable, Project Acorn uses remote sensing technologies, including the analysis of satellite imagery by specialized partners. The architectural design was built on a Dynamics 365 platform and uses customized Azure functionality.

### Optimizing offshore wind turbines with AI

Algo Engines and Microsoft helped Ørsted, the world leader in offshore wind energy, to optimize the performance of more than 1,300 turbines on its wind farms, enabling it to fully phase out coal by 2023 and increase offshore wind capacity to 15 GW (enough for 30 million people) by 2025. Ørsted uses Microsoft Azure AI to determine where new turbines should be deployed. Previously, the computations for the foundations alone took weeks. With the cloud, that time is reduced to four to eight hours. The company also uses drones to inspect equipment and predictive maintenance to ensure all equipment is running at peak performance.[8]

**1,300**

Microsoft helped Ørsted optimize the performance of more than 1,300 turbines, enabling it to fully phase out coal by 2023 and increase offshore wind capacity to 15 GW by 2025.

### Targeting carbon neutrality with Azure Digital Twins

Vasakronan, Sweden's largest real estate company, manages a real estate portfolio worth SEK170 billion (USD19.6 billion). To reduce operating costs for its commercial properties, the company has adopted ProptechOS, an Azure IoT-based solution that unlocks the potential of connected, intelligent properties. By adding Azure Digital Twins to this solution, in 2021 the company has saved upwards of 6 million krona (USD700,000) in energy consumption cost alone. By focusing on sustainability improvements, equally important to tenants, the company has experienced higher incomes through increased occupancy while simultaneously driving higher asset values.[8]

### Improving service efficiency with remote assistance

Mercedes-Benz USA chose Microsoft Dynamics 365 Remote Assist and HoloLens 2 technologies to improve service technician efficiency, reduce time to diagnose, and lower the cost and environmental impact of service-related travel. With Dynamics 365 Remote Assist and HoloLens 2, problems are typically resolved remotely without having to wait for a Field Service Engineer to visit the dealer. Travel has been cut by up to 40 percent, significantly lowering their carbon footprint.[8]

### Enabling building decarbonization with AI

Nomad Go used the Co-Innovation Labs, recently launched by Sony Semiconductor Solutions Corporation and Microsoft, to build a version of its building decarbonization solution using Azure Cognitive Services for computer vision with Sony's IMX500 intelligent vision sensor. Nomad Go's platform anonymously counts the number of people within a space (such as conference rooms or open areas), and then uses the real-time data to precisely heat, cool, and ventilate rooms only when occupied. This replaces set schedules, standard in most commercial buildings, which condition rooms for 12 hours or more a day, even when no one is in the space. The Nomad Go solution significantly reduces energy usage and greenhouse emissions by up to 38 percent.[8]

Vasakronan uses an Azure IoT-based solution for connected, intelligent properties.

# Enabling systems change

We know that our action alone will not address the climate crisis. 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 get to carbon zero.

At Microsoft we know that our action alone will not address the climate crisis, so we must help develop the markets for carbon abatement approaches. This is a partnership between our operational sustainability program, Climate Innovation Fund, and Microsoft Research to ensure that we are not only procuring and funding the technologies we need to meet our commitments, but also investing in the companies that provide them—and supporting research and development for pre-commercial solutions.

## Research and development

Researchers at Microsoft tackle critical challenges that will shape the future of the world and the company. Given the significance of sustainability challenges for our global future, research teams around the world are developing new technologies and approaches to reduce carbon, use compute resources more efficiently, and bring AI to bear on problems from carbon emissions modeling to improvements in renewable energy.

### Improving reliability of carbon removal projects

Afforestation (growth of net new trees) pulls carbon from the atmosphere. Trees on farms can also improve agricultural productivity and provide additional income to farmers through the sale of carbon credits. Buyers of such credits, however, want to ensure that the farmer is properly incentivized to safeguard tree growth over time. Using the lens of contract theory, Microsoft research shows how to calculate the optimal stream of payments over time to ensure incentive alignment. This research can be applied to enlarge the supply of carbon reduction credits, especially outside the developed world.

Trees on farms can provide additional income to farmers through the sale of carbon credits. Using contract theory, Microsoft research shows how to calculate the optimal stream of payments to ensure farmers are properly incentivized to safeguard tree growth over time.

### Reducing the energy impact of AI

Many AI tasks, like predicting the next word a person will type, rely on machine learning with neural networks, also known as deep learning. These neural networks can unlock new sustainability solutions, but also can consume a lot of energy. In a new effort, we are building tools for AI developers to predict the energy consumption of a neural network before deployment, so that more compute- and energy-efficient networks can be designed upfront. We have progressed on other techniques enabling more efficient networks, including factorizable neural operators (FNO), a compression technique that affords reductions in compute and memory requirements. Applied to large-scale language models such as BERT, FNO reduced memory usage by 80 percent and prediction time by 50 percent, with less than a 5 percent reduction in accuracy. Further improvements may be achieved by combining FNO with other model compression methods, such as distillation and quantization. Collaborating with researchers at NVIDIA, we've developed a new method to find neural networks that satisfy hardware constraints, such as low power consumption for mobile devices. This highly efficient method can find high-performing architectures in minutes, enabling carbon savings compared to previous methods. We also advanced AI systems research to explicitly optimize for server power reduction, in addition to capacity efficiency; this work has resulted in a multi-GWh/year reduction of power consumption for Azure and Microsoft 365.

# Enabling systems change (continued)

## Predicting the efficacy of carbon reduction strategies

By using deep learning methods, we have predicted carbon reduction and other climate-related outcomes with much faster turnaround times, and similar or better predictive accuracy, than using traditional physical simulation models. For example, with the University of Tokyo, we developed a neural network-based model that can simulate physical and chemical processes critical to carbon storage, such as the formation of hydrates that can fill cracks between sand and rocks under the ocean floor, thus playing a critical role in ensuring safer thousand-year storage of carbon. With this model, we were able to accurately predict hydrate formation 1,000 times faster than with numerical models. With Tsinghua University, we developed a neural network-based atmosphere simulator that estimates carbon and other pollutant emissions with better accuracy than widely used numerical atmosphere models, while using only 1 percent of the computational cost. For simulations of the behavior of fluids in the atmosphere to better understand the diffusion of pollutants and the global warming effect, we invented a neural network-based model to solve the necessary partial differential equations, delivering accuracy on par with traditional numerical solvers while delivering results 50 to 100 times faster.[8]

## Solving solar manufacturing problems before they start

Satisfying the growing global demand for renewable energy requires reducing costs and better integrating renewables into electricity and transportation grids. In collaboration with one of India's largest solar panel manufacturers, Microsoft researchers developed a machine learning-based computer vision system that can accurately detect and classify defects in solar panels as they are being manufactured. By fixing defects in real time, solar panel manufacturers can achieve higher yield and lower production costs, and solar energy operators can produce more energy per panel.

## Supporting new carbon reduction roadmaps

Carbon Insights is a visualization and analysis platform that provides carbon neutralization roadmaps for researchers, policy audiences, and other sustainability decision-makers. Dashboards and maps combine local detail with global consistency to show daily carbon emission sources, sinks, and flux with near-global coverage. The tool is based on data aggregated from Tsinghua University research and public datasets. It provides strategic insights for challenges such as prioritizing local emissions reductions or estimating impacts on economic growth.

Deep learning to predict carbon reduction and other climate-related outcomes.

**1%**

We developed a neural network-based atmosphere simulator that estimates carbon and other pollutant emissions with better accuracy than widely used numerical atmosphere models, while using only 1 percent of the computational cost.

# Enabling systems change (continued)

## Funding innovation

To achieve net zero emissions globally, we must reduce carbon emissions across every sector and scale carbon markets as much as possible, as soon as possible. From the outset, the Climate Innovation Fund (CIF) has identified and prioritized investment in sectors that have the largest carbon reduction and removal potential globally and where Microsoft's carbon footprint is greatest. We also make strategic philanthropic investments, like our $100 million donation to Breakthrough Energy's Catalyst initiative, to help accelerate and scale new carbon solutions.

Our initial CIF investments included innovations in market-enabling technologies such as climate impact certification, forest carbon analytics, and carbon transformation, plus industry-specific carbon reduction via sustainable fuels, distributed energy integration, and supply chain optimization technologies. Additionally, we have made investment commitments in carbon reduction solutions for global communities in emerging economies, including India and Africa, as well as clean energy access solutions for communities in the United States.

## New CIF investments in 2021 include:

### Market-enabling

#### Climate impact certification

SustainCERT is a software-enabled carbon emissions accounting and verification platform reimagining a future where issuance of high-quality carbon credits and other impact claims becomes scalable with integrity. SustainCERT has certified over 1,200 projects around the world.[8]

#### AI-enabled forest carbon exchanges

NCX (formerly SilviaTerra) is a science-driven forest carbon marketplace delivering large-scale, immediate impact for climate and communities. By using high integrity data to generate carbon credits that connect corporations to family forests, NCX is democratizing access to markets while enabling real climate action. In 2021, nearly 2,500 participating landowners with 4.3 million forested acres committed to defer their timber harvest.[8]

#### Transformation to low-carbon materials

Twelve is a carbon transformation company turning carbon dioxide into valuable materials and products. Its solution offers a pathway to replace fossil-derived carbon in essential products ranging from detergents to automotive parts. In 2021, Twelve produced the world's first jet fuel made from $CO_2$ using electrolysis. The CIF investment is supporting the scale-up of Twelve's system to industrial scale.

With NCX's science-driven forest carbon marketplace, nearly 2,500 participating landowners with 4.3 million forested acres committed to defer their timber harvest in 2021.

## Industry decarbonization

#### Sustainable fuels

LanzaJet is a sustainable fuels technology company and producer dedicated to decarbonizing hard-to-abate sectors, such as aviation. LanzaJet is constructing a renewable fuels plant in Georgia called Freedom Pines Fuels that will produce 10 million gallons of SAF and renewable diesel per year from sustainable ethanol, including from waste-based feedstocks.[8]

#### Distributed energy resources

AutoGrid delivers a suite of distributed energy applications that allow utilities and energy service providers to deliver clean, flexible power. In 2021, AutoGrid enabled a set of unified demand response and distributed energy resource programs totaling 165 MW in Texas, enabling peak plant flexibility for both grid resilience and renewable integration.[8]

#### Solar performance assurance

Omnidian provides solar system performance management for residential, commercial, and industrial clean energy generation. Omnidian's network of assets include 326 MW*, with incremental production from Omnidian's services resulting in 14,090 $mtCO_2$ avoided in 2020. (*These figures do not include Omnidian's systems under backup management.)[8]

## Emerging economies

#### Green growth in India

Eversource Capital's Green Growth Equity Fund is committed to accelerating India's rapidly growing climate innovation sectors, spanning electric mobility, renewable power, and circular economy solutions. To date, Eversource Capital's portfolio companies have generated 330 MWh of renewable power, resulting in 290,000 $mtCO_2$ avoided.[8]

# Enabling systems change (continued)

## Other 2021 investments include:

- **Just Climate**, a global, climate-led investment business focused on scaling capital towards the most impactful climate solutions.
- **Buoyant Ventures**, a venture capital fund focused on digital solutions for climate risk.
- **Carbon Direct Fund**, a growth equity fund dedicated to investing in high-growth carbon removal and utilization technology leaders.
- **Earthshot Ventures**, a climate technology venture capital fund, spun out of Elemental Excelerator that builds on their global network of customers, investors, corporations, and policymakers. Earthshot Ventures invests in hardware and software technologies in energy, mobility, food, industry, and carbon.
- **Energy Impact Partners Elevate Future Fund,** a venture capital fund focused on creating a more diverse founder community and inclusive venture capital ecosystem within the broader energy transition.
- **Energy Impact Partners Frontier Fund**, a venture capital fund which invests in emerging technologies providing solutions for the deep decarbonization of asset-intensive industries.

## Impact from our 2020 investments include:

### Supporting clean energy in Asia

Via the Southeast Asia Clean Energy Facility (SEACEF), we invested in Xurya, a clean energy company committed to accelerating the rooftop solar market in Indonesia. It executed the first wave of projects with 16.5 megawatts peak (MWp) in operation and 16.6 MWp under contract for construction as of November 2021, up from 0.8 MWp installed at the time of SEACEF's investment. In the 12 months following SEACEF's investment, Xurya produced 6,765 MWh resulting in 5,800 $mtCO_2$ avoided.[8]

Carbon savings from the deployment of smart thermostats across SmartRent's portfolio in 2020 were 55,000 MWh of energy, 5.5 million gallons of gasoline equivalent, and a net carbon savings of 68,000 $mtCO_2$.[8]

### Saving energy with smart home automation

Energy Impact Partners (EIP) Fund II participated in SmartRent's $60 million Series C funding round. SmartRent is a smart home automation platform which provides property managers with visibility and control over assets and delivers a smart home experience to residents in the United States and Canada. Environmental savings from the deployment of smart thermostats across its portfolio in 2020 were estimated to be 55,000 MWh of energy, 5.5 million gallons of gasoline equivalent, and carbon savings of 68,000 $mtCO_2$.[8]

### Addressing air pollution and climate inequities

In September 2021, *The Proceedings of the National Academy of Sciences* published a study that found that Hispanic and Black people in the San Francisco Bay Area experienced up to 30 percent higher air pollution than average. Drawing from Aclima's mobile measurements, the authors including UT Austin, UC Berkeley, and Aclima scientists found that substantial disparities arise from regional and local differences in pollution. These findings show that combining hyperlocal air pollution data with demographic data is an important way to identify disproportionate impacts that go unseen using traditional methods and can help decision-makers target emission reduction and mitigation efforts where they are needed most.[8]

Learn more about CIF here

Aclima's mobile measurements can help decision-makers target emission reduction and mitigation efforts.

# Enabling systems change (continued)

## Investing in AI

Through our AI for Earth program, we are supporting startups and nonprofits capitalizing on the cloud, data, and AI to accelerate the pace of innovation in carbon.

### Mapping forest carbon potential down to individual trees

The University of Maryland is applying machine learning algorithms on airborne lidar data, collected over the entire state of Maryland, to identify individual trees to measure forest carbon storage, thereby reducing uncertainties in current carbon monitoring prototypes used for measurement, reporting, and verification purposes in forest management and climate initiatives.

### Calculating carbon stocks with AI-based monitoring

Jejak.in is applying AI to automatically classify and label photos captured by drone cameras and satellites in the Citarum Watershed area in West Java, Indonesia, for a more effective and efficient method to identify trees and vegetation, as well as calculate carbon stocks in the area. This will be used to help monitor the success of conservation programs and make better decisions about future programs.

Machine learning to automatically distinguish and quantify Mexico's mangroves from drone and satellite imagery.

## Estimating mangrove biomass and carbon storage with remote sensing and machine learning

The University of California San Diego is using remote sensing technology and machine learning to better characterize mangroves, guide management of the habitat, and curb mangrove deforestation by increasing the availability of reliable data on mangrove coverage and extent. The Aburto Lab and Engineers for Exploration are developing a methodology that uses machine learning to automatically distinguish and quantify Mexico's mangroves from drone and satellite imagery, resulting in an improved understanding of how mangrove distribution changes through time, as well as the ability to estimate mangrove biomass and calculate the carbon storage.

# Enabling systems change (continued)

## Driving collective action

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

### Transform to Net Zero

Transform to Net Zero (TONZ) is a cross-sector initiative to accelerate the transition to a net zero global economy. The group's 2025 goal is for all Fortune Global 1000 companies to have targets backed up by transformation plans to achieve net zero no later than 2050. TONZ's strategy is to achieve this through enabling business transformation, taking collective action, and driving systemic change. This includes a focus on demonstrating the transformation of members' own businesses and inspiring transformation in other companies. Since its initial launch in late 2020, TONZ has released a position paper and action plan to define the group's position on net zero goals and their implementation, formed decarbonization approaches across key supply chain areas, and published two research reports on the building blocks of net zero and key sectoral challenges. In Q3 2021, TONZ published the first of a set of transformation guides to share lessons learned from TONZ companies on net zero implementation across procurement, net zero goalsetting, and policy engagement.

See TONZ Position Paper and Action Plan here

### Business Alliance to Scale Climate Solutions (BASCS)

Launched in 2021, BASCS aims to bridge the gap in climate finance by providing a central platform for businesses and experts to meet, learn, discuss, and act together. As a founding member of the alliance, Microsoft is sharing our resources and experiences as an early adopter of climate solutions, as well as an investor providing catalytic capital for nascent and first-of-a-kind climate solutions.

### Carbon Removal Climate Action Group

Microsoft co-founded the Carbon Removal Climate Action Group of the World Economic Forum (WEF) CEO Climate Leaders Alliance to help raise corporate awareness about the importance of carbon removal. The alliance will also create a due diligence platform and a joint purchasing strategy for carbon removal.

### Sustainable Aviation Fuel Buyers Alliance (SABA)

In April 2021, Microsoft was announced as one of the founding members of SABA. Led by RMI and the Environmental Defense Fund (EDF), SABA will work to accelerate the path to net zero aviation by driving investment in SAF, catalyzing SAF production and technological innovation, and supporting member engagement in policy-making efforts.

### Playing for the Planet

Our gaming business has partnered with the United Nations Environment Programme on the Playing for the Planet initiative. Its goals are to reduce the impact of the gaming ecosystem on the environment through better carbon accounting and educating gamers everywhere on sustainable causes. For example, the Minecraft Build a Better World Initiative delivers in-game content about the need to protect and conserve, and matching funds to charitable organizations focused on conservation.

**2025**

TONZ's 2025 goal is for all Fortune Global 1000 companies to have targets backed up by transformation plans to achieve net zero no later than 2050.

### Green activations in games

Mojang have already established themselves in the gaming community as world leaders in social outreach and education. Minecraft: Education Edition has reached millions of students with build challenges to create sustainable cities of the future, and with curriculum aligned lesson plans on climate and environmental themes. Mojang is committed to continued innovation in sustainability with new projects including the UNESCO Global Build Challenge, Climate Futures in partnership with Met Office, and the Sustainable City Map. By integrating green activations in games and supporting the global environmental agenda through initiatives ranging from planting millions of trees to reducing plastic in their products, we believe Xbox can have significant impact in improving the world.

### Green Software Foundation

Microsoft launched the Green Software Foundation in May 2021 alongside Accenture, ThoughtWorks, and GitHub to create green software industry standards, drive awareness, grow advocacy, and accelerate innovation to enable developers to reduce the carbon emissions of the software platforms that they build. The foundation has grown to 20 members and over 350 individual contributors collaborating on standards, innovation, and education. The first version of the Software Carbon Intensity (SCI) standard, a methodology for scoring software applications, was released in December 2021.

# Enabling systems change (continued)

## Advocating for net zero

Future climate-related risks would be reduced by the upscaling and acceleration of far-reaching, multi-level, and cross-sectoral climate mitigation and by both incremental and transformational adaptation. Those efforts must be guided by policy that accelerates carbon reduction and removal opportunities. Over the past year Microsoft deepened its policy advocacy on carbon and sharpened its focus on net zero goals, energy grid decarbonization, measurement, and markets in the United States and European Union through direct lobbying, engagement, and groups such as the Climate Leadership Council, CERES BICEP Network, Advanced Energy Economy, Climate and Clean Energy Solutions, and the Renewable Energy Buyers Alliance. Microsoft initiatives include the following.

### Net zero policies

Microsoft is encouraging countries to make net zero carbon-aligned national commitments and develop effective implementation plans. Microsoft advocated for the United States' reentry to the Paris Climate Agreement which occurred in January 2021 and for a national US climate target to cut emissions by 50 percent by 2030. We also voiced Microsoft support of the European Commission's "Fit for 55" package, a set of legislative initiatives that will set the framework for the whole EU to achieve the binding target of reducing GHG emissions by at least 55 percent by 2030 (based on 1990 levels).

### Grid decarbonization

Microsoft advocated for strong climate and clean energy provisions in the 2021 US budget reconciliation and infrastructure bills including new siting authority for transmission lines, support for innovative technologies and projects that remove carbon dioxide, modernizing the grid, accelerating clean energy, and strengthening resilience to the impacts of a changing climate. Microsoft actively engages in decarbonization and grid modernization policy efforts in Arizona, Texas, Illinois, and Virginia, and encouraged FERC to issue policy guidance on how to incorporate state-determined carbon prices in wholesale electricity markets. In Europe, Microsoft engages actively with the European institutions advocating for robust clean energy rules and sustainability metrics for datacenters and submitted comments in February to the European Commission Public Consultations on the revisions of the Renewable Energy Directive and Energy Efficiency Directive. Microsoft engaged with the UK government and energy regulator to inform the "Digitalising the UK energy system for net zero" strategy published in July and its implementation.

### Carbon measurement

Microsoft is advocating for common accounting and public disclosure of carbon and climate-related information. In June, Microsoft submitted comments to the US Securities Exchange Commission in support of the development and adoption of disclosure rules that will provide material, decision-useful information for investors. In September, Microsoft filed an aligned response to the UK Financial Conduct Authority's consultation on Carbon Measurement and provided information to the US Department of Defense on climate change disclosure practices to support implementation of the Executive Order on Climate Related Financial Disclosure. In March, Microsoft joined the European Green Digital Coalition, supported by the European Commission, with the goals of developing standardized, credible, and comparable methodologies for calculating the net impact of green digital solutions in different sectors, and accelerating the contribution of digital technology to our collective 2030 goals. Microsoft supported a new academic report by Cambridge Institute for Sustainability Leadership (CISL), exploring how trade and trade-related policies could be used to support decarbonization, focused on the EU Carbon Border Adjustment Mechanisms (CBAM), as part of advancing the conversation around common standards for carbon measurement and accounting.

### Carbon-related markets

Microsoft is advocating a range of policies to help carbon-related markets mature, including carbon pricing and research and development (R&D). Microsoft supported the Washington State Climate Commitment Act, approved in May, which sets a cap on emissions and establishes a robust carbon pricing and investment program. Microsoft advocated for increased US R&D in key technologies such as energy storage and direct air capture, which was included in the 2020 Energy Act and the bipartisan infrastructure package. Microsoft is advancing the development of carbon removal markets and consistent, high-quality carbon removal standards through comments to the US Department of Agriculture and by joining the Carbon Capture Coalition. In August, Microsoft submitted a response to the European Commission Carbon Removal Certification Mechanism survey to advocate for common standards for carbon removal quality and to provide input into the design of a future legislative framework.

Microsoft is advocating for common accounting and public disclosure of carbon and climate-related information.

# Key trends

FY21 was a year of progress and learning for Microsoft on our journey to carbon negative.

### 1 Carbon removal demand is hot—and durable supply is short.

Carbon removal is a seller's market. The pipeline is short for surging demand, and corporate buyers need more project development. Climate change is further complicating this, as wildfires erode the forest carbon purchases we've made and we, as well as other purchasers, need expanded credit buffers to ensure credits we pay for are removing carbon from the atmosphere.

### 2 Progress on carbon reduction will be "lumpy" as carbon data and measurement improves.

As Microsoft and the world mature in carbon accounting, we will continue to get better at understanding how our decisions reduce, or sometimes increase, carbon emissions. For example, some of the data used to estimate hardware emissions within certain categories of Scope 3 is drawn from industry-average "secondary" data rather than directly from suppliers. This data may not be reflective of recent supplier activity, which may cause fluctuations in emissions as primary data from suppliers is introduced.

### 3 Carbon removal still lacks common standards needed to scale.

Projects don't consistently account for durability, additionality, and leakage. To scale the market in the long term, we need the enabling infrastructure to measure, monitor, and verify carbon removal quality now, and we need clear guidelines under the Paris Agreement about how to reconcile corporate and country-level actions. See Microsoft Carbon Removal - Lessons From an Early Corporate Purchase to learn more.

### 4 Climate change is a global issue whose impacts are felt locally.

Displacing incumbent technologies and spurring innovation needs to be supported in all geographies to address the uneven distribution of those impacts—both positive and negative—around the world.

### 5 Small percentages of our emissions require big efforts to address.

For example, diesel fuel accounts for less than 1 percent of Microsoft's overall emissions. But finding solutions to reduce reliance on traditional diesel fuels, which power the backup infrastructure that supports our datacenters, will require significant innovation and investment by those with a much greater stake and reward than Microsoft alone. This same scenario plays out for electrifying our fleet and transitioning to induction cooktops.

# What's next?

## 1 Develop the markets

Longer-term purchasing contracts send a firm demand signal for developers, creating a business case for them to help build plants.

## 2 Drive quality

Microsoft is dedicated to continuing being a pioneer in addressing the climate crisis head on. We will continue to help ensure project quality in the market and drive for more accurate carbon accounting.

## 3 Innovate in renewable energy and carbon reduction

We expect to focus on further innovations in renewable energy, carbon reduction, and carbon-free materials. For example, by using machine learning to forecast electricity load, we can enable grid-interactive datacenter components, such as batteries for backup power, to participate in ancillary energy markets and stabilize an electric grid with a higher penetration of renewable energy sources. We'll conduct new research to inform the technical and business possibilities of co-locating datacenters with offshore wind farms and investigating the feasibility of using supercritical carbon dioxide ($sCO_2$) as a coolant for immersion of servers within the datacenter.

## 4 Pilot diesel-free backup power

We are innovating and piloting other backup power sources in our datacenter regions, which could in the future provide viable replacements for generators. Batteries already supply short-term backup power needs, filling the roughly 30-second gap between a potential outage on the grid and the time it takes to power up the diesel generators. In the future, batteries with a longer duration could replace the role diesel generators play today.

## 5 Reduce embodied carbon

We are continually evaluating design changes and developing new specifications to facilitate deep embodied carbon reductions in our campus and datacenter designs. We are analyzing both the optimal use of conventional materials, such as concrete and steel, and pursuing more ambitious opportunities with emerging alternative materials that carry significantly less embodied carbon. We are also developing solutions to help organizations reduce and manage emissions and energy consumption, such as through Azure IoT solutions for energy and sustainability.

## 6 Continue to invest in carbon removal

We continue to pursue new opportunities to fund high integrity, engineered carbon removal projects. We are also investing in digital tools to scale nature-based carbon removal solutions, such as soil carbon sequestration technologies.

## 7 Decarbonize our supply chain

We will continue refining emission reduction plans with suppliers and ensuring that they have the resources they need to make these reductions with a goal of having the aggregate reductions meet Microsoft's Scope 3 commitment. We will continue to embed sustainability into procurement processes and reset goals, metrics, and incentives to support carbon reduction targets.

## 8 Enable product carbon comparability

In Microsoft's commentary to the Securities Exchange Commission climate disclosure, we predicted, "Individual consumers will have the ability to choose among competing products based on relative carbon emissions, as they do today when it comes to the nutritional content of food products." While many companies report their products' carbon footprints using well-established methodologies, these footprints are not currently comparable due to divergent, non-standard, and proprietary data and assumptions. Microsoft is exploring how to enable new methodologies and standards for comparable product labels that could be used across industries and administered by independent certification or regulatory bodies.

# Resources

## Capacity-building tools and resources

Developed in partnership with ENGIE Impact, WSP, and CDP to help companies, and our suppliers, report their GHG emissions, develop clean energy strategies, and reduce their energy-related emissions.

Find out more here

## Carbon removal program website

Microsoft's carbon removal program webpage that houses content about the program's ambitions and provides resources about our request for proposals.

Find out more here

Microsoft is committed to sharing our progress, challenges, learnings, and best practices throughout our sustainability journey.

## Criteria for high quality carbon removal

Microsoft's minimal viable project type criteria for procurement considerations.

Find out more here

## Carbon dioxide removal guidance

Microsoft's request for proposals (RFP) guidance on project requirements, rules of engagement, and expectations.

Find out more here

## A buyer's guide to soil carbon offsets

A Microsoft-funded independent analysis of the soil projects on the voluntary carbon market and assessment based on four key criteria.

Find out more here

## Reducing embodied carbon in construction

A white paper with an inside look into how Microsoft is reducing emissions during the construction of new buildings and datacenters.

Find out more here

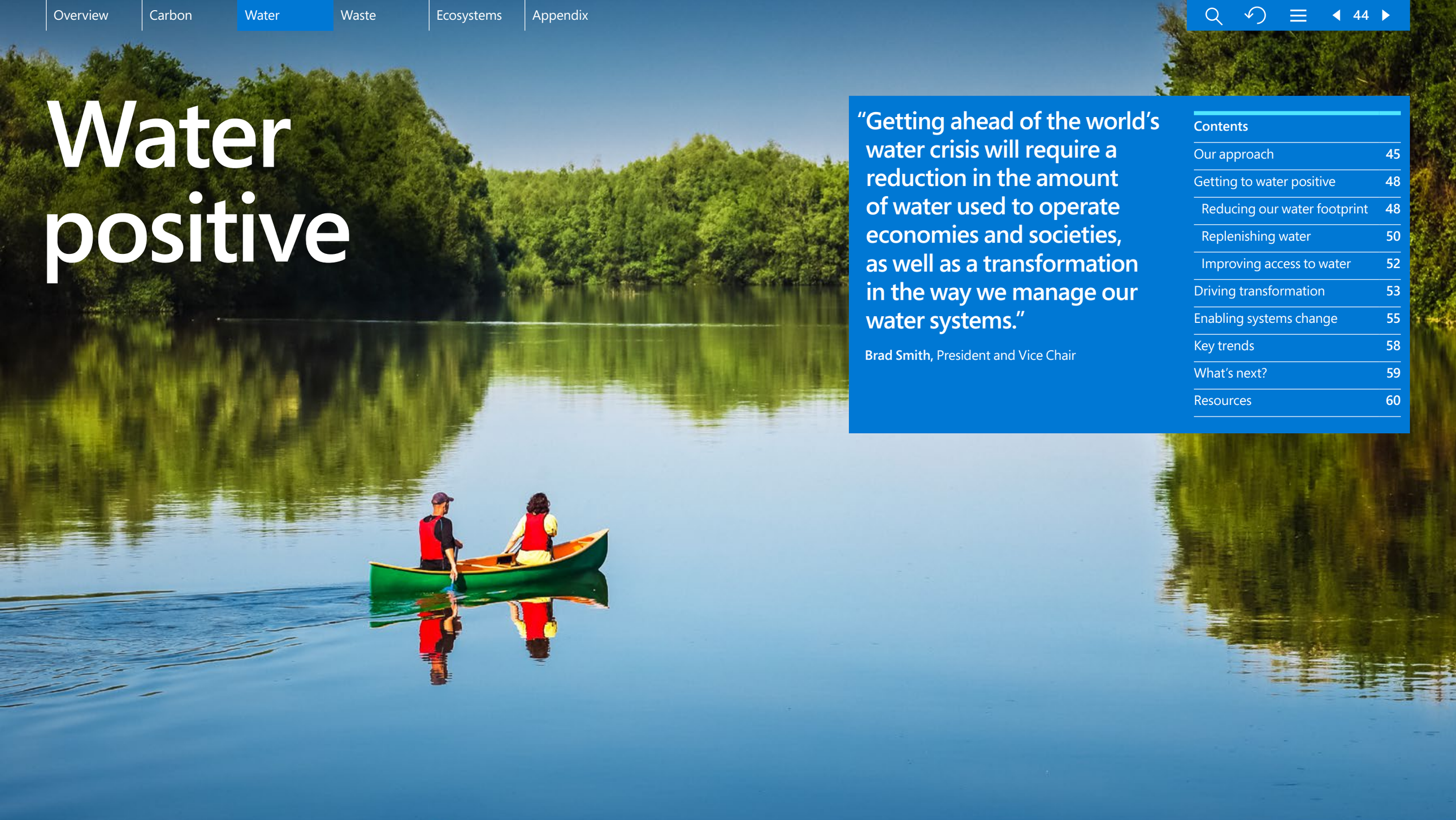
## Principles of Sustainable Software Engineering

A Microsoft Learn course on the competencies needed to define, build, and run sustainable software applications.

Find out more here

We are committed to becoming a carbon negative company by 2030 and helping others on their journeys.

# Water positive



"Getting ahead of the world's water crisis will require a reduction in the amount of water used to operate economies and societies, as well as a transformation in the way we manage our water systems."

**Brad Smith,** President and Vice Chair

Contents

## Our approach

# A commitment to a water positive future

### The context

The scientific consensus is clear: water security and our capacity to safeguard sustainable access to quality freshwater resources is increasingly at risk. There is a global increase in water demand that follows population growth, economic development, and changing consumption patterns. Research by WRI projects that by 2030, there will be a 56 percent deficit in water supply relative to demand if no actions are taken to alleviate this. At present, about 25 percent of the global population lives in countries that suffer from water stress, and one in ten people lack access to safe drinking water.

We are committed to becoming a water positive company by 2030. We will do this by continuing our water stewardship work across our operations, building on the steps taken to reduce the water consumption in our datacenters and campuses over the past decade. In addition to reductions, we aim to become water positive through expanding access to clean water and replenishment projects.

## Our commitment: water positive by 2030

### Replenishing more water than we use by 2030

We will reduce the water intensity of our direct operations and replenish in water-stressed regions where we work.

### Empowering our customers and partners

We will continue to develop solutions to help customers and partners understand water-related risks.

### Reducing water use in datacenter operations

We will reduce water waste in our datacenter operations by 95 percent by 2024.

### Investing in the future of water

We will work with companies around the world to drive innovation and adoption of water technologies.

### Increasing access to water

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

### Influencing policy

We will use our voice at the local, national, and global levels to increase water access and availability, improve quality, and ensure the integration of water into climate strategies.

### Digitizing water data

We will use our technology to generate actionable insights, increase awareness of water issues, and optimize water replenishment.

### Driving collective action

We will partner with others to drive collective action to increase access and reduce water stress.

# Our approach (continued)

## Our progress

### 1.3M cubic meters

In FY21, Microsoft invested in replenishment projects that are expected to generate over 1.3 million cubic meters of volumetric benefits, bringing us to 21 replenishment projects to date in nine water basins across the globe.

### 116 grantees

Through AI for Earth, Microsoft has supported 116 projects that create data-driven solutions supporting water resources monitoring, modeling, and management centered around water.

### 670M liters of water benefit

Our programs with Water.org account for over 670 million liters[9] of water benefit per year in areas facing water scarcity and climate challenges that overlap with our business operations in strategic locations.

### U.S. Water Prize

In 2021, Microsoft was awarded the U.S. Water Prize for Outstanding Private Sector Organization for adopting our water positive program and committing to being water positive by 2030.

### Water access for >95,000 people

Through our partnership with Water.org, we provided more than 95,000[10] people with access to safe water or sanitation.

### Democratizing access to water data

Microsoft, in collaboration with BlackRock and WRI India, supported the Wave2Web Hackathon to help develop new datasets on water stress in emerging markets and improve predictive modeling for better planning of water resources and risk preparedness in cities.

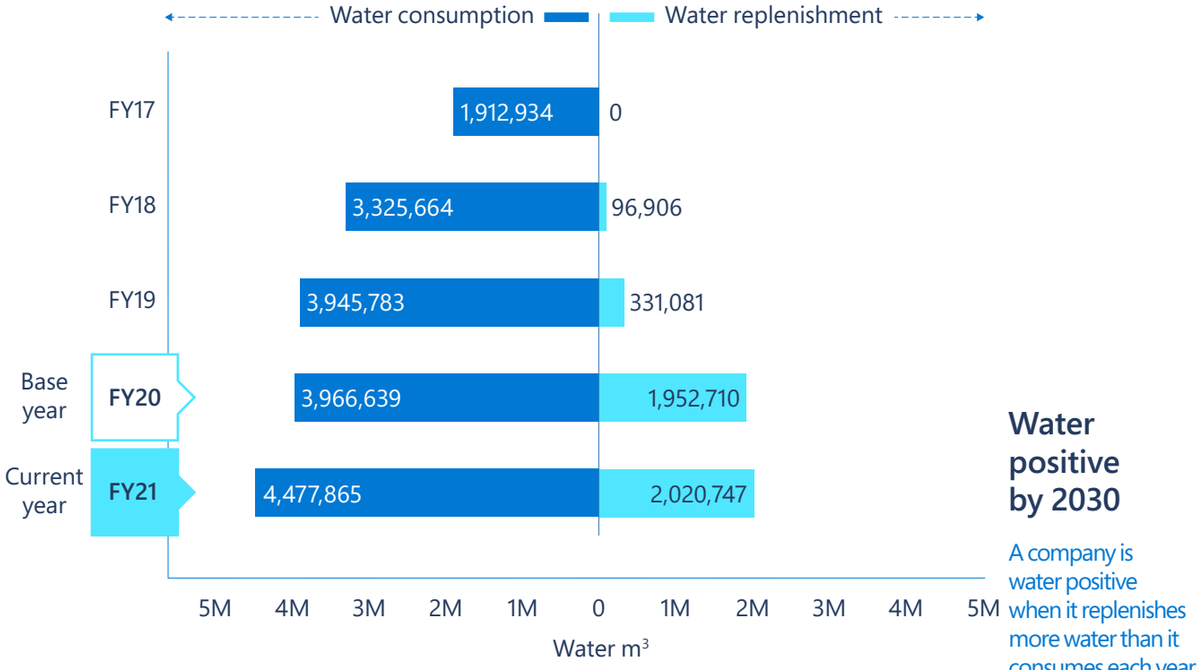
A year of progress and impact to get to water positive by 2030.

# Our approach (continued)

Water Table 1

## Replenishing more water than we use on our journey to become water positive by 2030

In FY21, our contracted water replenishment amounted to 45 percent of our global water consumption across our operations.




### Water positive by 2030

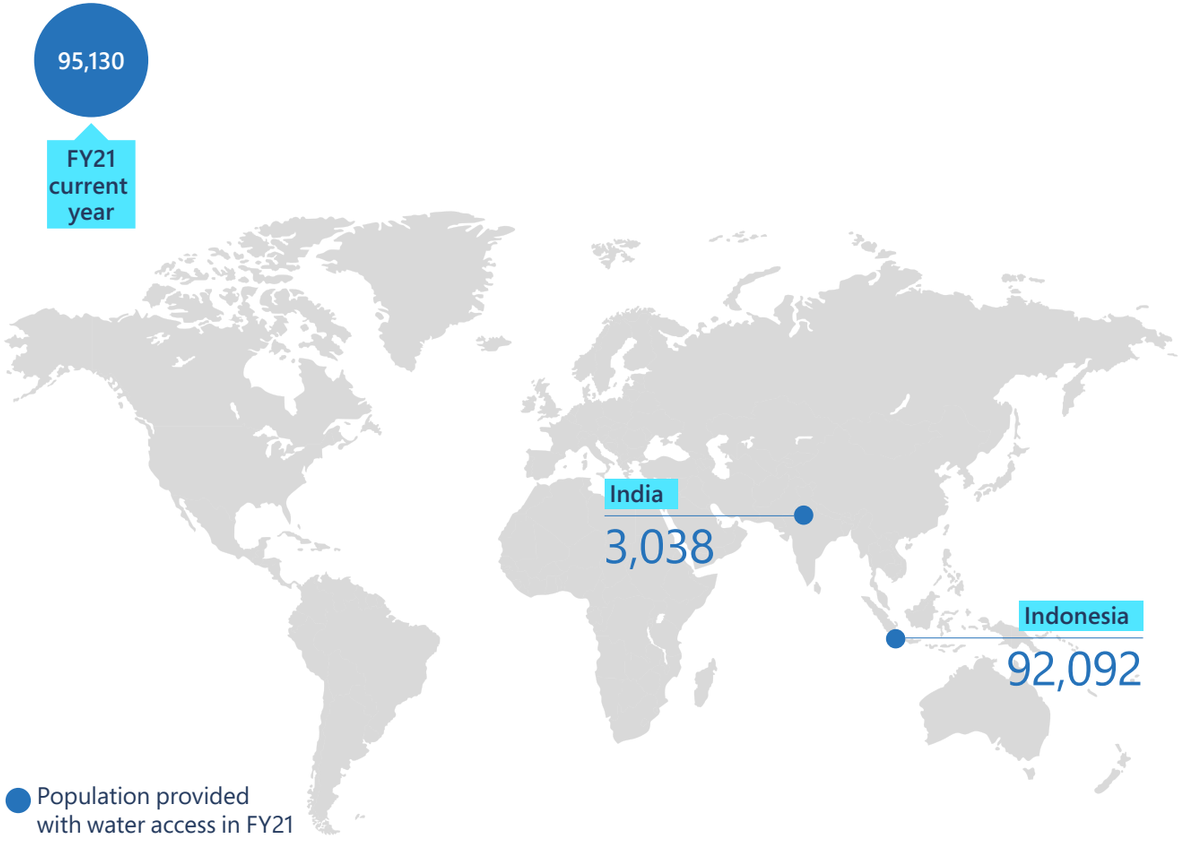
A company is water positive when it replenishes more water than it consumes each year.

a. Reported water replenishment volumes represent total contracted water replenishment projects for each fiscal year. Reported water replenishment volumes may be adjusted once individual projects are completed and volumes verified.

Water Table 2

## Delivering on our commitment to enable the provision of water and sanitation services to 1.5 million people in seven water-stressed countries by 2030

In FY21, we provided 95,130 people with water access across India and Indonesia. From the program's inception through calendar year 2021, we have provided 242,988 people with water access in Mexico, India, and Indonesia.




a. Reported values represent data reviewed and validated by water.org.

# Getting to water positive

To meet our commitment to being water positive by 2030, we will reduce our water footprint across our direct operations, while replenishing and increasing water access in water-stressed regions where we work.

## Reducing our water footprint

We are taking new approaches to water collection, treatment, reuse, and reduction at our campuses and datacenters across the globe. This includes efficiency measures as well as fit-for-purpose water usage design—we are focused on using the right type of water in the right context from campus to datacenters to device manufacturing. Key efforts include the following.

### Using less, reusing more, and recycling water across our datacenters

Microsoft is using the Smart Water Navigator, which we developed with Ecolab, in our datacenters to prioritize and manage incoming water quality sources like recycled water. In San Antonio, Texas, we have significantly reduced the datacenter's potable water usage, which will now be used to supply water to homes, providing economic as well as environmental benefits. We deployed sensors in our Quincy, Washington datacenter location, where we're using the data on real-time water quality to drive operational insights and adjustments to maintenance and water chemistry. Across our operations, we're testing new techniques, like raising supply air temperatures and harvesting water from our rooftops, to further reduce water consumption.

Using the right type of water in the right context in datacenters.

### Keeping datacenters cool using air

Across our global datacenter fleet, outside air is our primary method of cooling for an average of nine months of the year. External temperatures and humidity play a key role in determining when additional cooling is required—and when required, we utilize an adiabatic cooling system to reduce air temperature by evaporating water in its presence. Adiabatic cooling, along with higher temperature operations, significantly reduces power and water usage when comparing to mechanical water-based cooling systems. At our new datacenter region in Arizona, which opened in June 2020, we use zero water for cooling for more than half the year, taking advantage of adiabatic cooling. We are also partnering with First Solar to provide solar energy rather than traditional electricity generation, which will reduce power plant cooling water.

## Zero water

At our new datacenter region in Arizona, we use zero water for cooling for more than half the year, taking advantage of adiabatic cooling.

# Getting to water positive (continued)

## Pioneering research and implementation of liquid immersion cooling to reduce water

In 2021, Microsoft was the first cloud provider to run two-phased liquid immersion cooling in a production environment, demonstrating viability for broader use in our datacenters. We are using liquid immersion in a production environment, which involves placing servers in a tub of inert fluid that boils at 50°C, which removes the heat generated by the chips, servers, and power supplies, and condenses the fluid in coils at the top of the rack. This "rains" back in the tank. Because of the elevated operating temperature, this type of cooling does not require use of evaporated water. Our latest testing addresses the concept of overclocking, which is to operate chip components beyond their pre-defined voltage, thermal, and power design limits to further improve performance. Our tests found that some chipsets show an increased performance by 20 percent with liquid cooling. This may also have benefits beyond reduction of water use, as this approach can allow for datacenter rack designs that create increased capacity per square foot in a datacenter.

## Raising the temperature while maintaining quality

We're investigating and piloting turning up the heat in our datacenters. The higher server inlet temperatures will reduce cooling hours and water use. If the pilot is successful, we expect to be fully implemented by 2025, which has the potential to eliminate water use for cooling in regions like Amsterdam and Dublin, while reducing water use in dry regions like Arizona and Wyoming.

Fit-for-purpose water design in our Hyderabad campus.

**4M liters**

In Hyderabad, India, we're piloting air-to-water generators to help offset 4 million liters of ground water extraction per year.

## Building net zero campus in California

In 2021, our new Silicon Valley campus officially opened. It is now operating as the first technology campus with a net zero water certification as not a drop of water for more than 2,000 employees, 15 acres of landscape, and 643,000 square feet of built space will come from municipal sources, beyond drinking fountains and sinks.

## Recycling water in our campuses

Our Herzliya, Israel site's landscaping also uses 100 percent of the air conditioning condensate water for its irrigation and cooling towers, resulting in an estimated savings of over 3 million liters annually. Our LinkedIn headquarters in California is planning to utilize municipal recycled water for landscaping and internal plumbing, thus saving 30 million liters of potable water each year.

## Testing new generation techniques

Our Herzliya, Israel site utilizes Watergen's technology to produce fresh drinking water from the humidity in the air, producing an estimated 237,000 liters annually, based on company calculations. In Hyderabad, India, we're piloting air-to-water generators that will capture the moisture in humid air, purify it, and produce safe drinking water. These generator plants will help offset 4 million liters of ground water extraction per year, based on company calculations, in this water-stressed region, where water scarcity is an ongoing crisis that is expected to worsen.

## Reducing water in device textiles

Microsoft uses textiles in our computer palm rests and type covers, and the textile industry is one of the biggest consumers of water. Each of the various manufacturing phases, including yarn processing, greige production, and the dyeing finish process requires a significant amount of water. To reduce water, we removed the dyeing process on our CLARINO fabric by switching to a solution dye technique which reduces water consumption by 20 percent. This is a completely solvent-free, environmentally friendly manufacturing choice that is used in three of our products currently in production across the HoloLens and Surface type cover lines.

# Getting to water positive (continued)

## Replenishing water

As part of our commitment to be water positive by 2030, we will replenish more water than we consume, focusing on high water-stressed regions. We will achieve this goal by investing in water projects that protect watersheds, restore wetlands, and improve infrastructure. In addition to generating volumetric water benefits, many projects offer a wide range of additional co-benefits.

When sourcing water replenishment projects, we consider contextual conditions of the watershed and aim to invest in projects that align with site-specific water assessments and have local stakeholder support.

We have invested in 21 projects to date in nine water basins across the globe. In FY21, Microsoft invested in projects that are expected to generate over 1.3 million cubic meters of volumetric benefits. Progress towards our commitment is made possible due to several strategic partnerships with non-governmental organizations, such as Bonneville Environmental Foundation (BEF), the Water Resilience Coalition (WRC), the Nature Conservancy, and implementation partners, including Trout Unlimited, Ducks Unlimited, National Audubon Society, and WaterAid. We also participate in the California Water Action Collaborative, a network of over 25 organizations learning together, collectively developing projects, and advancing innovative solutions to improve water security and resilience across California.

Reversing environmental degradation in the Sierra Nevada and Cascade mountain ranges.

**1.3M**

In FY21, Microsoft invested in replenishment projects that are expected to generate over 1.3 million cubic meters of volumetric benefits.

Given the nascent water replenishment project market, we make investments at least a fiscal year before a project delivers volumetric benefits. We are still able to make estimates on volumetric benefits, just as we do with renewable energy projects upon signing even though the project has yet to be built. We are taking new steps to validate these estimates. In FY21, 10 of Microsoft's replenishment project investments underwent a third-party quantification to verify and update the initial volumetric benefit estimates using the Volumetric Water Benefit Accounting (VWBA) guidance. We will continue to use the VWBA guidance to quantify volumetric water benefits when contracting with a replenishment partner.

Many projects are already delivering volumetric, ecosystem, and community benefits, such as the following.

### Restoring the East Creek meadow

Microsoft has invested in a project to restore the East Creek meadow and reverse environmental degradation caused by disconnection of the channels in California's Sierra Nevada and southern Cascade Mountain ranges from the meadows and floodplains below. September 2021 groundwater levels indicate that the meadow is beginning to retain groundwater during the dry season, even with reduced precipitation and late-season contributions from snowpack runoff. The restoration has also contributed to fire resiliency—within two months of the Dixie fire, native species were re-sprouting in the burned areas due to residual soil moisture.

# Getting to water positive (continued)

## Groundwater recharge and water security in Phoenix

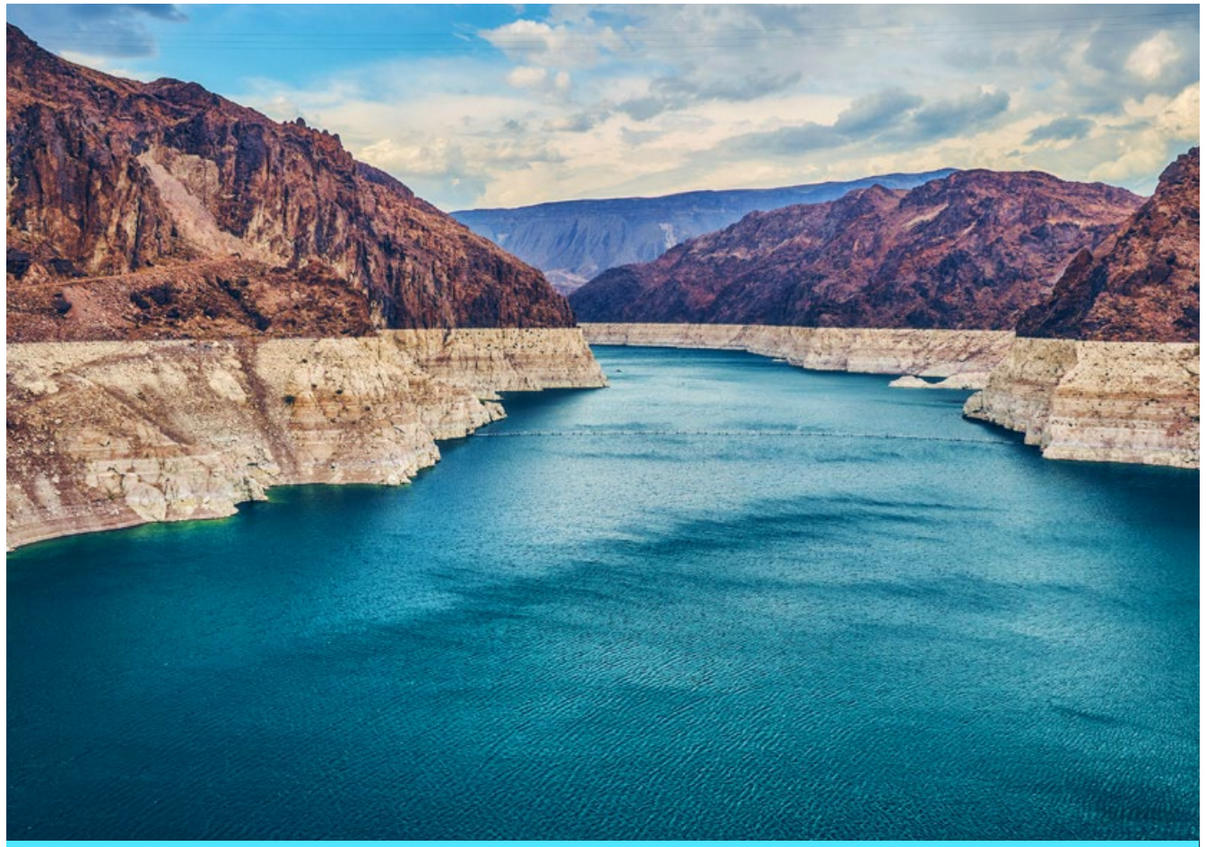
Microsoft and Gila River Water Storage are recharging and replenishing groundwater levels in the cities of Goodyear and El Mirage, Arizona, to balance a portion of Microsoft's future water use, contributing an estimated additional 610,000 cubic meters. Microsoft is also collaborating with The Nature Conservancy to support water conservation in the Verde River Basin in Arizona through projects such as piping irrigation ditches to efficiently water farmland and leave more water in the Verde River.

## Restoration in the Columbia Basin

Microsoft supported three water restoration projects in the Columbia River Basin near Quincy, Washington. One of the projects benefits the Roaring Creek by improving habitat for fish listed under the Endangered Species Act, including Upper Columbia Steelhead, spring Chinook, bull trout, lamprey, and cutthroat trout. The second project is focused on relocation of beavers to watersheds where natural beaver dam building helps to promote fish passage, improves water quality, increases groundwater storage, and mitigates flooding. The third project improves water use efficiency on farm and irrigation delivery infrastructure to help local agricultural producers adapt to changing growing conditions while also supporting rivers and local fish.

## Drought contingency planning with the Colorado River Indian Tribes

Under the Drought Contingency Plan, Arizona is seeking to help stabilize water levels in Lake Mead and reduce the impact and severity of shortage declarations in Nevada, Arizona, and Southern California by financially compensating the Colorado River Indian Tribes (CRIT) for water saved. Microsoft has contributed funds to compensate the CRIT for their water rights to the Colorado River through a lease for system conservation and water supply benefits. In exchange for monetary compensation, the CRIT have pledged to forgo irrigation water deliveries and fallow approximately 10,000 acres of farmland, leaving significant volumes in Lake Mead over the next few years.



Stabilizing lake levels in Lake Mead to reduce water shortage.

We will replenish more than we consume, focusing on high water-stressed regions and investing in water projects that protect watersheds, restore wetlands, and improve infrastructure.

# Getting to water positive (continued)

## Improving access to water

With 1.1 billion people in the world without access to clean water, it's not enough to simply reduce and replenish—we need to improve people's access to safe, clean water. Our goal is to provide access to safe drinking water and improved sanitation solutions for 1.5 million people while accounting for 25 billion liters of net positive water impact in high-stress watersheds where we also operate, namely India, Indonesia, and Mexico, by 2030.

### Progressing towards our goal with Water.org

In 2020, we began our work with Water.org to help people living in underserved communities gain lasting and reliable access to safe drinking water and improved sanitation solutions. This includes household taps and toilets, piped connections, rainwater harvesting, water storage, purification, and community filtration. In FY21, we helped more than 95,000 people in India and Indonesia[10] and expect to reach at least 840,000 people by September 2023. Nearly all the beneficiaries are women and live below the poverty line. These programs account for over 670 million liters of water benefit per year in areas facing water scarcity and climate challenges that overlap with our business operations in strategic locations.[9]

**95,000**

Through our partnership with Water.org, we provided more than 95,000 people with access to safe water or sanitation.

**670M**

Programs run through Water.org account for over 670 million liters of water benefit per year.

Affordable water and sanitation loans in India for piped water in homes.

## Providing safe water and improved sanitation in India

In Rasulpur Aul Kendrapara, houses are made of thatch, mud, and concrete, and rarely have water or sanitation connections. Rehana and her daughter used to walk up to six hours a day to get water for cooking, laundry, and baths from an unreliable hand-pump managed by the government. On days it was unavailable, they collected water from the river or purchased it from a vendor, paying high prices for water in time and money. Families like Rehana's find the small water and sanitation loans offered by Water.org's partners in India to be affordable, practical solutions to their family's water and sanitation needs. Rehana learned that she could make affordable payments to establish a water connection and was approved for a loan to construct a piped water connection from the municipal water line to her home. Now the family enjoys access to safe water and improved sanitation at home.

# Driving transformation

We believe that Microsoft's most important contribution to water reduction will come not from our own work alone, but by helping our customers, partners, and suppliers around the world reduce their water footprints through our learnings and with the power of data, AI, and digital technology.

We are not a particularly large consumer of water today, but we are learning from our work in our own operations. We are taking these lessons learned, new approaches, and innovative partnerships and bringing them to our global customer base, where we believe we can have a transformative impact.

As it so often does, the pathway to progress begins with data. Water data is often segmented and siloed, both within an organization and across multiple organizations operating in the same watershed, which makes managing a shared resource particularly challenging. Water data often lacks context, meaning it is provided without an understanding of underlying conditions in the area.

This makes it difficult for any single organization to assess its impact on a water basin, which in turn complicates or obscures the most impactful intervention to address water issues in that area. In addition, water data often suffers from discontinuities, where data collection is interrupted due to equipment failure or lack of funding for observational networks.

The digitization of water data is about making water data credible, transparent, useful, and actionable. It includes the Internet of Things (IoT), cloud platforms, business intelligence, and AI. We are bringing new solutions to organizations to better manage water consumption and risk.

We are digitizing water data to make it credible, transparent, useful, and actionable.

## Product

### Azure IoT Central government application templates

#### Water Consumption Monitoring application template

With this tool, available today, organizations can remotely monitor and control water flow and valve pressure, manage alerts, and set up device commands to reduce water costs and waste.

Download application template here

#### Water Quality Monitoring application template

Organizations need to also understand the quality of their water, a key stressor on water availability. With this solution, organizations can monitor water quality to improve health outcomes and environmental impact.

Download application template here

### Azure-based risk management product

#### Smart Water Navigator

Developed by Ecolab and running on Azure, organizations can identify water risks, set meaningful context-based water goals, and leverage response tools to help companies implement sustainable water practices with this free platform from Ecolab.

# Driving transformation (continued)

## Customers and partners

### Assessing global flood risk and water reserves

Deltares, a world leader in water and subsurface with expertise in flood risk forecasting and ecosystem monitoring, used Azure and the Microsoft Planetary Computer to generate two global multi-decade datasets: a Global Flood Risk dataset to assess the risk of flooding, in particular the impact in coastal areas subject to sea level rise, and a Global Water Reservoirs dataset to determine water availability for up to 3,000 reservoirs around the world for both drinking water and hydro power planning. Both datasets help organizations to relate changing water conditions to humanity, infrastructure, and environments.

### Reducing water usage in facilities with the cloud

Enova, a joint venture between Majid Al Futtaim and Veolia, is an integrated energy and facilities management provider offering comprehensive services and performance-based solutions to its clients to help achieve their financial, operational, and environmental targets. Powered by over 4,500 employees and a strong, scalable, and secure cloud infrastructure on Azure, Enova has achieved total savings of 320 million kWh of energy, 5 million cubic meters of water, and 210,000 tons of $CO_2$ emissions. In 2021, Enova adopted a new business model involving ICONICS and other tools supported by Azure cloud services and over 320 customized fault and ECM rules. Covering 28 medium to large sites, this resulted in an additional 2 percent of energy savings and 17–25 percent improvement in staff efficiency.[8]

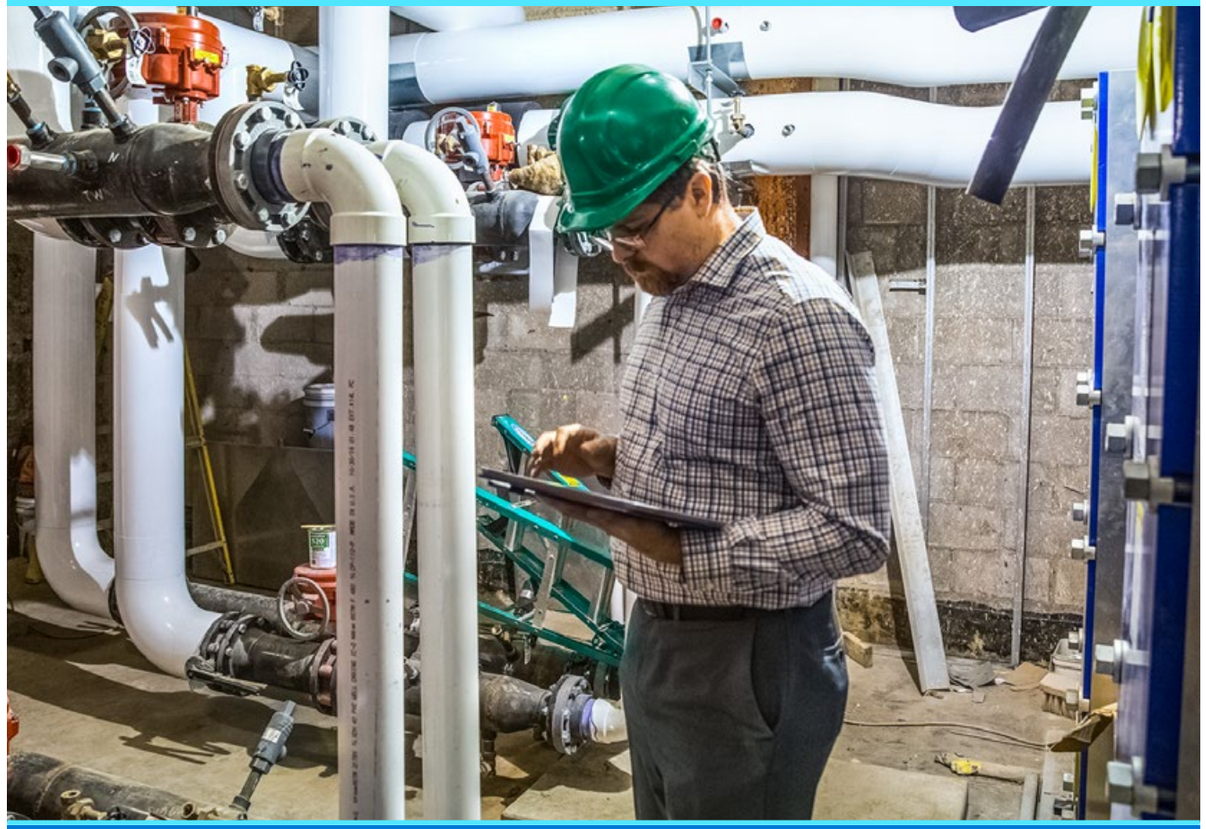
### Enabling modeling of global water supply and demand

Microsoft is working with WRI to provide partners with access to the latest Coupled Model Intercomparison Project Phase 6 (CMIP6) global climate projections, as well as socioeconomic development projections based on IPCC scenarios, on Microsoft Azure. Partners are now able to model global water supply and demand with CMIP6 data and scenarios for the first time.

### Forecasting real-time water availability in reservoirs

With WRI and BlackRock, Microsoft sponsored a global hackathon challenge, Wave2Web. The organizations worked together to develop new datasets on water stress in emerging markets, inviting students and young professionals to develop predictive modeling to forecast water availability in reservoirs near Bengaluru, India. The Wave2Web hackathon included 2,130 participants across 293 teams globally. Twenty-five shortlisted teams received hands-on support to develop unique, forward-looking solutions. The three winners showcased their prototypes in front of state and national stakeholders at an online town hall conducted in October 2021. The Commissioner of the Karnataka State Natural Disaster Management Center plans to continue working with the winning teams to explore applications of the prototypes as well as other opportunities for collaboration to solve the growing water challenges faced by Bengaluru.

Smart metering with Anglian Water is saving almost 3 million liters of water every day.



## Water smart metering with the cloud and AI

Anglian Water supplies more than 6 million customers with water and water recycling services in the UK. It is working to efficiently manage water supplies and raise customer awareness of water conservation. A key part of its strategy is smart metering, which it is rolling out across its entire region by 2030. Using Azure, Anglian built a robust system for customer-side smart metering, as well as monitoring and analysis of its network. It also uses AI to understand the behavior of reservoirs through each day, each season, and varying meteorological conditions. Since the smart metering program went live, customers have been able to find and fix around 40,000 leaks in their homes, saving almost 3 million liters of water every day.[8]

# Enabling systems change

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 more effectively address water availability and accessibility.

To reach a water positive future, the world will need new partnerships, solutions, and markets. That is why we go beyond our operations and even our products to make direct investments in the future of water, from R&D to actual funding investments in promising technologies that have the potential to scale rapidly and globally.

## Research and development

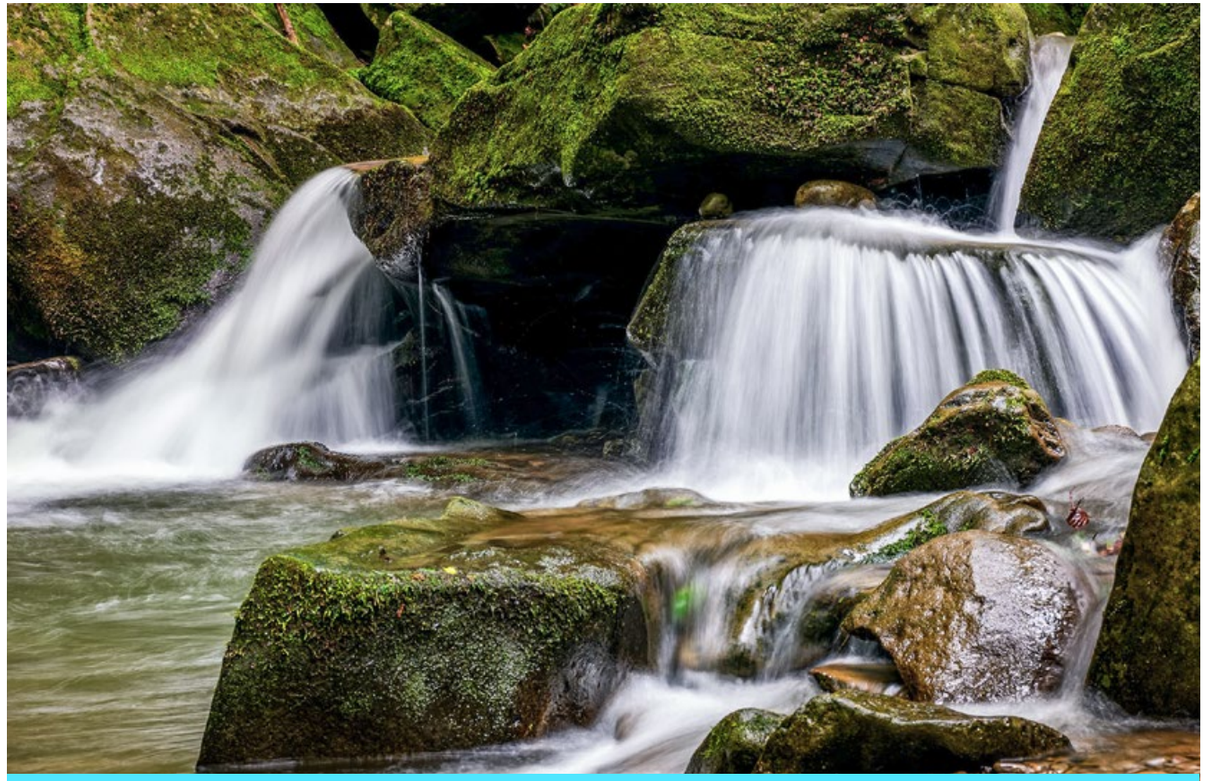
Researchers at Microsoft tackle critical challenges that will shape the future of the world and the company. Given the significance of sustainability challenges for our global future, research teams around the world are developing new technologies and approaches to ensure water efficiency.

### Azure Verified Telemetry for IoT

Our research on Dependable IoT is enabling water positivity for Microsoft and other companies by developing the capability to ensure the accuracy of sensors used to monitor water leaks, quality, and efficient usage. With the incorporation of this capability into Azure Verified Telemetry for IoT, we are partnering with FluxGen, a sustainability startup in India that develops AI and IoT-based water management solutions to make industries water positive. The partnership is through the Microsoft-Accenture Amplify program and Microsoft Research India's Center for Societal Impact through Cloud and AI.

## Funding innovation via CIF

The Climate Innovation Fund (CIF) invests in the development and deployment of new technologies, processes, and production changes that can improve the condition and sustainability of our water resources. Our investment into Emerald Technology Ventures' Global Water Impact Fund invested in Sofi Filtration is currently serving early to expansion-stage companies globally to drive critical innovation and its adoption in the water space.



To reach a water positive future, the world will need new partnerships, solutions, and markets.

# Enabling systems change (continued)

## Investing in AI

Through our AI for Earth program, Microsoft is putting AI tools into the hands of individuals and organizations working on the frontlines of environmental challenges, including water. To date, 116 AI for Earth grantees have worked on water-related projects.

### Remote sensing to assess agricultural water demand

Government agencies in Egypt face difficult decisions when allocating water for agriculture and civilian use. To help agencies, the Egyptian government developed a proof of concept solution that uses satellite image analysis deep learning to determine crop type and land area boundaries of smallholder farms. The intelligent visualization using ArcGIS detects field boundaries, identifies crops, and provides water demand forecast estimates for decision makers that results in more accurate allocations for sustainable agriculture and fair water distribution for citizens.

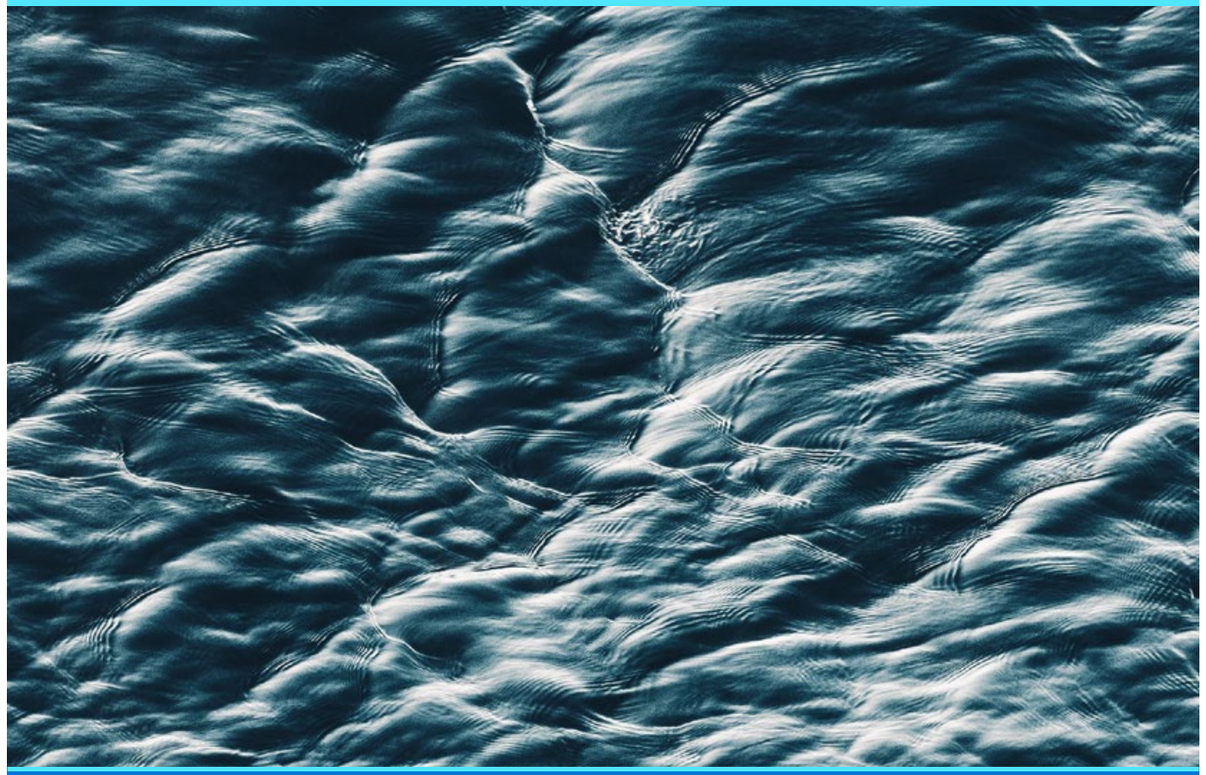
### AI and satellite imagery to track forest-related water availability

Microsoft supported a forest and water management project by Conservation Science Partners by providing resources around AI, machine learning, and cloud computing on the Microsoft Azure platform. Using Azure, Conservation Science Partners aggregates and analyzes satellite imagery at high resolutions to better understand how the forest cover across the western United States changes from forest disturbance events and how this influences water supply records. By linking the forest data to water flow rate data records from before and after a forest disturbance, an analysis can provide insights for conservation planning and adapting forest and water management to future climate change impacts. As a result, local communities, regional organizations, and the federal government can better manage and protect these vital resources.

**116**

To date, 116 AI for Earth grantees have worked on water-related projects.

Providing scientifically informed estimates of the impact of extreme drought events on drinking water availability.



## Machine learning to predict regional water shortages

Recognizing that lower income and small communities often face the largest barriers to safe and reliable drinking water, Microsoft provided a grant to the Leadership Counsel for Justice and Accountability to support their work around secure water supplies. The Leadership Counsel will assimilate data from disparate sources, using Azure resources to host and deploy machine learning models and create a dashboard that people can interact with on a server. The dashboard will provide regulators, advocacy groups, and the public with scientifically informed estimates of the impact of extreme drought events on drinking water availability. This contribution also allows the Leadership Counsel to engage in wider community outreach efforts, advocate for policy efforts that will protect well water levels, and inform residents about the potential impact of water conservation policy efforts.

# Enabling systems change (continued)

## Driving collective action

We partner with like-minded companies and leading scientific organizations to develop and deliver research, guidance, and implementation roadmaps that enable all businesses to solve water challenges.

### 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. We are committed to working with the Water Resilience Coalition and its more than 30 members to make progress against the WRC's 2030 roadmap for collective action. Microsoft is also advancing the development of tools and resources to enable companies to step forward by assessing and improving their water stewardship actions in partnership with the CEO Water Mandate.

Water Action Hub Platform 4.0 was first presented during the 2021 World Water Week, was developed by the CEO Water Mandate and made possible with support from Microsoft. This latest version of the hub connects more than 1,500 projects with over 1,000 partner organizations worldwide. It also helps direct users to water tools by Ecolab, WWF, WRI, and other leading organizations.

**Nature-Based Solutions Tool** is a web-based tool developed to serve as a key starting point for organizations looking to invest in nature-based solutions (NBS), and for those wishing to learn more about benefit identification and accounting. The tool was developed based on and in accordance with the published Benefit Accounting of Nature-Based Solutions for Watersheds Guide.

### California Water Action Collaborative

Convened and facilitated by Ag Innovations, the California Water Action Collaborative (CWAC) is a network for diverse stakeholders to come together and pursue collective action projects that will improve California's water resilience for people, business, agriculture, and nature.

**1,500**

The Water Action Hub platform connects 1,500 projects with 1,000 partner organizations worldwide.

## Advocating for water

Governments play a fundamental role in ensuring the availability of safe and clean drinking water, maintaining and expanding water infrastructure, protecting critical water ecosystems, and responding to water crises. As a leading company committed to using its voice for policy, Microsoft has engaged in the following activities.

### Promoting US water infrastructure and resilience

Microsoft advocated for clean energy and environmental provisions in the US Infrastructure Investment and Jobs Act, which commits over $8 billion for western water infrastructure and significant funding for water-related and other resilience efforts.

Governments play a key role in ensuring the availability of safe and clean water.

### Supporting WaterEurope

In 2020, Microsoft joined WaterEurope, the leading association in Europe focused on technology and innovation aspects of water, with a focus on digital water. We have called for the inclusion of water-related topics in EU polices, such as water infrastructure into the COVID-19 recovery packages.

**$8B**

The US Infrastructure Investment and Jobs Act commits over $8 billion for western water infrastructure and significant funding for water-related and other resilience efforts.

# Key trends

2021 was a year of progress and learning for Microsoft on our journey to water positive.

**1 Water requires a collective approach.**

Companies will not be successful in managing water stress in regions where we operate if we try to tackle challenges independently. It will be vital to partner with a wide range of stakeholders, including NGOs, governments, customers, and competitors—particularly in high-stress locations with a limited supply of replenishment projects.

**2 Replenishment is more than a procurement exercise.**

Project oversight and monitoring of projects with multi-year benefits, and check-ins with implementation partners are all important. It's also necessary to validate the total volumetric benefit, additional co-benefits, and project duration through third-party quantification. Cultivating credible partners to identify the right project type for each unique location is critical, particularly for locations with limited supply of shelf-ready projects.

**3 Better water data drives action.**

Utility bills only provide some of the information companies need to truly understand and manage their risk and reduce their water use and the data typically does not arrive for months after the water was used. By installing sensors across our datacenters, we have been able to track our water use in real time, allowing us to more effectively monitor our reductions and identify opportunities for increased water efficiency. As we improve the quality of data across our operations, we have learned that the true cost of water is not aligned with its true value. This misalignment makes it challenging for companies to make the business case for water-related investments. It is something we are grappling with and will continue to explore across our operations.

# What's next?

## 1 Replenish more water than we consume by 2030

We will continue to make progress against our 2030 replenishment commitment. We have prioritized our investments in high-stress locations where we operate and work with partners to identify the right type of replenishment projects that align with the unique challenges in each location. We will continue to prioritize opportunities to partner with other stakeholders, including companies that operate in the same locations.

## 2 Enable access to drinking water and sanitation

We will continue to work with Water.org to make progress against our accessibility commitment, providing 1.5 million people with access to clean water by 2030. Our support thus far has focused on Brazil, India, Indonesia, and Mexico, and will expand to include China, Malaysia, and South Africa. We will continue to explore water, sanitation, and hygiene (WASH) solutions that will provide people across the globe with access to clean water and continue to identify opportunities to implement them.

## 3 Invest in partnerships

We will continue to invest in new and existing partnerships that will enable Microsoft to make progress against our commitments and help protect water resources for future generations. Given the collective approach required to solve shared water challenges, we will continue to build on partnerships like the Water Resilience Coalition (WRC) that bring companies together to pool funding and invest in solutions in locations with extreme water stress. We will also continue to support investments through our AI for Earth fund that strengthen water data and drive outcomes.

## 4 Increase water efficiencies across our operations and identify innovative solutions

To drive water use reductions in the short and long term, increasing efficiency is critical and it must be paired with innovation to ensure businesses can continue to operate in an unpredictable future with increasing water challenges. As we identify innovative approaches that work, we look forward to scaling these within Microsoft and sharing them outside of our four walls to further reduce pressure on the shared water resources we depend on.

## 5 Evaluate water impacts beyond our operations

We recognize that water is a challenge not just across our operational footprint, but also across our value chain. We will continue to explore ways we can support suppliers in understanding and managing their water risks. We also recognize that water and energy are interlinked. Energy is required to pump and transport water and similarly water is required to produce electricity. We will continue to strengthen our understanding of the ways our energy procurement decisions can affect water resources.

## 6 Identify technology adoption opportunities for water

We will use the investment from our Climate Innovation Fund into Emerald Technology Ventures to identify technology adoption opportunities for emerging water technologies that can help Microsoft achieve our water positive commitment and support our customers.

# Resources

### How Microsoft plans to become water positive by 2030 video

Get inspired by our strategy.

Find out more here

### 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.

Find out more here

### 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.

Find out more here

### Water Risk Monetizer

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

Find out more here

Microsoft is committed to sharing our progress, challenges, learnings, and best practices throughout our sustainability journey.

### WRI Aqueduct Tool

Use this tool to understand the local water stress and scarcity concerns where you operate.

Find out more here

### Water quality monitoring tutorial

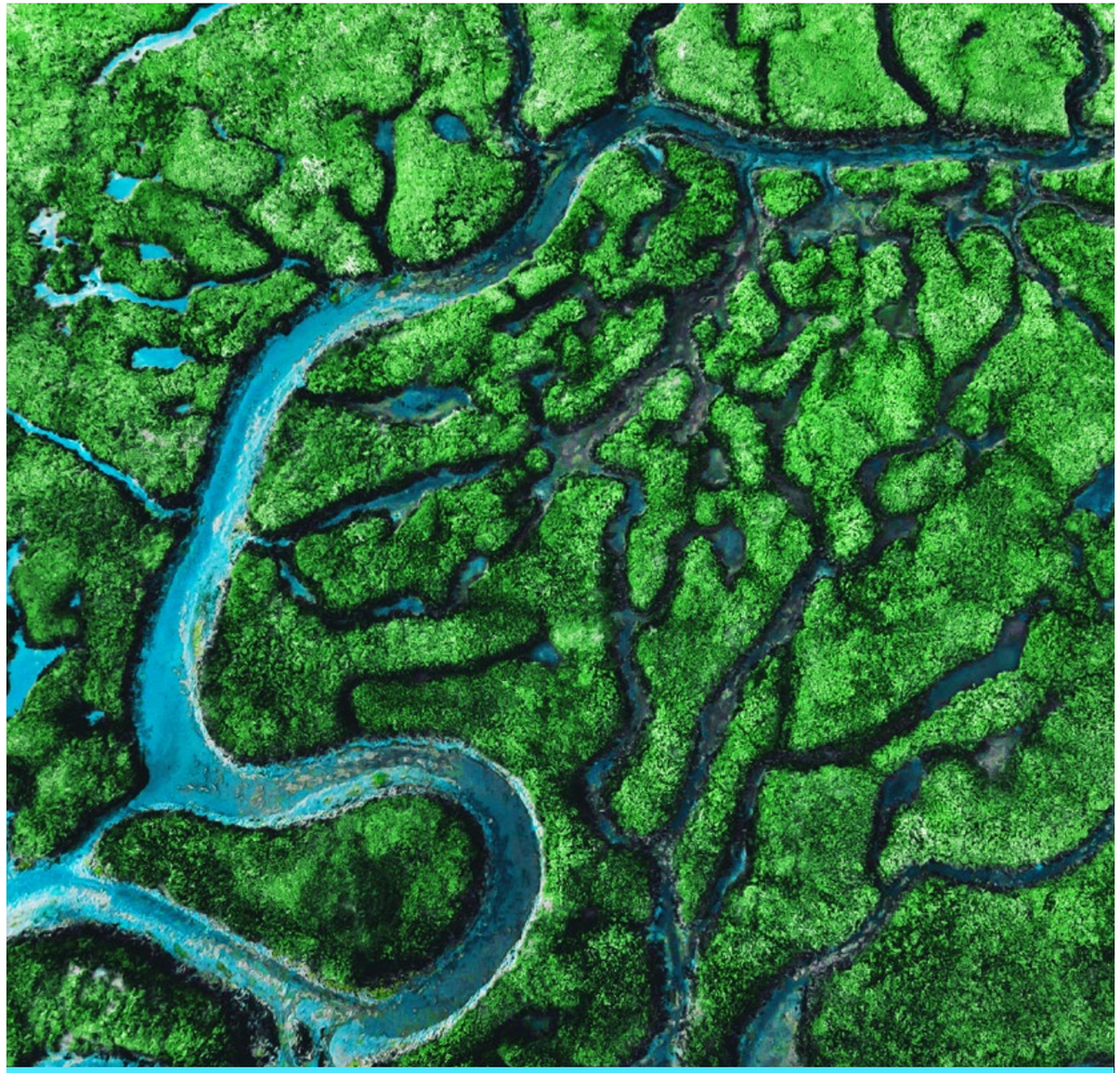
Learn how to create a water quality monitoring application in Azure IoT.

Find out more here

### Water consumption monitoring tutorial

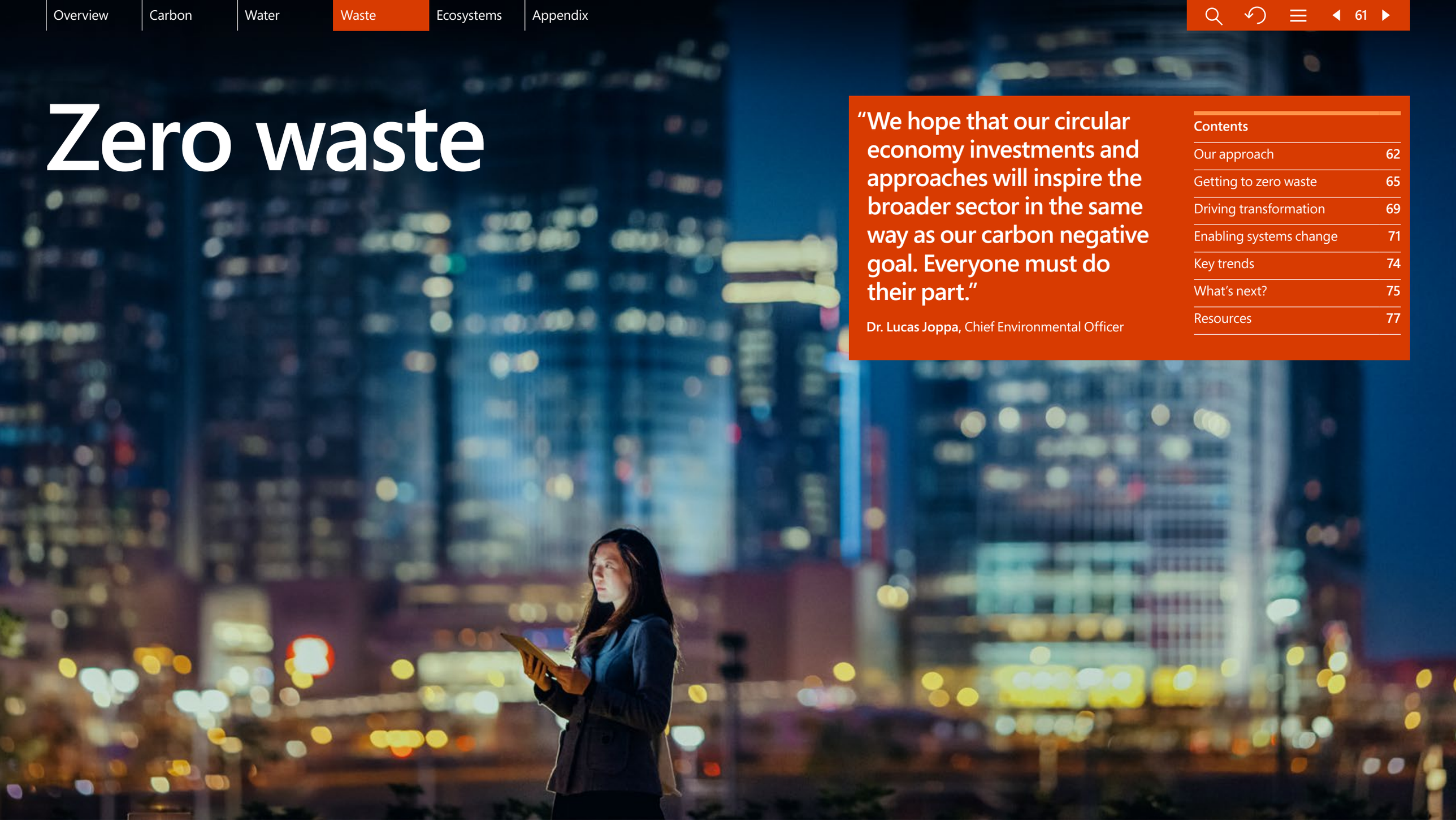
Learn how to create a water consumption monitoring application in Azure IoT.

Find out more here



We are committed to becoming a water positive company by 2030 and helping other companies on their journeys.

# Zero waste



"We hope that our circular economy investments and approaches will inspire the broader sector in the same way as our carbon negative goal. Everyone must do their part."

**Dr. Lucas Joppa,** Chief Environmental Officer

Contents

## Our approach

# Our commitment to a zero waste future

### The context

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 2021 Circularity Gap Report. Linear systems and existing infrastructure are not adequate to maintain, collect, and redistribute materials effectively for a global circular economy. As a result, waste, including plastics, e-waste, and food waste, pollutes our land, clogs our waterways, depletes natural resources, and contaminates the air we breathe.

We recognize the urgent need to protect the world's biodiversity and ecosystems, give equal access to a safe and healthy environment, reduce carbon emissions associated with the creation and end-of-life of these materials, and meet the needs of a growing population. As a company that makes and manufactures devices, as well as uses manufactured goods in our campuses, datacenters, and operations, we have an obligation to responsibly source materials and an opportunity to build a more circular approach into our work and the world.

To reach our commitment to become a zero waste company by 2030, we are 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 content, selecting recyclable or compostable materials, reducing hazardous substances, and designing out waste. We keep products and materials in use longer through reuse, repair, and recycling programs.

## Our commitment: zero waste by 2030 across our direct waste footprint

### Increasing reuse of servers and components through Circular Centers

By 2025, 90 percent of servers and components within our regional datacenter networks will be reused.

### 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.

### 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.

### Transforming waste accounting

We will continue to improve waste data accounting to ensure accuracy, auditability, and reporting.

### 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.

### Investing in the future of circularity

We will partner with companies around the world to drive circular economy innovation and adoption of technologies to reduce waste and reuse materials and products.

# Our approach (continued)

## Our progress

### Circular Centers

We have planned five Circular Centers, with Amsterdam open, construction underway in Boydton, Virginia, and three more to be added in Dublin, Chicago, and Singapore in 2022. This has projected savings of $100 million per year once fully scaled and will enable 90 percent reuse by 2025.

### 18% reduction

We reduced single-use plastics in our Microsoft product packaging by 18 percent or from 5.7 percent to 4.7 percent by weight (on average) of plastic per package in FY21.

### Zero Waste datacenters

Four datacenters are Zero Waste certified, with new certifications for the San Antonio, Texas and Quincy, Washington datacenters and renewed certifications for our Boydton, Virginia and Dublin, Ireland locations.

### >15,200 metric tons

In FY21, we diverted more than 15,200 metric tons of solid waste otherwise headed to landfills and incinerators across our direct operational footprint.

### >90% recyclable

We achieved a 97 percent recyclable Xbox Series X and S, and a 93 percent recyclable metal Surface Laptop 4, in Organization for Economic Cooperation and Development (OECD) countries per the UL methodology ECVP 2789.

### Zero Waste campus roadmaps

Eleven campuses now have customized roadmaps to achieve zero waste by 2030. Our Puget Sound campus has been Zero Waste certified since 2016.

### Transformed waste accounting

We transformed our waste accounting using Microsoft technology, including PowerApps, Dynamics 365, and Power BI, increasing our collection of actual waste data and providing greater visibility into waste types.

### Recycled waste materials

We introduced two new accessories that are made in part from recycled waste materials: several new Xbox Wireless Controllers, built using over 30 percent post-consumer recycled (PCR) materials; and the Ocean Plastic Mouse, which has a plastic shell made with 20 percent recycled ocean plastic.

### Invested in Rheaply

We invested in circular economy startup Rheaply to help companies measure carbon emissions savings from reuse and fuel the circular economy.

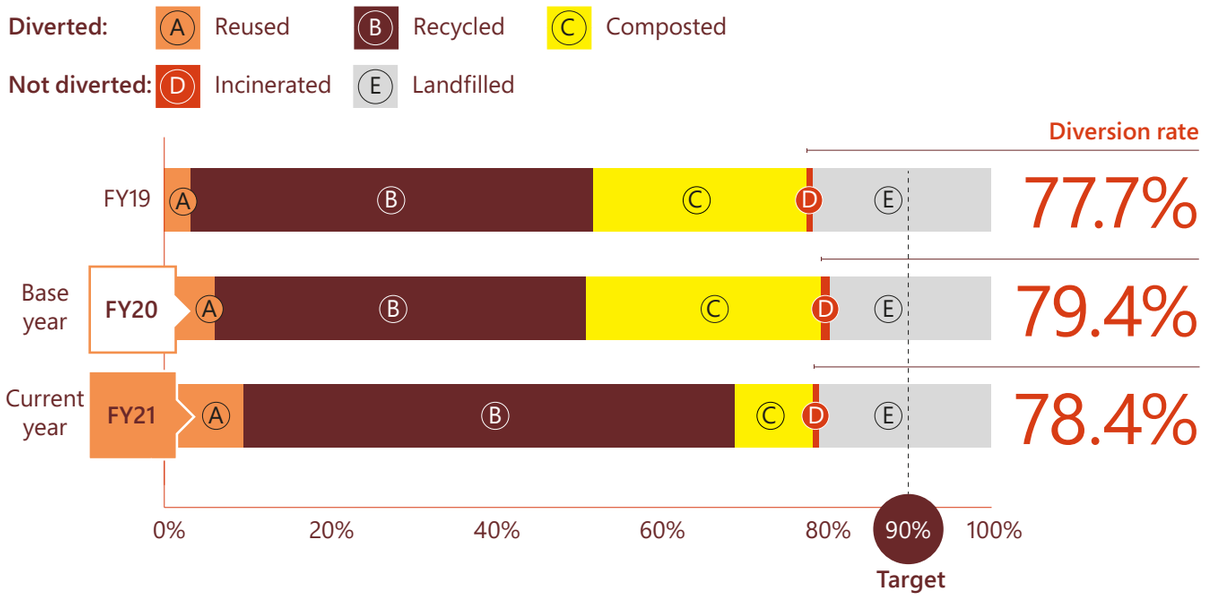
A year of progress and impact to get to zero waste by 2030.

# Our approach (continued)

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 FY21, our diversion rate remained nearly flat from FY20, and we diverted more than 12,600 metric tons of waste from being landfilled or incinerated. Employees working from home was one of the main drivers of the decrease of over 44.4 percent in total waste generated.

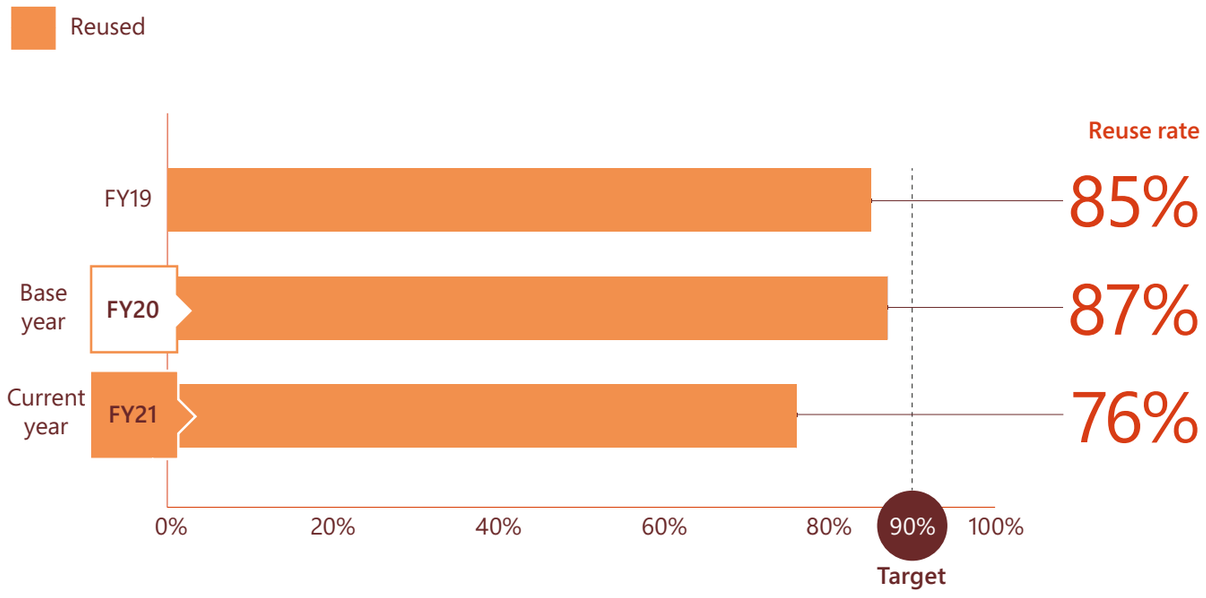



a. Waste generation values and classifications have been updated for FY19 and FY20 to be consistent with data collection and estimation methodology improvements established in FY21. As we continue improving our waste accounting, our reported values may change.

Waste Table 2

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

The main drivers of our reuse percentage are the functional equipment that is remarketed (either whole or parted-out), or materials that could be reused after the recycling process. In FY21, a reduction in the volume of decommissioned assets and increase in the volume of recyclable material in the mix contributed to the overall reduction in the reuse percentage. Expansion of our Circular Centers program and investments in systems and policy changes will further enable us to achieve our 90 percent reuse target of servers and components by 2025.




a. Our program and supplier data quality has consistently improved over the years. Access to more accurate data has helped us update our methodology for percentage reuse calculation. For consistency, previously reported years have been updated to reflect latest methodology applied to FY21.

# Getting to zero waste

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

## Campuses and datacenters

Our operations are a considerable part of our waste footprint. Getting to zero waste requires more ambitious efforts to reduce as much waste as we can, reuse products to extend use life, and recycle or compost wherever possible, as well as thinking through everything from visitor badges to server racks with circularity in mind.

### Building a circular cloud

At Microsoft, we have taken a first-of-a-kind approach towards designing and implementing circularity into our cloud, aligning our end-of-life dispositioning processes with an integrated plan across the entire supply chain. It starts with sustainable design and responsible sourcing of an asset. We use our assets as long as we can effectively, then reuse what we can to extend hardware life. After decommissioning, we move towards a diversified approach, ensuring that assets are dispositioned to optimize value, security, compliance, and sustainability. Over the past year, we engaged new suppliers who are able to remanufacture assets and components, effectively enabling new lifecycles for our assets. We have successfully demonstrated takeback/buyback models with our original asset suppliers, closing the loop on assets and enabling suppliers to repurpose or reuse assets and components, returning higher financial benefits as well as significant sustainability outcomes for carbon emissions reduction and material recovery.

We have built Circular Centers inside our large datacenter campuses to intercept and process all decommissioned assets. These include an intelligent disposition and routing system using Azure SQL, Power BI, and Embedded Power Apps integrated with Dynamics 365, which determines the optimal route for every component, creating a plan for every part, extending useful lifecycles well beyond the datacenter, and engaging our upstream and downstream suppliers.

Reusing datacenter hardware via Circular Centers.

The Circular Centers are also a significant contributor to our spares program, using harvested components from decommissioned assets to repair cloud hardware. Increasingly, such approaches are creating more value and enabling greater resilience across our supply chain. Our circular cloud will enable 90 percent reuse of datacenter hardware by 2025, significantly contributing to our goal of achieving zero waste datacenters by 2030 and goal of more than 50 percent emissions reduction by 2030.

### Reusing cloud hardware via Circular Centers

A critical piece of achieving our zero waste goal is managing e-waste from our growing datacenters. Last year, we piloted a new approach to asset reuse by building a Circular Center within our Amsterdam datacenter campus, which represents 7 percent of our server capacity globally. We process decommissioned cloud hardware to service strategic routes, secondary markets, and suppliers, using intelligent routing software in combination with Dynamics 365.

**90%**

Our circular cloud will enable 90 percent reuse of datacenter hardware by 2025.

# Getting to zero waste (continued)

Over the past year, our Amsterdam Circular Center model has achieved 83 percent reuse and 17 percent recycling of cloud hardware. Based on the success of the pilot, we're expanding to five additional campuses in the US (Boydton, Chicago, Quincy), EMEA (Dublin), and APAC (Singapore) regions, and extending this model to most of our cloud computing assets. This program should achieve 90 percent reuse by 2025 with projected savings of approximately $100 million each year, once scaled.

We also seized opportunities to become more resilient, build better ties with communities, and increase collaboration with upstream and downstream partners. We're bridging the skills divide in our datacenter communities by supporting technical training programs at community colleges, vocational schools, and other education institutions. This work depends on decommissioned and excess datacenter equipment to facilitate the "hands-on" labs called Datacenter Academies in datacenter communities.

## Zero waste datacenters

Microsoft has a goal to achieve 90 percent diversion of datacenter operational waste by 2030. To reach this goal, we're working closely with our waste haulers to optimize waste diversion programs across our global datacenter portfolio. We're also partnering with third-party industry experts to investigate options for hard-to-recycle materials, such as air filters used in our datacenters. Exploring innovative partnerships and solutions to reduce waste and transition to a circular economy are key strategies for achieving our 2030 goal. In FY21, we achieved Zero Waste certifications for our San Antonio, Texas and Quincy, Washington datacenters and renewed certifications for our Boydton, Virginia and Dublin, Ireland locations.

**75%**

Our goal is 75 percent construction and deconstruction waste diversion for all projects.

**90%**

Our goal is 90 percent waste diversion for campus projects over 75,000 square feet.

## Zero waste campuses

We've created a roadmap for key zero waste initiatives for each campus and committed to Zero Waste certifications by 2030 for all Microsoft campuses. LinkedIn's new campus in Omaha opened in 2021 with a focus on zero waste, which led to the team utilizing reclaimed wood wherever possible, including tabletops, lockers, and stairs. 52 percent of the wood on the project is reclaimed and the remaining 48 percent is FSC certified.

## Construction waste diversion

Microsoft has a goal of 75 percent construction waste diversion for all projects and 90 percent for campus projects over 75,000 square feet. To reach these goals, Microsoft and LinkedIn are refining RFIs for vendors, standardizing waste tracking and reporting, and establishing a decommissioning partner to ensure that our used furniture and materials are reused. Our Puget Sound campus modernization project included deconstructing 12 existing buildings.

We found multiple reuse opportunities, including using concrete waste for temporary roads and fill for the new campus, and recycling ceiling and carpet tiles into new tiles. Our Puget Sound project is currently achieving over 90 percent diversion.

## Reducing waste in campuses

Last year, we began the rollout of recyclable paper visitor badges to Microsoft sites globally, which will help avoid seven tons of plastic waste annually. Additionally, we're establishing new programs to reduce food waste, other single-use plastics, and virgin finite materials. Across Asia, sites like Singapore are utilizing sustainable meal boxes to cut down on waste generation. Similarly in Japan, a new reusable cup initiative launched in July 2020 has completely phased out disposable cups and is estimated to potentially save 960,000 paper cups annually. Our Istanbul site is using solar powered compost tanks to reduce waste by 1,000 kg each month.

Our Puget Sound modernization project is currently achieving over 90 percent construction waste diversion.

# Getting to zero waste (continued)

## Devices

Zero waste for our devices and packaging means taking a circular economy approach to design out waste and keep materials in use longer. We are extending the lifespan of our devices through programs like "Design for Repair"; we are designing our devices and packaging to use fewer materials and to be increasingly recyclable; and we are supporting reuse, repair, refurbishment, and recycling infrastructure to ensure that Microsoft devices are kept in use longer. We're also increasing use of recycled material in our own devices, accessories, and packaging.

### Shifting to recycled materials

#### Ocean plastics

In October 2021, we launched the Ocean Plastic Mouse which has a shell made with 20 percent recycled ocean plastic, the first consumer electronics application of this material. Going beyond just ocean-bound plastic, which is plastic that is collected within 50 km from shorelines, each mouse contains resin made from recycled water bottles taken directly out of oceans, beaches, and waterways.

The launch of the Ocean Plastic Mouse is a small step on our longer journey to use innovative recycled materials. The resin is now available for others to use in their own products to help address the global challenge of ocean plastic.

#### Post-consumer recycled plastic

Over the past year, we have used more post-consumer recycled (PCR) plastics in our products, including Surface power supply units, Surface devices, Xbox consoles and controllers, and PC accessories.

With the new Electric Volt and Daystrike Camo Special Edition controllers, we incorporated 30 percent PCR resins into the external housing and 50 percent PCR in the internal midframe for the first time in any Xbox hardware. Following in their footsteps came the Aqua Shift controller, four variations of the Space Jam New Legacy controllers, and our Xbox Design Lab series of controllers. These controllers contain a portion of resins made from recycled materials like automotive headlight covers, plastic water jugs, and CDs. Our testing shows the materials provide the same controller durability and performance gamers have come to expect. With the re-launch of our Xbox Design Labs, we have incorporated the same PCR resins into 75 percent of all Xbox Design Lab controllers.

Starting in late 2021, Xbox Series S became our first console to incorporate PCR resins into the manufacturing of the body and various internal components. To date, we have incorporated approximately 28 percent PCR into the product's overall design without compromising quality or durability. We are now investigating ways to incorporate more PCR into the design along with reducing wall thickness to utilize less material overall.

Zero waste for our devices and packaging means taking a circular economy approach to design out waste and keep materials in use longer.

#### Post-industrial recycled materials

We are developing opportunities to reuse manufacturing scrap in aluminum production, allowing us to use lower-carbon, 100 percent post-industrial recycled closed loop aluminum for future Surface computer housings. For our neodymium magnets, a rare earth material, we are also exploring post-industrial scrap as a manufacturing feedstock, which would enable us to produce 100 percent recycled neodymium in magnets for future products.

#### Repurposed inventory

Textiles at Microsoft are normally used on Surface palm rests and type covers. However, given the unique challenge of the COVID-19 pandemic, we experimented with scrap Alcantara fabric and repurposed it into a product engineered to be a reusable, premium, and comfortable three-layer face covering for Microsoft employees.


The Ocean Plastic Mouse is the first consumer electronics application of recycled ocean plastic.

# Getting to zero waste (continued)

## Reducing waste in production

Traditionally, many materials used in the production of devices are made using industry-standard computer numerical control (CNC) manufacturing. With CNC, the shape of the product component is cut out of a large block of raw materials after which the excess is discarded. To reduce waste in production, we have started to introduce material "stamping" techniques in our manufacturing which instead mold the raw materials to the desired end shape. For our new Surface Laptop Studio, stamping reduced our manufacturing aluminum scrap rate for the product's base by at least 25 percent.

## Enabling repair

Repairability and serviceability can extend the lifespan of our devices. In 2021, our Design for Repair engineering program helped launch the Surface Pro 8, the Surface Laptop Studio, and Surface Laptop SE, which are considered to be some of the most repairable devices in their product lines with replaceable displays, batteries, keyboards, and more. We have also established a growing Authorized Service Provider (ASP) network to expand customer repairs across countries including the United States, Canada, Australia, Germany, and France. We recently partnered with iFixit to offer service tools for Surface devices to iFixit Pro independent repairers, Microsoft Authorized Service Providers, Microsoft Experience Centers, and Microsoft Commercial customers which can be purchased directly from iFixit. Our goal is to continue to expand safe, secure, and sustainable repair options for our Surface and Xbox devices.

Microsoft has also committed to hiring an independent consultant to conduct a study on the sustainability benefits of repairable Surface and Xbox devices, including impacts on carbon emissions and waste. Microsoft will publicly post a summary of our findings on our website by May 2022.

## Designing for recyclability

### Sustainable packaging

As we make progress on our 100 percent recyclable packaging goal for all devices by 2030, our Ocean Plastic Mouse and new Surface Slim Pen, available in 2021, are the first of our products to ship in 100 percent recyclable and plastic-free packaging. The Ocean Plastic Mouse packaging is comprised of 20 percent wood fiber, which is sustainably forested, and 80 percent Bagasse fiber, a fast-growing and highly regenerative bio-renewable material.

The packaging for our holiday 2021 Surface products—such as Surface Duo 2 and Surface Pro 8—are 99 percent recyclable on average. And, starting with our Surface Laptop 4 packaging launched in April 2021, all of our new packaging is made with 100 percent sustainably forested content as certified by the Forest Stewardship Council (FSC). We also eliminated a single-use plastic product, converting our Xbox gift cards from plastic to paperboard, reducing over 500,000 kg of plastic annually.

### Recyclable devices

Driven in large part by both materials selection and designing for disassembly—a natural byproduct of designing for repair—we produced a Surface Laptop 4 (metal version) that is 93 percent recyclable in OECD countries by UL standard ECVP 2789. Our Xbox Series X and S were also found to be 97 percent recyclable as a part of Microsoft expanding its recyclability commitment to also include Xbox and Xbox accessories.

Complex flame retardants, additives, and polymer grades used in consumer electronics make recycling of many plastics at end-of-life difficult. Microsoft is collaborating with suppliers in the industry to explore a closed loop supply chain for these difficult-to-recycle materials. Using end-of-life plastic material from Xbox consoles, PC accessories, and more, we've created a new closed-loop recycled resin that is being evaluated for use in upcoming products.

### Responsible end-of-life

We have focused on enabling responsible end-of-life with our devices, processes, and materials. To ensure products are kept in use longer, Microsoft and our partners work to repurpose or recycle used devices through several programs while encouraging consumers to engage with recycling programs in their own communities. Examples include Microsoft's Devices Trade-In Program, our Microsoft Authorized Refurbisher Program (MAR), and our voluntary mailback recycling program.


**100%**

Packaging for Ocean Plastic Mouse and Surface Slim Pen are 100 percent recyclable.

**500,000 kg**

We eliminated a single-use plastic product, reducing over 500,000 kg of plastic annually.

**75%**

of all Xbox Design Lab controllers now utilize post-consumer recycled plastic.

# Driving transformation

We believe that Microsoft's most important contribution to waste reduction will come not from our own work alone, but by helping our customers, partners, and suppliers around the world reduce their waste footprints through our learnings and with the power of data, AI, and digital technology.

Implementing a circular model that minimizes waste requires interventions up and down the value chain—innovative design, materials, service business models, reuse and redistribution processes, collection, processing, and more.

To achieve multiple uses for a material, many of these levers need to be used at once and require coordination with a diverse set of stakeholders. Technology can play a role in bringing data transparency of material flows and connectivity for business and consumer engagements. We believe that Microsoft's most important contribution to waste reduction will not come from our own work alone, but by helping our customers, partners, and suppliers around the world reduce their waste footprint through our learning and with the power of data, AI, and digital technology.

That said, our own operations are our best laboratory for innovation. In FY21, we invested to digitize waste data across the company and identified opportunities to improve data collection. We used Microsoft technology to track and report on materials and waste, developing PowerApps for facility managers, APIs to directly connect with recycling vendors, Dynamics 365 to aggregate bulk data, and the Power BI platform to visualize data across portfolios. We now have more consistent, high-quality data about the amount of waste, the type and quality, where it is generated, and where it goes, informing strategy to achieve our targets.

## Customers and partners

We are dedicated to using our technology to help customers, partners, and suppliers around the world reduce their waste footprints through our learnings and with the power of data, AI, and digital technology.

Collecting e-waste for responsible recycling in India.

## Tackling India's e-waste with a secure cloud

Startup Karo Sambhav is taking on the seemingly impossible task of formalizing India's e-waste economy. Roughly 7,200 tons of e-waste lands in India's capital city from across the country and abroad every day. When a team collects a waste shipment from an aggregator, its members upload photographs and details into an app. This information is hosted securely on Microsoft Azure. Karo Sambhav is operating in 28 states and three union territories in the country today. It had engaged with more than 500 companies and government institutions, 22,700 schools, 5,000 informal sector aggregators, and 800 repair shops as of December 2020 and was able to collect and send about 12,000 metric tons of e-waste for responsible recycling.[8]

# Driving transformation (continued)

## Blockchain to power the plastic reduction ecosystem

Plastic Credit Exchange (PCX), a nonprofit organization with origins in the Philippines, partnered with Microsoft to develop a blockchain-protected credit registry for the first global nonprofit plastic offset program, effectively reducing the flow of plastic waste into our landfills and oceans. PCX has built a wide ecosystem of partners to facilitate the recovery, transport, and processing of post-consumer plastic waste, seeking out the most environmentally recommended solutions available. The company undergoes verification via a third-party audit using its Plastic Pollution Reduction Standard and results are made public through an online registry. PCX now uses a Microsoft Azure-based blockchain solution to provide confidence, traceability, and transparency within its ecosystem. By the end of 2021, PCX is projected to have enabled the removal of approximately 37 million kilograms of plastic waste from the environment.[10]

## Waste and recycling digital transformation

Australian businesses export around 6,700 consignments of waste each year. As of January 2021, the Australian Department of Agriculture, Water, and the Environment (DAWE) requires that any business that wants to export waste glass must apply for a license. Working with Atturra and Microsoft, DAWE created a digital platform using Dynamics 365 to streamline the application process for both exporters and department personnel while keeping data secure and private. The system also provides detailed national-level data on exports of waste in near-real time, improving Australia's understanding of the evolving circular economy and providing an evidence base for future policies.

## Creating a more sustainable fashion supply chain

H&M Group is on a mission to lead the charge towards a more sustainable fashion future. As part of its efforts, in March 2020 the Group launched Treadler, a B2B service that offers access to H&M Group's supply chain to other fashion brands across the industry. Treadler's clients will have the necessary data to make more sustainable product development, sourcing, production, and logistics decisions. From selecting materials to choosing suppliers and factories, these sustainable choices can be traced across the H&M Group's global supply chain and put towards global sustainability goals for the entire fashion industry. Microsoft supported Treadler in the development of its technology infrastructure and backbone. To ensure deployment was fast, Treadler was supported by the Microsoft team to help guide a successful and efficient implementation. Treadler is also rolling out a dashboard that will help clients better consider manufacturing impacts as they place orders, and provide information about the sustainability performance to make even more informed decisions about sustainability.

## Cleaner beaches with AI and robots

Every year, 4.5 trillion cigarette butts end up in the environment. When water touches discarded cigarette butts, the filters leach more than 30 chemicals that are highly toxic to aquatic organisms. TechTics is working on a solution to resolve this environmental and social issue with technology. It has built a mobile beach-cleaning machine called BeachBot, which uses AI with the help of Azure infrastructure and Microsoft Trove to spot cigarette butts, pick them up, and dispose of them in a safe bin. The beach rover's AI system is trained to recognize cigarette butts, based on photos submitted via Trove by the public. This responsible approach to AI helps contributors to the project feel like they are part of a larger community tackling cleanup in their environments.


BeachBot uses AI to spot cigarette butts, pluck them out, and dispose of them in a safe bin.

**37M**

By the end of 2021, PCX is projected to have enabled the removal of approximately 37 million kilograms of plastic waste from the environment.

# Enabling systems change

We are focused on new ways to harness the power of technology, partnerships, and investments to drive impact at scale and pace to help the world more effectively transform to a circular economy.

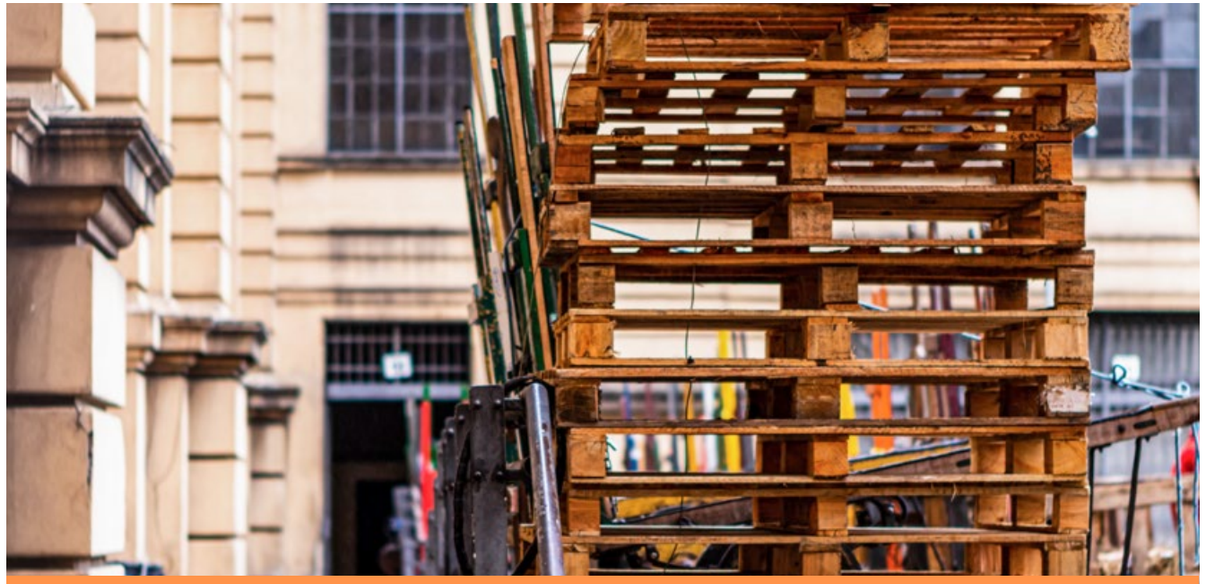
Circular materials management requires all stakeholders to participate in the transition from discarding materials to reusing them. Appropriate infrastructure and technology are important factors needed to actualize this vision while minimizing environmental impact.

To enable and accelerate the circular economy, the world must consider what materials are used, how goods are manufactured, how products are used and reused, how and where materials are collected at end-of-life, and how they are brought back into the supply chain.

## Funding innovation via CIF

The Climate Innovation Fund (CIF) invests in technologies and processes that can reduce the amount of waste generated by repurposing waste into other usable materials and products and enabling the continuous safe use of natural resources.

In 2021, we invested in Rheaply, a technology-enabled platform that brings together companies, government, educational institutions, and more to generate increased visibility and circularity of physical assets. Rheaply allows for transfers of materials that may otherwise go to waste and is building insights around waste diversion and embodied carbon emissions saved on the platform.



Circular materials management requires the transition from discarding materials to reusing them.

In FY21, we kicked off an internal pilot with Rheaply to better understand the opportunity for creating an internal hardware reuse program. We aim to extend the life of internal hardware turned in for recycling, creating a standardized, scalable, traceable, and circular program for our assets prior to responsibly recycling.

We are also seeing impact from our 2020 Closed Loop Partners fund investments, including the following developments in their portfolio.

### Turning waste into clean energy

HomeBiogas (HBG), based in Israel, is a leader in developing affordable, simple-to-use biogas systems, enabling people and businesses around the globe to turn their own organic waste into renewable energy and liquid fertilizer on site. A typical household can save six tons of $CO_2$ emissions a year with the entry-level biogas system. HBG serves over 10,000 households across more than 100 countries. The company has improved the circularity of the products themselves—lengthening the shelf life to over 15 years, and making the materials used for the digester 100 percent recyclable. Closed Loop Partners, an early investor of HBG, currently represents the largest ownership stake in the company, which currently trades on the Tel Aviv Stock Exchange.[8]

### Providing a model for circular economy infrastructure

Balcones Resources, the largest privately held recycling company in Texas, became the Closed Loop Leadership Fund's inaugural investment in October 2019. As part of Balcones' growth strategy to build best-in-class recycling operations across the southern United States, the company closed a bolt-on acquisition of Single Stream Recyclers (SSR) in 2020. SSR is the first AI-powered recycling company in the United States. Balcones's facility in Austin, Texas processed 136,000 tons of high-quality recyclable materials in 2020, including 80,000 tons of paper, more than 20,000 tons of glass, and at least 4,000 tons of plastics.[8]

# Enabling systems change (continued)

## Investing in AI

Through our AI for Earth program, we are supporting startups and nonprofits using cloud, data, and AI to accelerate the pace of innovation in waste, including the following projects.

### Using AI to study the sustainability of housing demolitions and relocations

The University of Connecticut is applying AI to detect construction changes between the years of 2014, 2017, and 2020 in Shanghai, China. The purpose is to find out whether demolition and relocation has led to substantial waste of resources.

### Seeing trash and targeting local actions using AI

Let's Do It Foundation has developed an AI algorithm for detecting trash in geolocated images. Today, the algorithm is surveying images all over the world, locating waste on a global scale so that a network of cleanup teams and local municipalities can target the most affected locations.

Using AI and robotics to accelerate the world's transition to the circular economy.


## Revolutionizing the waste management industry

Recycleye uses AI and robotics to revolutionize the waste management industry, accelerating the world's transition to the circular economy. In 2021, Recycleye scaled from research and development to commercialization with strategic and technical support from Microsoft. The company brings greater transparency to the waste management industry by detecting materials on a waste management facility's conveyor belts to deploy automated sorting. Their operating system is built on Microsoft Azure, ensuring data and model security, as well as scale. To train the Recycleye Vision computer vision solution, millions of images and data points have been collected from waste facilities. As Recycleye's datasets continue to grow, the company can easily scale up its Azure resources in line with requirements.

# Enabling systems change (continued)

## Driving collective action

Transitioning to a global circular economy takes an ecosystem of aligned partners. We seek transformational partnerships that help develop and deliver research, guidance, and implementation roadmaps that enable the circular economy.

### Collaborating as a Partner to the Ellen MacArthur Foundation

In July 2021, we advanced our relationship with the Ellen MacArthur Foundation from Member to Partner, elevating opportunities for Microsoft employees to learn and engage on topics of the circular economy through community platforms, workshops, events, courses, and collaborative projects.

### Leading on packaging innovation

In January 2021, Microsoft kicked off a project with members of the Ellen MacArthur Foundation Network (including Aquafil, BASF, Berry Global, CHEP/Brambles, Cisco, the Estée Lauder Companies, Flex, Mainetti, Mondi, and SCG) to create a circular packaging solution to replace the existing linear path plastic-based stretch wrap that is used to stabilize and protect products in transit. This cross-sectoral group is researching and piloting three different pathways to eliminate single-use stretch wrap used in a linear path: replacing stretch plastic with a compostable film, implementing reusable materials for securing pallets, and improving the recovery of single-use, linear plastic-based film for higher value and closed loop recycling solutions. The pilots and results will be detailed in a white paper to be published in Q2 of 2022.

### Driving standards with the Capital Equipment Coalition North America

In January 2021, Microsoft became a founding member of the Capital Equipment Coalition North America alongside DLL, GE Digital, Philips, and SAP and in partnership with the U.S. Chamber of Commerce Foundation and the Platform for Accelerating the Circular Economy (PACE). We joined 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.

**10**

Microsoft is collaborating with 10 other companies to test circular packaging solutions to replace stretch wrap packaging.

Delivering research, guidance, and roadmaps that enable the circular economy.

### Designing new solutions with Circular Electronics Partnership

An alliance of international organizations and their member companies, the Circular Electronics Partnership is committed to driving a coordinated transition towards a sustainable and economically viable circular industry by creating alignment, avoiding duplication, and stimulating ambitious circular action across the electronics value chain. The Partnership builds off the collaboration that produced A New Vision for Circular Electronics and convenes seven global organizations and their respective members: the Global Electronics Council (GEC), the Global Enabling Sustainability Initiative (GeSI), International Telecommunications Union (ITU), Platform for Accelerating the Circular Economy (PACE), Responsible Business Alliance (RBA), World Business Council for Sustainable Development (WBCSD), and World Economic Forum (WEF). The partnership is the first time that experts, business leaders, and international organizations will co-design solutions around the circular electronics industry and will establish a network to elevate the action and ambition of the industry in a coordinated way.

# Key trends

FY21 was a year of progress and learning for Microsoft on our journey to zero waste.

**1 Circularity supports decarbonization pathways.**

Implementing circularity activities like purchasing recycled materials, offering a service model, or keeping materials in use longer can reduce the embodied carbon of materials. Circularity plays a key role in reaching our carbon negative commitment to reduce our Scope 3 emissions by half by 2030.

**2 Circularity still lacks common standards needed to scale.**

Circular economy initiatives do not share a standard method of measurement across industries or product types and may not always accurately represent environmental impact. To scale implementation in the long term, we need the enabling infrastructure to measure, monitor, and verify material origin and flows.

**3 Waste data tools optimize quality and time.**

In FY21, we invested to digitize waste data across the company. We now have more consistent, higher-quality data about the amount of waste, its type and quality, where it is generated, and where it goes. As we implemented waste data tools across the entire company, we saved time collecting and reporting this data from our cross-company sustainability managers to executive leadership, to customers and regulatory bodies.

**4 Equity and economy are equally important in a circular economy.**

To date, the primary focus of a circular economy has been on the "economy" aspect. Equity is equally as important, and we need to focus on a just transition for every person, organization, and community. The world must address the disproportionate effects of upstream resource extraction and downstream waste management and pollution. It is critical to develop a strategy that ensures under-represented and under-resourced communities are not left behind in the transition to a circular economy.

**5 Zero waste roadmaps need site-level adaptability.**

Planning for waste interventions must be considered throughout the value chain and by location. Upstream decisions like procurement and use of materials affect downstream management and processing of materials as eventual waste. Location also affects zero waste implementation, and a certain degree of customization can ensure alignment to global efforts while contextualizing the program for local realities. While there are best practices that can be shared and replicated on a global scale, there are unique characteristics for each campus, such as its local infrastructure, size, or dining services. Creating a localized approach to zero waste drives local ownership and program effectiveness, while also laddering up to a global target.

# What's next?

## 1 Continue towards zero waste by 2030

We will scale programs such as our Circular Centers and the elimination of single-use plastics from packaging for Microsoft products and within our supply chain. Across the company, we are using baseline data to inform annual roadmaps that will result in meaningful environmental outcomes for our employees, consumers, and the diverse communities in which we operate.

## 2 Build circularity into our contracts

We will work upstream to develop better materials, including recycled materials, and ensure contracts are in place to support circular processes. We are also contracting with suppliers to engage in reverse logistics models and take-back programs for waste reduction and reuse of packaging materials. From downstream waste haulers, we are contractually requesting data transparency, optimization of services, and waste sorting education to promote zero waste outcomes.

## 3 Use our voice to align waste and circularity standards

We will help to drive standardization across circularity standards within the Capital Equipment Coalition and use our voice to coalesce industries towards a set of principles to promote circular economy progress. There is an opportunity for cross-industry collaboration for waste and circularity data standards, including a framework for capturing reliable and consistent data and methodologies.

## 4 Implement circularity to reduce embodied carbon

We are continually exploring design changes, material selection, and business processes to facilitate deep embodied carbon reductions across our operations and products. We are analyzing the optimal use of conventional materials, such as concrete and steel, and pursuing more ambitious opportunities with emerging alternative materials that carry significantly less embodied carbon.

## 5 Advance waste data tools

Building on our FY21 work to transform our waste accounting, we will continue to improve our waste data tools so they more accurately model business activity. The ability to forecast environmental impacts will drive upstream sustainable decision-making that minimizes waste and associated carbon emissions. It will also help us understand the environmental impacts of circularity practices like reuse, repair, redistribution, and recycling. We are exploring the best methods to account for this, such as measuring the per-year and absolute carbon footprint of a product.

## 6 Increase employee engagement

In FY22, as new recycling initiatives are deployed at the Circular Centers, we are focused on further iterating operational procedures and training for zero waste practices. We are also building design guidelines for engineers that define principles for circular, low-carbon hardware.

# What's next? (continued)

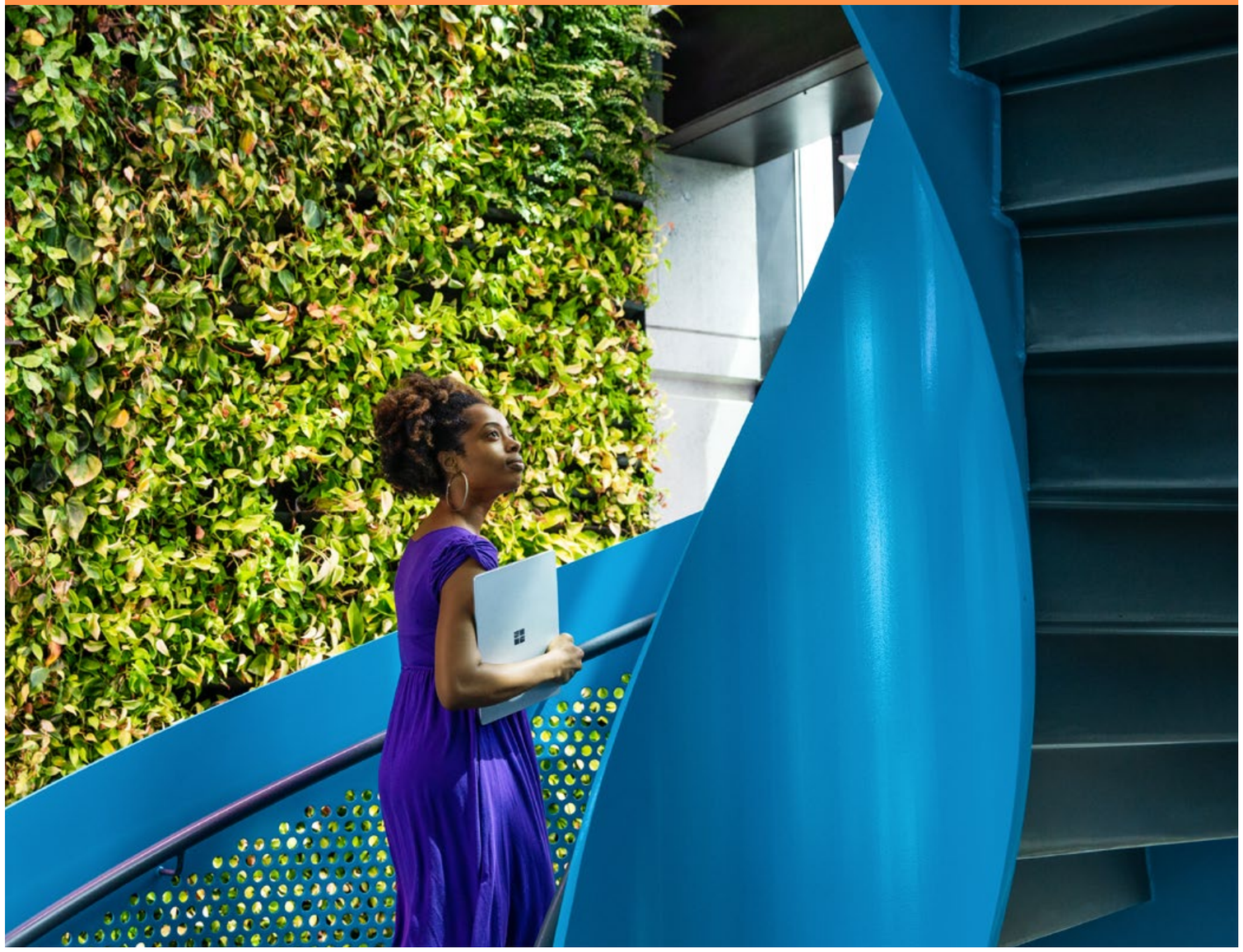
## 7 Expand our circular strategy in devices

Our work around recycled content, repairability, recyclability, and material efficiency continues to grow. Our framework for circularity will account for each phase of the device lifecycle and align with leading industry reporting standards and forthcoming circularity legislation. We will also continue expanding programs, such as the Microsoft mailback program, to ensure consumers around the world have access to an easy, convenient, and free service for returning their Microsoft branded devices and packaging for reuse, refurbishment, or recycling. By the end of FY22, Microsoft plans to implement the mailback program in 40 countries.

## 8 Scale the circular cloud

We are deploying new Circular Centers in Dublin, Chicago, and Singapore by July 2022. We also plan to launch a Circular Center in Quincy, Washington in 2022, followed by Sweden in 2025. Working with our internal and external partners, we will develop new dispositions that maximize reuse and minimize waste. In addition, we are exploring additional circularity functionality, such as harvesting for spares and warranty reuse, scaling buyback to network hardware, and providing recycling support—all of which can be performed at the Circular Centers. We are also working with our logistics packaging partners to reduce single-use plastic in packaging and transition to recyclable and compostable packaging.

We are focused on further iterating operational procedures and training for zero waste practices.



# Resources

Microsoft is committed to sharing our progress, challenges, learnings, and best practices throughout our sustainability journey.

## How circular centers will help Microsoft achieve zero waste by 2030 video

Get inspired by our first-of-a-kind approach towards designing and implementing circularity into our cloud.

Find out more here

## Microsoft Circular Centers | Azure Videos | Channel 9 (msdn.com)

Learn more about circularity and our Circular Centers.

Find out more here

## Achieving Operational Zero Waste

An inside look into Microsoft's operational zero waste journey.

Find out more here

## Global end-of-life programs for devices, batteries, and packaging

Find out where and how to recycle your Microsoft devices, courtesy of Microsoft.

Find out more here

## IT asset disposition guide

Learn about IT asset disposition options for customers migrating to Microsoft Azure.

Find out more here

## Capital Equipment Coalition North America

Learn more at the U.S. Chamber Foundation's open forum to reduce the environmental footprint of the capital equipment sector through goal setting, information-sharing, and collaboration.

Find out more here

## Ellen MacArthur Foundation

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

Find out more here

## Rheaply Asset Exchange Manager (AxM) Platform

Learn about Rheaply's resource management and exchange platform to resource assets, services, and expertise.

Find out more here

We are committed to becoming a zero waste company by 2030 and helping other companies on their journeys.

# Ecosystems

"Only when we have a massive amount of planetary data and compute at a similar scale can we begin to answer one of the most complex questions ever posed—how do we manage natural resources equitably and sustainably for a prosperous and climate-stable future?"

**Dr. Lucas Joppa**, Chief Environmental Officer

Contents

Our approach

# A commitment to protect more land than we use and build a Planetary Computer

## The context

Healthy ecosystems are critical for a healthy planet—environmental sustainability can't exist without ecosystem sustainability. Unhealthy ecosystems, created or exacerbated by climate change and biodiversity collapse, threaten our entire civilization. And yet, according to the latest United Nations Intergovernmental Science Policy Platform on Biodiversity and Ecosystem Services (IPBES-8) study, the health of ecosystems on which we and all other species depend is deteriorating more rapidly than previously thought. Put simply, we are eroding the very foundations of our economies, livelihoods, food security, health, and quality of life worldwide.

Microsoft recognizes that ecosystems are the thread that connects all our sustainability commitments. Ecosystems are where we invest in carbon sequestration projects that help us achieve carbon negativity, they are the watersheds we commit to protect and replenish, and they are where waste is ultimately diverted. We need a strong, efficient, scalable way to monitor, understand, measure, and ultimately manage the impact of our actions or inactions on ecosystems—both globally and locally.

In the past year, Microsoft has made considerable progress towards its leading ecosystem commitments of protecting more land than we use and delivering our Planetary Computer to provide access to the world's critical environmental datasets and to function as a computing platform that enables partners to measure, monitor, model, and manage healthy ecosystems.

## Our commitment: protect more land than we use by 2025 and build a Planetary Computer

### Building a Planetary Computer

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

### 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.

### Using our voice on ecosystem-related public policy issues

We will support and advocate for public policy initiatives that measure and manage ecosystems at the national and global scale.

### Empowering partners and customers around the world

We will use the Planetary Computer to develop and deploy the digital technology that helps our partners and customers with environmental decision-making in their organizational activities.

# Our approach (continued)

## Our progress

### >17,000 acres

In FY21, we contracted to protect more than 17,000 acres of land. This puts us on a path to exceed our commitment to protect more land than we use by more than 5,000 acres.

### 850+ grants

Since its inception in 2017, our AI for Earth program has provided more than 850 grants to organizations working in 110 countries around the world, granting more than $20 million in Azure credits.

### >500 Planetary Computer users

The Planetary Computer private preview released as planned in April 2021, with more than 500 users signed up and using the APIs and scalable compute.

### Delivered new Planetary Computer applications

We partnered with subject matter experts to use the power of the Planetary Computer to develop a growing set of applications that enable data-driven decision-making for the environment, ranging from conservation planning and forest risks to land cover and classification.

### 24 petabytes of data

We have made available 24 petabytes of data with more than 30 key environmental and Earth observation datasets to Azure in consistent, analysis-ready format that is freely available for use by anyone.

Ecosystems Chart 1

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

In FY21, we contracted to protect more than 17,200 acres, which is 50 percent more than the land we use to operate.

Protecting ecosystems

# Taking responsibility for our land footprint

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 looking at ways for our datacenters to integrate and give back to the natural environment.

Since making this commitment in April 2020, we identified two leading land protection organizations, the National Fish and Wildlife Foundation (NFWF) within the United States and The Nature Conservancy (TNC) globally, to partner with to achieve our commitment to protect more land than we use. We used a data-informed approach to identify ecosystems most at risk, using TNC's last chance ecosystem framework and NFWF's national landscape conservation framework. We also prioritize projects that have the support and involvement of local and indigenous populations.

In FY21, we contracted for projects that will help protect more than 17,000 acres of land, including the following

## TNC Belize Maya Forest Project

We contributed to the purchase of the Maya Forest land, one of the largest remaining tropical forests in the Americas outside of the Amazon. The approximately 236,000 acres secures a vital wildlife corridor in Central America's dwindling forests. This area is critical for the protection of iconic wildlife species, such as jaguars and ocelots, and preserves a significant living carbon reserve.

## NFWF Western Big Game Migration Program

We contributed to the purchase of permanent conservation easements in Montana, Colorado, New Mexico, and Nevada that will protect the migration corridors for species of greatest conservation need, including mule deer, elk, bighorn sheep, and moose. This effort also allows apex predators to thrive, including mountain lions, grizzly bears, and Canada lynx. Providing contiguous protected lands is crucial for enabling the successful migration of these wide-ranging species.

## Giving back to the natural environment

As we expand our operational footprint with new datacenters, our approach includes work to find ways for our datacenters to give back to the natural environment. Understanding how we can provide the same (or better) performance as an intact ecosystem starts with understanding how an ecosystem performs on its own. We have begun assessment of ecosystem performance in 12 datacenter regions, to be completed by end of 2021. Through this research, we are quantifying ecosystem performance in terms of services including water quantity and quality, air, carbon, climate, soil health, human health and wellbeing, and biodiversity. The goal is to renew and revitalize the surrounding area—resulting in mutual, regenerative value for the local community and environment.

We measure this in percentages of intact ecosystems, meaning the higher the percentage, the more effective we are at meeting nature's benchmark for the area.

The findings are helping to inform one of our first projects in North Holland, which is part of our Amsterdam datacenter region. Around the datacenters, we will construct lowland forested areas as well as forested wetlands, which are highly saturated with water and vegetation suited for water filtration to naturally process storm water and runoff. Modeled results from these different approaches 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).

The Maya Forest land is one of the largest remaining tropical forests in the Americas outside of the Amazon.

**5,000**

We will exceed our commitment to protect more land than we use by contracting for more land protection, putting us on path to exceed our goal by 50 percent.

# Driving transformation

We believe that Microsoft's most important contribution to protecting ecosystems and biodiversity is delivering the Planetary Computer, which provides access to the world's critical environmental datasets, AI, and digital technology.

Our land footprint is relatively small, which is why we also focus on using our technology to support ecosystem health.

We believe that our biggest contribution to the protection of ecosystems is to identify, invest in, and orchestrate a coherent cloud infrastructure that brings together all relevant stakeholders and offers best-in-class science-driven tools, AI, digital catalogs of species, distributed computing frameworks, and global satellite images. We make these tools cloud-native, bring our business partners to deploy them to be used, and build trust by making visible the science roots and the provenance of the data, while creating best practices for deployment by deploying ourselves first. We are also embracing open source, identifying critical petabytes of satellite images being collected and released as open data, including the Copernicus satellite programs and tools like Marxan.

The manifestation of this work is what we call the Planetary Computer. This open-source solution includes data catalogs, APIs, and applications to empower both data scientists and environmental scientists to craft more effective and informed strategies to protect and restore ecosystems.

## Product

In April 2021, we released the Planetary Computer, which enables global-scale environmental monitoring by combining petabytes of data and spatial analysis tools to power sustainability applications. It is a platform that lets users build on the power of the cloud to accelerate environmental sustainability and Earth science.

The Planetary Computer consists of four major components:

- The **Data Catalog**, which includes more than 24 petabytes of data about Earth systems, hosted on Azure and made available to users for free.
- **APIs** that allow users to search for the data they need across space and time. Instead of sifting through millions of files, we index content so any user can ask directly for a type of data (for example, "give me all data from these satellites for Kansas in summer 2020 when it was not cloudy and give me those times on a specific map projection of the average values"). This vastly reduces the complexity of dealing with petabytes of data.
- The **Hub**, a managed computing environment that allows scientists to process massive geospatial datasets. To date, we have seamlessly deployed more than 20,000 cluster node workers to support our user workloads.
- **Applications**, built by our network of partners, that put the Planetary Computer platform to work for environmental sustainability, ranging from conservation planning and forest risk management to land cover classification.

The Sentinel-2 program provides global imagery in 13 spectral bands and a revisit time of five days.

# Driving transformation (continued)

The Planetary Computer uses open-source tools and supports open standards. In fact, the foundation of the Planetary Computer is the incredible ecosystem of tools being developed in the open by our partners and the much broader open-source community. For example, our Hub builds on the work done by the Pangeo community to put the tools of data science to work for the Earth science community, and our API builds on the work done by the STAC community to streamline and standardize the cataloging and discovery of geospatial data.

The Planetary Computer API and Planetary Computer Hub are currently in private preview, accepting a small set of early users, with plans to go public in mid-2022. All the datasets are available and can be accessed via Azure Blob Storage. Datasets can be used by developers working within or outside of our Planetary Computer Hub. They can integrate each component in their existing processes or use the full Planetary Computer with one single experience.

**24 PB**

We have made available 24 petabytes of data with more than 30 key environmental and Earth observation datasets.

Protecting and managing land, oceans, and biodiversity.

## Customers and partners

We partnered with subject matter experts to use the power of the Planetary Computer to develop applications that enable data-driven decision-making for the environment, including the following.

### Global land cover maps

In June 2021, Esri published a new high-resolution 2020 Global Land Cover map for users around the world. The 10-Meter Land Cover map is the collaborative result of compute and Sentinel-2 data from the Microsoft Planetary Computer and a novel deep learning AI model developed by Impact Observatory. High-resolution, open, accurate, and timely land cover maps are critical for decision-makers in many industry sectors and developing nations, supporting a broad range of sustainability and conservation efforts. The data is hosted in ArcGIS Living Atlas of the World and the Planetary Computer.

### Ecosystem mapping and monitoring

Conservation Science Partners' Analytics Lab uses the Planetary Computer to better visualize ecosystem monitoring projects and help make the findings more intuitive and accessible. These mapping applications assess wildlife habitat connectivity on working landscapes, anthropogenic impacts to terrestrial landscapes, and changes in forest structure over time.

### Conservation planning with spatial data

The Nature Conservancy (TNC) is using the Planetary Computer to protect and manage land, oceans, and freshwater biodiversity for nature and people. In partnership with Microsoft, TNC is scaling impact and accelerating conservation with Marxan, a world-leading decision-support software for spatial conservation planning. Microsoft and TNC are enabling more equitable access to Marxan by bringing it to the cloud with platform development support from Vizzuality. Together we are helping people around the world make evidence-based decisions more quickly, inclusively, and transparently to protect the world's biodiversity.

### Risk assessments for forest-based climate solutions

CarbonPlan is using the Planetary Computer to enable more transparent and scientifically rigorous evaluation of forest-based climate solutions. By shining a light on data from past and future carbon offset projects, procurement programs can better understand the climate risks of carbon credit purchases. Microsoft used this application to visualize the climate risks of forest carbon offsets to help us manage our carbon removal purchasing program more effectively.

### Carbon sequestration estimates for above-ground stock

Chloris Geospatial uses the Planetary Computer to generate their "above-ground carbon stock" non-commercial product, which gives anyone the ability to analyze forest carbon globally.

# Enabling systems change

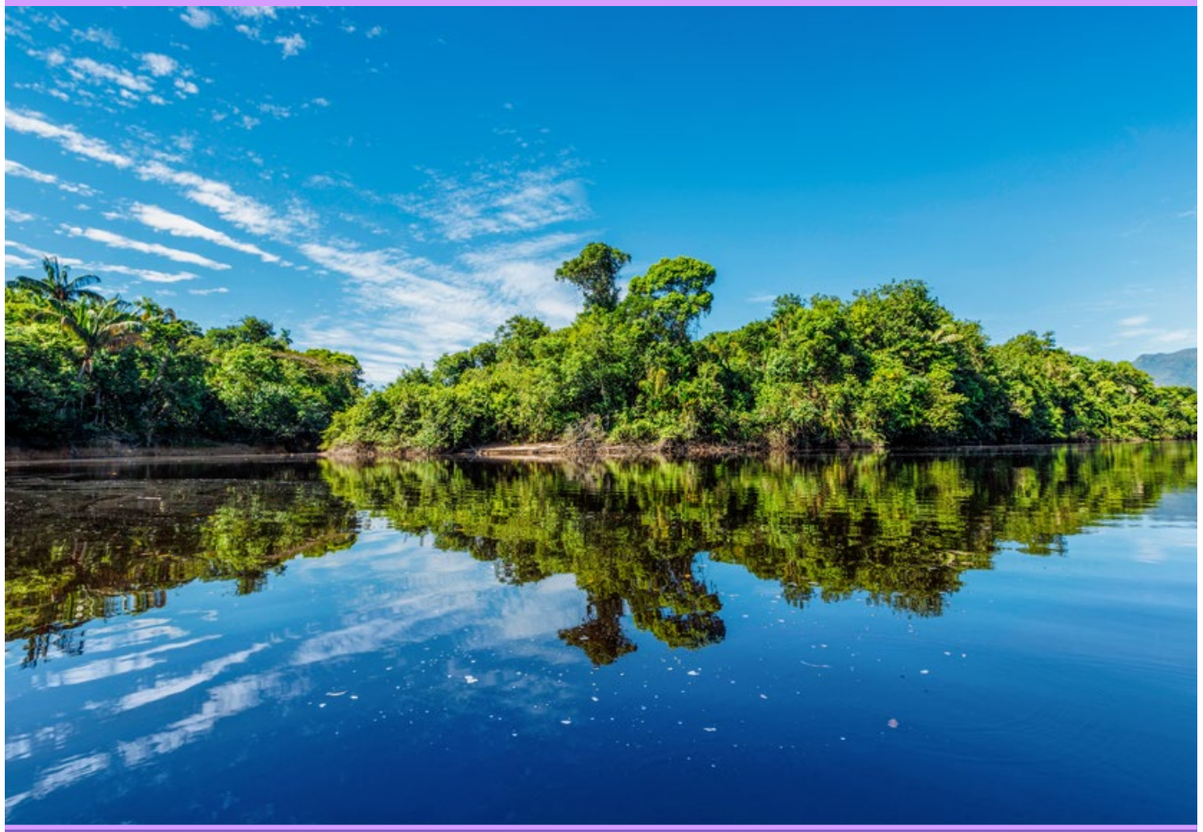
We are focused on new ways to harness the power of technology, partnerships, investments, and policy to drive impact at scale and pace to help the world protect ecosystems and biodiversity.

At Microsoft we know that our actions alone will not be enough to protect ecosystems and biodiversity. The world will need new partnerships, solutions, and policies that have the potential to scale rapidly and globally.

## Investing in AI

To empower organizations working on environmental challenges, we provide training and access to cloud and AI technologies. Since its inception in 2017, our AI for Earth program has provided more than 850 grants to organizations working in 110 countries around the world. While initially these grants provided access to Microsoft cloud services and additional training, we've expanded the program to now include the Planetary Computer. This past year, we also added new partners that bring significant new capabilities to the program. We partnered with the Group on Earth Observations (GEO) Secretariat to better reach geospatial researchers and practitioners working at the forefront of environmental use cases. We launched the $1 million GEO-Microsoft Planetary Computer grant program to support early adopters of the Planetary Computer to apply Earth observations to address environmental and societal challenges. We selected the first eight grant recipients in September 2021 who all received access to the NICFI Satellite Data Program on Azure and launched a second request for proposals in October 2021 in partnership with Planet Labs.

Monitoring to be able to create more effective reforestation plans and monitor reforestation progress.



## Deforestation prediction

We partnered with Vale and our Brazilian subsidiary to build PrevisIA, a solution for NGO Imazon that anticipates information on regions with a higher risk of deforestation and wildfires in the Amazon Rainforest through AI. The open platform analyzes various data such as topography, land cover, urban infrastructure, official and unofficial roads, and socioeconomic statistics to refine the deforestation risk model and identify the different types of territories threatened by deforestation in the Amazon Rainforest including indigenous lands and conservation units. All the information is publicly disclosed at a control panel. Public bodies, private companies, and civil society can plan and carry out preventive actions, combating and controlling deforestation.

# Enabling systems change (continued)

People-powered research, using open source and Azure technologies to lower the barriers to entry for scientific discovery.

## Accelerating scientific discovery with crowdsourcing

Zooniverse is the world's largest platform for people-powered research, using open source and Azure technologies to lower the barriers to entry for scientific discovery. Researchers upload their images, videos, or audio files—like camera trap images of wild animals or satellite imagery of a star—and Zooniverse's global community of over 2 million volunteers tags, annotates, or transcribes the file to aid classification.

### Preventing illegal trade of shark and ray products

We partnered with Conservation International and the National Parks Board of Singapore to develop a mobile application that helps identify shark and ray species using technology such as computer vision and AI. This will enable ground inspectors at national borders to rapidly assess and identify shark and ray species and seize products that are suspected to be illegal.

### Protecting coastlines and shorelines

We partnered with the Qatar Environment and Energy Research Institute (QEERI) to build a solution using remote sensing technologies to detect coastal changes and predict shorelines and water line evolution for the next 10, 20, and 50 years. A change detection map assesses the coastal hazards on urban infrastructure and population, including the impact of seawater intrusion on agricultural and food production in the north of Qatar.

### Modeling release sites for disease-fighting mosquitoes

The World Mosquito Program (WMP) uses Azure to model human population distribution in dengue-endemic areas to determine the best release locations for disease-fighting mosquitoes to stop the spread of deadly dengue fever. Through high-resolution satellite imagery, demographics, and climate data the model is trained to provide accurate estimations of spatially-distributed human population density. This allows WMP experts to easily develop optimal release strategies for *Wolbachia* mosquitoes. Research shows that *Wolbachia* can sustain itself in mosquito populations without continual reapplication, making this a long-term, cost-effective and self-sustaining approach with no adverse impact on natural ecosystems.

# Enabling systems change (continued)

## Driving collective action

Successful strategies, interventions, and approaches to improve ecosystem health require a great deal of data and collaboration across public and private sectors, as well as civil society. We are taking an ecosystem approach to ecosystems, creating or broadening our relationships to provide more people with better access to this critical information.

### UN Biodiversity Lab

In 2021, we launched a new partnership with the UN Biodiversity Lab to help connect remote observations, field data, and AI/machine learning tools. This work, powered by the Planetary Computer, will enable countries to develop richer environmental accounts and drive better environmental decision-making.

### GEO BON

Fostering global connections and collaboration will be critical to address climate change. In the past year, we broadened our work with the Group on Earth Observations Biodiversity Observation Network (GEO BON) to connect with a global network of scientists to enable a scalable approach to expanding and accessing biodiversity information and insights.

### CSIRO

We're supporting CSIRO in Australia to establish a climate intelligence platform that puts trusted and credible climate risk science in the hands of businesses in Australia and the Asia region and enables them to assess, disclose, and manage their climate risks. In addition, together with CSIRO and the University of Reading, we have developed a research partnership to improve our understanding and assessment of climate change risk.

### Radiant Earth

The Radiant Earth Foundation develops Earth observation machine learning libraries and models through an open-source hub to support global missions like agriculture, conservation, and climate change. We support Radiant Earth by co-building some of the key software libraries, making it easy to bridge to and from the Planetary Computer. We are also jointly running competitions to improve machine learning models.

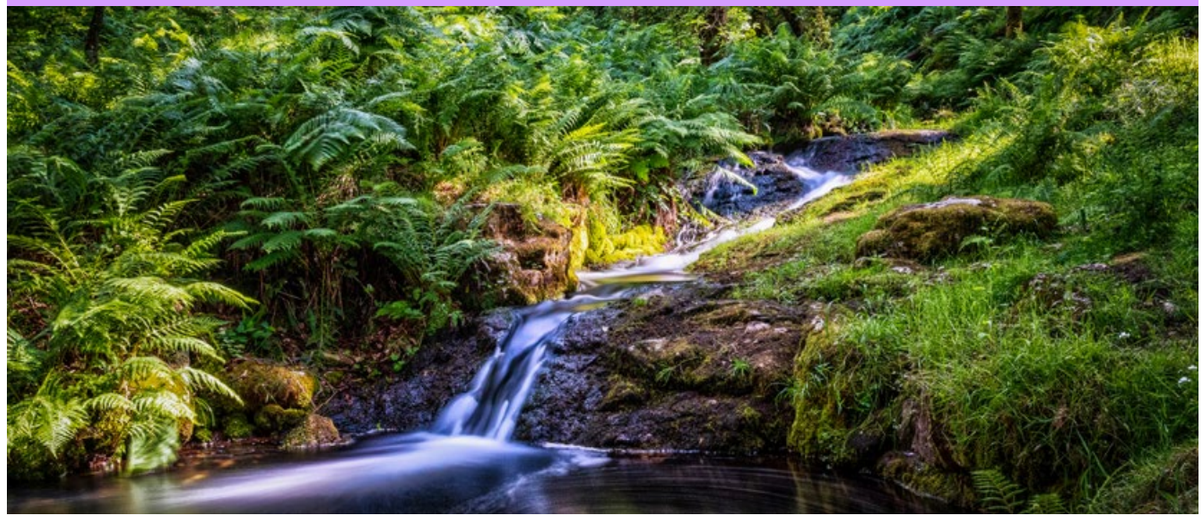
### OS-Climate

We continue to support the OS-Climate initiative, which is accelerating the development of scenario-based predictive analytic tools and investment products that manage climate-related risk and finance climate solutions across every geography, sector, and asset class. Microsoft is a founding member, contributes our expertise on climate risk and data, and provides additional technology support for the development of new tools and approaches.

### C4IR

In 2020, Microsoft joined the World Economic Forum's Center for the Fourth Industrial Revolution Network for ocean innovation and technology in Norway (C4IR Ocean). Since then, we have expanded our work with a new project that has us working with C4IR Ocean to deliver a tracking application for maritime vessels to forecast GHG emissions from maritime transportation. This information is made available through C4IR's Ocean Data Platform for regulators, finance institutions, and port and coastal authorities to enable data-driven decisions related to the environmental impact of shipping.

Successful strategies to improve ecosystem health require data and collaboration across public and private sectors.



## Advocating for healthy ecosystems and biodiversity

Governments play a unique and important role in measuring and managing ecosystems and biodiversity as they collect and make publicly available massive amounts of data critical to environmental science. They also own billions of acres of public land that they can use to protect, manage, and restore critical ecosystems. And they establish and implement policies governing the use and management of natural resources and ecosystems.

### Advocating for policies that advance measuring and managing biodiversity and ecosystems

Microsoft submitted comments to the USDA on ways to advance climate-smart agriculture and forestry.

Microsoft is advocating for the US Congress to pass the Growing Climate Solution Act to advance climate-smart agriculture and nature-based carbon markets. In addition, Microsoft supported funding in the Washington state budget to develop high-quality nature-based carbon removal protocols. Microsoft serves on the steering committee of the US chapter of Trillion Trees and submitted one of the initial corporate pledges. We have been working with the organizers on ways to design the initiative in a way that accelerates reforestation and meaningfully removes carbon. In Europe, Microsoft supported and engaged on the EU Biodiversity Strategy for 2030, that aims to increase protected areas across the EU and to identify new measures for managing and restoring ecosystems. Microsoft also committed to support a new dedicated "European Biodiversity Partnership," Biodiversa+, that will bring together science, policy, and practice, and support data-driven research to stop the loss of biodiversity.

# Key trends

2021 was a year of progress and learning for Microsoft on our journey to delivering the Planetary Computer.

### 1 The volume and variety of spatial data continues to grow exponentially.

Whether it's satellites in the sky or sensors on the ground, data about the Earth is being captured at higher resolutions, more often, with a variety of data formats and purposes. There is also a growing set of model output and derived products which are large spatial datasets themselves, valuable to a broad set of use cases. This creates a deluge of data waiting to be unlocked for positive environmental sustainability impact.

### 2 Data providers are eager to make their data more accessible for environmental sustainability use cases.

The organizations that are producing spatial data know what's at stake for our ecosystems. They want to see their data utilized to meet the sustainability challenges we are facing and work together to enable users to utilize the data in a common, interoperable manner.

### 3 Getting data to the cloud is the only way to scale the work of a broad range of users.

Data that exists in the cloud has a huge advantage over data that must be first downloaded on a user's system. Unless you own a supercomputing system, there is no way to download and compute over the vast amount of data needed to scale the analyses and operationalization of that data.

### 4 Finding and sharing data about the Earth remains a huge challenge.

Users need to search the vast amount of data available to find the data they need and have easy access to data in the areas and times they care about. Just because data is available does not mean it is accessible. There is a growing effort in the geospatial community to enable access to cloud-hosted data through utilizing cloud-optimized formats and supplying APIs to search through standards-based metadata.

### 5 Open data, open source, open science, and open standards are critical to collaboration.

The scope of the problems facing our world mean that no one organization or person will be able to solve them. The easier it is for governments, academia, and industry to work together, the faster we can all move in the same direction. The best mechanism currently for this collaboration is doing things in the open: publishing open datasets, using and investing in open-source software, publishing open science, and making data accessible through open standards.

# What's next?

## 1 Make publishing and using spatial data in the cloud simple

We are developing features in the Planetary Computer that will make it easy to push data to the cloud and open access to some or all users.

## 2 Solve data access challenges for science and operational applications

Enabling efficient geospatial workflows on Azure will unlock the power of the massive amount of data the world is collecting about our Earth to monitor, model, and manage Earth's natural systems. The Planetary Computer will solve the core data access problems for planetary scale problems, ranging from scientific research to enterprise-grade applications, so that developers building applications on top of it can focus on what makes their solutions unique.

## 3 Expand the catalog of datasets hosted in the Planetary Computer

We are continuously identifying and onboarding high-value, openly licensed datasets for broad usage in the Planetary Computer. We are improving our pipelines to reduce the latency between data becoming available and being findable and usable in users' existing workflows.

## 4 Support the growing ecosystem of applications powered by the Planetary Computer

We will continue to grow our network of partners developing impactful environmental sustainability applications using the data and services of the Planetary Computer. This includes investing in partners that use technologies like AI to push the boundaries of what is possible and empower their users with the tools they need to make decisions to protect the ecosystems of our planet.

## 5 Continue to invest and grow the open-source ecosystem of tools working with Earth science data

Microsoft will continue to support the open-source ecosystem of tools that we use to deploy our services and that our users rely on to process, analyze, and operationalize the data of the Planetary Computer.

We will target new domains like climate forecast and biodiversity observation data.

# Resources

## The Planetary Computer

Learn about how the Planetary Computer supports sustainability decision-making with the power of the cloud.

Find out more here

## The Planetary Computer Data Catalog

Explore the catalog of datasets available through the Planetary Computer API.

Find out more here

## AI for Earth technical resource

Access the open-source tools, models, infrastructure, data, and APIs from Microsoft engineering and data science teams to support sustainability and environmental science.

Find out more here

Microsoft is committed to sharing our progress, challenges, learnings, and best practices throughout our sustainability journey.

## AI for Earth grants

Learn about the work of AI for Earth grantees and learn more about the program.

Find out more here

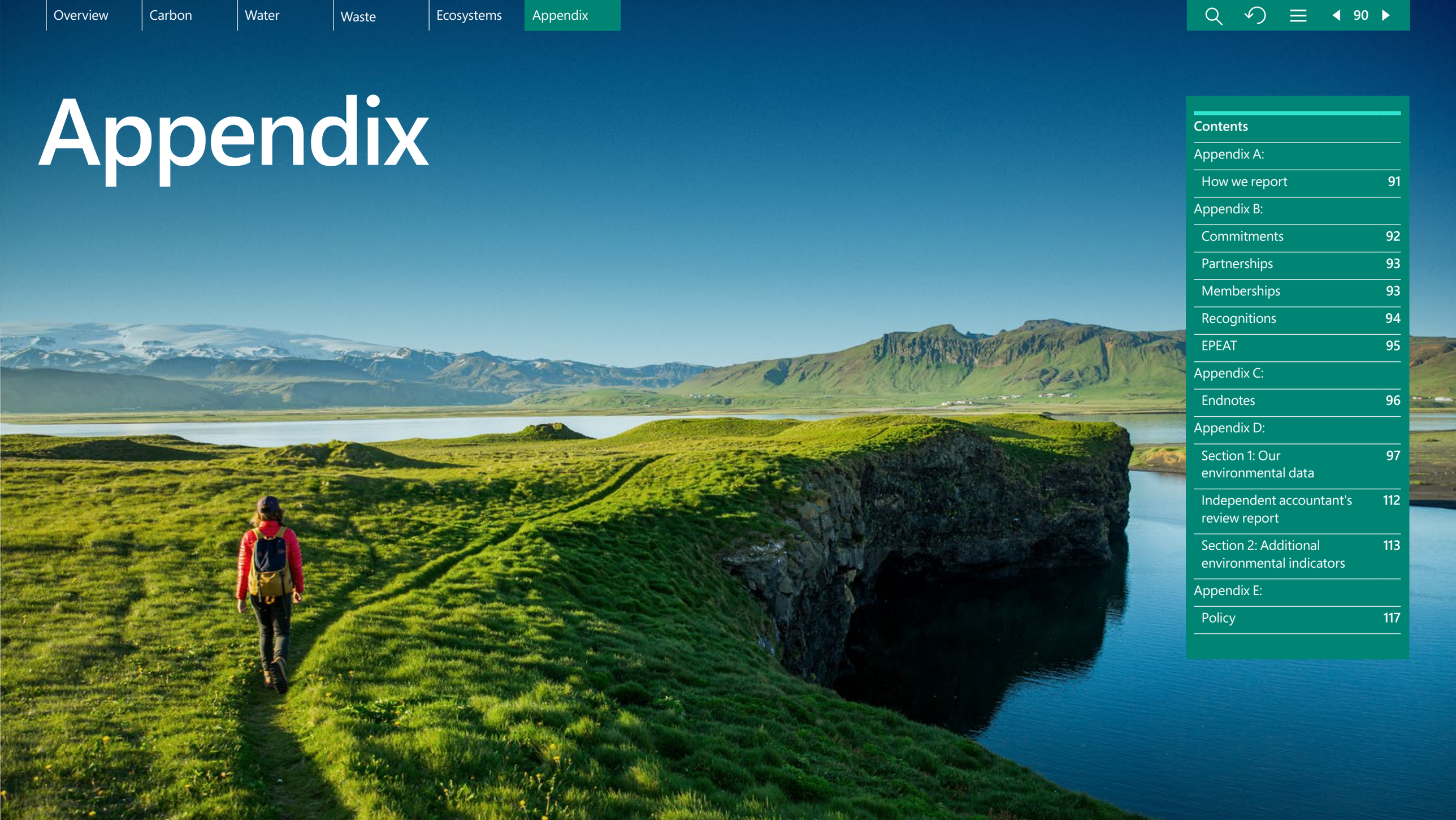
## AI for Earth partners

Learn about AI for Earth and Planetary Computer partners and their work.

Find out more here

We are committed to delivering the Planetary Computer and helping others protect ecosystems.

# Appendix



Contents

Appendix A

# How we report

## Reporting standards

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 such as sector-based materiality maps provided by the Sustainable Accounting Standards Board (SASB), the United Nations Guiding Principles on Business and Human Rights Reporting Framework, and the UN Sustainable Development Goals. We presented greenhouse gas emissions in accordance with the GHG Protocol and select environmental metrics that reference the Global Reporting Initiative Standards (GRI). We have been reporting to CDP since 2010, consistently making it to CDP Climate Change A-list and earning the highest band of A and A- for CDP Water Security since 2016. On climate-related issues, we are committed to fully aligning with the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD).

Our commitment to sustainable development

Read our TCFD report

## Our policies and practices

We work to apply the power of technology to earn and sustain the trust of the customers and partners we empower and the communities in which we live and work. This focus extends to our work to build a sustainable future where everyone has access to the benefits and opportunities that technology can bring. It's central to our mission to empower every person and organization to achieve more, and it's why many of our employees come to work every day.

## 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 those topics which 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 last year's report.

## Governance

Microsoft has made sustainability part of its business, including embedding it deeply into its governance structure. Our Board of Directors provides insight, feedback, and oversight across a broad range of environmental and social matters. In particular, the responsibilities of the Board's Regulatory and Public Policy Committee include providing oversight and guidance to the Board and management about the company's policies and programs that relate to corporate social responsibility, including the company's environmental sustainability strategy and commitments. Microsoft's management team understands that sustainability performance is linked in myriad ways to the company's long-term financial performance and growth that is sustainable in every sense of the word. We are committed to building and executing on strategies to help foster a healthy planet and advance a more inclusive economy that fosters additional growth opportunities for everyone. Additional information about our governance structure for sustainability can be found in our TCFD report as well as our CDP responses.

## 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

# Commitments

## Our history 2012–2019

**2012**
100% carbon neutral
Internal carbon fee instituted

**2016**
Zero waste campus certification

**2017**
AI for Earth launch
LEED Gold certification for new datacenters

**2018**
Supplier carbon engagement in China launched
Net zero potable water
Silicon Valley campus groundbreaking

**2019**
Carbon fee raised to $15
Water replenishment goal set

## Our commitments 2020–2050

**2025**
Operate with 100% renewable energy
Find out more here

**2025**
Protect more land than Microsoft uses
Find out more here

**2030**
Become carbon negative
Find out more here

**2030**
Become zero waste
Find out more here

**2030**
Become water positive
Find out more here

**2050**
Remove all historical emissions
Find out more here

# Appendix B (continued)

## Partnerships

Founding member of **Transform to Net Zero**, whose 2025 goal is for all Fortune Global 1000 companies to have targets backed up by transformation plans to achieve net zero no later than 2050.

Find out more here

Founding member of **Water Resilience Coalition**, which will provide tools and guidance for companies to assess and improve water resilience.

Find out more here

Founding member of LF **Climate Finance Foundation** to help model climate risks.

Find out more here

Partner with **Center for the Fourth Industrial Revolution Oceans** (C4IR) to develop technology-based solutions to improve ocean health.

Find out more here

Partner with the **Ellen MacArthur Foundation** to engage on topics of the circular economy through community platforms and collaborative projects, including a pilot of innovative circular packaging solutions for stretch wrap film.

Find out more here

Partner with **Water.org** to enable access to drinking water and sanitation in seven stressed regions around the globe.

Find out more here

Partner with the **Alliance of CEO Climate Leaders (WEF) Carbon Removal Climate Action Group** to support corporate assessment and scale-up of carbon removal opportunities.

Find out more here

Partner with Australia's **CSIRO** to establish a climate intelligence platform that puts trusted and credible climate risk science in the hands of businesses in Australia and the Asia region.

Find out more here

Partner with the **UN Biodiversity Lab 2.0**, an initiative of the United Nations Development Program (UNDP), the United Nations Environment Program World Conservation Monitoring Centre (UNEP-WCMC), and the Secretariat of the UN Biodiversity Convention, to help governments and others better understand and manage the environment.

Find out more here

Partner with the **Radiant Earth Foundation** to bring AI models and training data to the Microsoft Planetary Computer.

Find out more here

## Memberships

Advanced Energy Economy
BOARD NOW coalition for sustainable flying
BICEP Business for Innovative Climate & Energy Policy
Business Alliance to Scale Climate Solutions
California Water Action Collaborative
U.S. Chamber of Commerce Foundation
Carbon Capture Coalition
CEBA Clean Energy Buyers Association
C2ES Center for Climate and Energy Solutions
CEO Water Mandate
circular electronics partnership
CLG Europe
Climate Leadership Council
Eco Skies Alliance
eurelectric
op2b one planet business for biodiversity
Race to Zero
SABA Sustainable Aviation Buyers Alliance
Sustainable Packaging Coalition
Third Derivative
Water Europe Technology & Innovation
wbcsd
1t.org

# Appendix B (continued)

## Recognitions

**2021 Green Power Leadership Award:**
CRS International Market Development

Find out more here

**2021 EPA Green Power Leader:**
U.S. Environmental Protection Agency (EPA)

Find out more here

**2021 Climate Leadership Award:**
Organizational Leadership

Find out more here

**2021 UN Global Climate Action Award:**
Climate Neutral Now

Find out more here

**World Environment Center 2021 Gold Medal:**
Corporate Sustainability

Find out more here

**2021 The Just 100:** For the fourth year in a row, Microsoft took first place on The Just 100, a list by Just Capital and Forbes to rank companies perceived as "the best at doing right by America".

Find out more here

**America's Most Responsible Companies 2021:**
Microsoft was ranked third by Newsweek's assessment of companies across leading ESG areas.

Find out more here

**U.S. Water Prize:**
Awarded the U.S. Water Prize for Outstanding Private Sector Organization celebrating Microsoft's achievements in the advancement of sustainable, integrated, and inclusive solutions to water challenges.

Find out more here

**#1 in Top 100 Most Conscious Brands of 2020:**
Microsoft tops Wolff Olins and Hall & Partners' inaugural list of the world's 100 most conscious brands.

Find out more here

**2021 COTE Top Ten Award:**
Microsoft Silicon Valley Campus was awarded COTE Top Ten Plus designation for exemplary performance data and post occupancy lessons.

Find out more here

**Compass Award at COP26:**
Microsoft awarded for Environmental Leadership.

Find out more here

**#1 in the 10 most innovative corporate social responsibility companies of 2021:**
Fast Company ranked Microsoft #1 for setting incredibly ambitious long-term carbon neutrality goals.

Find out more here

**#1 in EcoAct International Top 20 for 2021:**
Microsoft was rated as the highest performing company in demonstrating corporate leadership on climate reporting across all indices within the DOW 30, Euro STOXX 50, and FTSE 100.

Download here

**CDP A List 2021 for Climate and Water:**
Named to the CDP A List for Climate Change and Water Security.

Find out more here

**EPEAT** see next page

## Appendix B (continued)

# EPEAT

EPEAT (Electronic Product Environmental Assessment Tool) is the leading global Type-1 ecolabel for the technology sector, managed by the Global Electronics Council (GEC). The program requires independent verification of product and corporate eco-attributes to ensure that the product meets the EPEAT criteria as claimed. We apply EPEAT standards to our Surface devices. Surface devices must meet specific sustainability and lifecycle-based design and performance criteria to achieve the baseline tier, "Bronze" EPEAT registration level. The achievement of additional optional criteria results in a higher registration of "Silver" or "Gold" level.

We are continuously working to reach the highest level of EPEAT registration level, "Gold", for all our devices. In late 2020, we achieved registration not just in the United States but also in Canada, and in 2021 we expanded our registration to most of Europe.

Following is a summary of our Surface computers on the EPEAT registry.

These ratings are used by customers to make purchasing decisions based on product and corporate environmental and social attributes. We track progress against EPEAT targets across our Surface portfolio. For more information, visit the EPEAT registry which includes a listing of all registered devices including the countries of registration and the EPEAT tier.

| Product | US + Canada | Europe (27 countries)* |
|---|---|---|
| Surface Pro 8 | Gold | Gold |
| Surface Laptop Studio | Gold | Gold |
| Surface Pro X | Gold | Gold |
| Surface Go 3 | Gold | Silver |
| Surface Pro 7 | Gold | Gold |
| Surface Pro 7+ | Gold | Gold |
| Surface Laptop Go | Gold | Gold |
| Surface Laptop 4 13.5-inch, Alcantara palm rest | Gold | Gold |
| Surface Laptop 4 13.5-inch, metal palm rest | Gold | Gold |
| Surface Laptop 4 15-inch, metal palm rest | Gold | Gold |
| Surface Laptop 3 13.5-inch, Alcantara palm rest | Gold | Gold |

| Product | US + Canada | Europe (27 countries)* |
|---|---|---|
| Surface Laptop 3 13.5-inch, metal palm rest | Gold | Gold |
| Surface Laptop 3 15-inch, Alcantara palm rest | Gold | Gold |
| Surface Laptop 3 15-inch, metal palm rest | Gold | Gold |
| Surface Go 2 | Gold | Silver |
| Surface Book 3 15-inch | Gold | – |
| Surface Book 3 13.5-inch | Silver | – |
| Surface Book 2 15-inch | Silver | – |
| Surface Book 2 13.5-inch | Silver | – |
| Surface Pro 6 | Silver | – |
| Surface Pro 5 | Silver | – |
| Surface Go | Silver | – |

* Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, United Kingdom.

# Appendix C

## Endnotes

1 Scope 2 references in the report represent market-based emissions.

2 Reported value represents contracted tons during FY21 reporting year. This number might change based on contract fulfillment.

3 Measurement is based on the device industry best-practice life cycle methodology, which is not currently reflected in Microsoft's corporate disclosure.

4 Net Zero by 2050 – Analysis – IEA

5 Measurement is based on construction industry best-practice life cycle methodology, which is not currently reflected in Microsoft's corporate disclosure. Updates to Microsoft's corporate disclosure methodologies will be published annually.

6 This statistic is based on a life cycle methodology for emissions reporting that Microsoft has not yet adopted in its corporate disclosure.

7 Measurement is based on the Global Logistics Emissions Council (GLEC) methodology, which is not currently reflected in Microsoft's corporate disclosure. Updates to Microsoft's corporate disclosure methodologies will be published annually.

8 These numbers are self-reported by the organization and have not been verified by Microsoft.

9 672 million liters per year is measured using the Volumetric Water Benefit Accounting method with WRI and Limnotech.

10 Total number of people reached confirmed through independent third-party verification. 95,130 people reached in FY21. Country-level distribution: India—3,038 people and Indonesia—92,092 people.

Appendix D

# Our environmental data

As part of Microsoft's commitment to disclose information about our environmental footprint, the following sections are a compilation of environmental metrics across greenhouse gas emissions, energy, water, waste, and land.

Section 1 presents greenhouse gas emissions in accordance with the GHG Protocol and select environmental metrics that reference the Global Reporting Initiative (GRI) Standards. Deloitte & Touche LLP performed a review engagement on management's assertion related to the specified information presented in Section 1 of Appendix D as of and for the fiscal year ended June 30, 2021 and includes their review report. Information relating to periods prior to the fiscal year ended June 30, 2021, was not subject to Deloitte & Touche LLP's review and, accordingly, Deloitte & Touche LLP does not express a conclusion or any form of assurance on such information.

Section 2 presents additional environmental metrics that show additional detail and breakdowns and was not subject to Deloitte & Touche LLP's review.

All reported values represent best available data at the time of publication. Data is adjusted to incorporate updated methodology, structural changes, and/or accuracy improvements. Additional detail on these changes is included as footnotes where applicable.

## Environmental data contents

Appendix D (continued)

# Section 1: Our environmental data

## 1.1 Greenhouse gas (GHG) emissions

Table 1

### GHG emissions by Scope ($mtCO_2e$)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Scope 1 | 107,452 | 99,008 | 117,956 | 118,100 | **123,704** |
| Scope 2 | | | | | |
| Location-Based | 2,697,554 | 2,946,043 | 3,557,518 | 4,102,445 | **4,745,197** |
| Market-Based | 139,066 | 183,329 | 275,420 | 228,194 | **163,935** |
| *Subtotal emissions (Scope 1 + 2 market-based)* | *246,518* | *282,337* | *393,376* | *346,294* | ***287,639*** |
| Scope 3 | | | | | |
| Category 1 – Purchased Goods & Services[1,2,5] | 4,058,000 | 4,452,000 | 4,411,000 | 4,156,000 | **4,930,000** |
| Category 2 – Capital Goods[1,2,5] | 1,666,000 | 2,185,000 | 2,340,000 | 2,962,000 | **4,179,000** |
| Category 3 – Fuel- and Energy-Related Activities (Location-Based)[1] | 540,000 | 550,000 | 650,000 | 770,000 | **810,000** |
| Category 3 – Fuel- and Energy-Related Activities (Market-Based)[1,4] | 250,000 | 220,000 | 270,000 | 310,000 | **310,000** |
| Category 4 – Upstream Transportation[1,2] | 52,000 | 53,000 | 96,000 | 102,000 | **225,000** |
| Category 5 – Waste[1,6] | 700 | 500 | 10,500 | 9,500 | **5,700** |
| Category 6 – Business Travel | 419,020 | 461,787 | 476,457 | 329,356 | **21,901** |
| Category 7 – Employee Commuting[1] | 343,000 | 345,000 | 411,000 | 317,000 | **80,000** |
| Category 9 – Downstream Transportation[1,3] | 85,000 | 98,000 | 57,000 | 47,000 | **45,000** |
| Category 11 – Use of Sold Products[1,3,5] | 3,757,000 | 3,910,000 | 3,375,000 | 2,983,000 | **3,950,000** |
| Category 12 – End of Life of Sold Products[1,3] | 31,000 | 18,000 | 18,000 | 17,000 | **19,000** |
| Category 13 – Downstream Leased Assets[1] | 700 | 1,700 | 800 | 6,100 | **18,900** |
| *Subtotal emissions (Scope 3 market-based)*[7] | *10,662,000* | *11,745,000* | *11,466,000* | *11,239,000* | ***13,785,000*** |
| Total emissions (Scope 1 + 2 + 3)[7] | 10,909,000 | 12,027,000 | 11,859,000 | 11,585,000 | **14,073,000** |

1 The reported emissions for this category represent an estimate based on assumptions as outlined in section 1.9 and have therefore been rounded.

2 The emissions calculations for these categories have been adjusted in the current year to reflect improved availability of suppliers' reported emissions via CDP Supply Chain. Previous years have been updated to reflect this change.

3 As the product life cycle assessments for Microsoft devices continue to be improved, the emissions calculations for these categories have been updated for improved accuracy. Energy use assumptions have been updated to reflect our latest understanding of device use via telemetry. In addition, minor error corrections were made. Previous years have been updated to reflect this change.

4 Market-based fuel- and energy-related emissions in FY17—FY20 have undergone a change in calculation methodology to improve accounting of electricity transmission and distribution.

5 Overall increase in Scope 3 categories 1 and 2 emissions is driven mainly by the growth of Microsoft's cloud services business and device manufacturing. Increase in Scope 3 category 11 is driven by an increase in sales and usage of devices.

6 As of FY21, waste emissions calculations include emissions for all waste streams, except construction and deconstruction which is currently not reported and will be part of data improvements going forward. This change due to improved data availability has been retrospectively applied to FY20 and FY19, but not FY18 or FY17 because comprehensive waste data was not available in those years.

7 Market-based emissions included in these values. Values rounded to nearest thousand $mtCO_2e$.

# Appendix D (continued)

Table 2

## GHG emissions by type

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| **(mt)** | | | | | |
| Scope 1 | | | | | |
| Scope 1 – $CO_2$ | 82,448 | 81,263 | 95,667 | 96,700 | **94,292** |
| Scope 1 – $CH_4$ | 2 | 2 | 2 | 2 | **3** |
| Scope 1 – $N_2O$ | 1 | 1 | 1 | 1 | **1** |
| Scope 1 – HFCs | 23 | 17 | 20 | 19 | **27** |
| Scope 1 – $SF_6$[9] | | 0 | 0 | 0 | **0** |
| Scope 2 (Location-Based) | | | | | |
| Scope 2 – $CO_2$ | 2,684,866 | 2,929,720 | 3,537,892 | 4,079,782 | **4,720,190** |
| Scope 2 – $CH_4$ | 64 | 188 | 222 | 271 | **318** |
| Scope 2 – $N_2O$ | 37 | 39 | 47 | 53 | **57** |
| Scope 2 (Market-Based) | | | | | |
| Scope 2 – $CO_2$ | 138,411 | 182,313 | 273,900 | 226,933 | **163,354** |
| Scope 2 – $CH_4$ | 3 | 12 | 17 | 15 | **6** |
| Scope 2 – $N_2O$ | 2 | 2 | 4 | 3 | **1** |
| **($mtCO_2e$)** | | | | | |
| Scope 1 | 107,451 | 99,009 | 117,956 | 118,100 | **123,704** |
| Scope 1 – $CO_2$ | 82,448 | 81,263 | 95,667 | 96,700 | **94,292** |
| Scope 1 – $CH_4$ | 45 | 45 | 50 | 53 | **63** |
| Scope 1 – $N_2O$ | 248 | 261 | 256 | 236 | **150** |
| Scope 1 – HFCs | 24,710 | 17,408 | 21,951 | 21,070 | **29,177** |
| Scope 1 – $SF_6$[8] | – | 32 | 32 | 41 | **22** |
| Scope 2 (Location-Based) | 2,697,554 | 2,946,043 | 3,557,518 | 4,102,445 | **4,745,197** |
| Scope 2 – $CO_2$ | 2,684,866 | 2,929,720 | 3,537,892 | 4,079,782 | **4,720,190** |
| Scope 2 – $CH_4$ | 1,605 | 4,700 | 5,550 | 6,768 | **7,942** |
| Scope 2 – $N_2O$ | 11,083 | 11,623 | 14,076 | 15,895 | **17,065** |
| Scope 2 (Market-Based) | 139,066 | 183,329 | 275,420 | 228,194 | **163,935** |
| Scope 2 – $CO_2$ | 138,411 | 182,313 | 273,900 | 226,933 | **163,354** |
| Scope 2 – $CH_4$ | 84 | 293 | 430 | 377 | **150** |
| Scope 2 – $N_2O$ | 571 | 723 | 1,090 | 884 | **431** |

8 In FY18 the estimating of $SF_6$ leakage at datacenters began.

Table 3

## GHG emissions by region ($mtCO_2e$)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Scope 1 | | | | | |
| Asia | 9,699 | 6,483 | 7,330 | 8,650 | **9,664** |
| Europe, Middle East, Africa | 44,873 | 41,276 | 57,957 | 61,719 | **69,251** |
| Latin America | 6,260 | 6,173 | 3,919 | 3,871 | **4,403** |
| North America | 46,620 | 45,076 | 48,750 | 43,860 | **40,386** |
| *Subtotal* | *107,452* | *99,008* | *117,956* | *118,100* | ***123,704*** |
| Scope 2 (Location-Based) | | | | | |
| Asia | 439,035 | 528,277 | 691,772 | 804,567 | **942,892** |
| Europe, Middle East, Africa | 399,194 | 519,058 | 681,743 | 860,858 | **866,689** |
| Latin America | 20,968 | 23,450 | 25,403 | 15,707 | **16,204** |
| North America | 1,838,357 | 1,875,258 | 2,158,600 | 2,421,313 | **2,919,412** |
| *Subtotal* | *2,697,554* | *2,946,043* | *3,557,518* | *4,102,445* | ***4,745,197*** |
| Scope 2 (Market-Based) | | | | | |
| Asia | 121,930 | 174,533 | 266,725 | 219,416 | **157,841** |
| Europe, Middle East, Africa | 14,460 | 7,301 | 7,463 | 7,376 | **5,353** |
| Latin America | 2,053 | 751 | 632 | 594 | **433** |
| North America | 623 | 744 | 600 | 808 | **308** |
| *Subtotal* | *139,066* | *183,329* | *275,420* | *228,194* | ***163,935*** |

# Appendix D (continued)

Table 4

## GHG emissions intensity ($mtCO_2e$/Revenue M$)

| | FY17 | FY18 | FY19 | FY20 | **FY21** |
|---|---|---|---|---|---|
| Revenue (M$) | 96,571 | 110,360 | 125,843 | 143,015 | **168,088** |
| Scope 1 | 1.1 | 0.9 | 0.9 | 0.8 | **0.7** |
| Scope 2 (Location-Based) | 27.9 | 26.7 | 28.3 | 28.7 | **28.2** |
| Scope 2 (Market-Based) | 1.4 | 1.7 | 2.2 | 1.6 | **1.0** |
| Scope 1 + 2 (Location-Based) | 29.0 | 27.6 | 29.2 | 29.5 | **29.0** |
| Scope 3 (Business Travel) | 4.3 | 4.2 | 3.8 | 2.3 | **0.1** |

Table 5

## Carbon offsets ($mtCO_2e$)

| | FY17 | FY18 | FY19 | FY20 | **FY21** |
|---|---|---|---|---|---|
| GHG Emissions within Carbon Neutral Boundary[9,10] | 573,871 | 652,282 | 781,345 | 612,927 | **292,106** |
| Offsets Applied to Reporting Year | 573,871 | 652,282 | 781,345 | 612,927 | **292,106** |
| Net GHG Emissions within Carbon Neutral Boundary[10] | – | – | – | – | **–** |
| Total Removal Offsets Contracted[11] | | | | | **1,391,187** |

9 Represents the values prior to historic recalculations due to acquisitions and methodology changes.

10 This data supports Microsoft's ongoing target to be carbon neutral every year from fiscal year 2013 onward. The boundary for this carbon neutral commitment includes global Scope 1, Scope 2 Market-based, and Scope 3 business air travel. As progress is made towards the carbon negative commitment, which includes purchasing removal offsets, the commitment to carbon neutrality will also be maintained.

11 Values reported represent offsets contracted. Contracted removal values only include removal credits that have been evaluated as compliant with Microsoft's quality removal criteria. This number might change based on contract fulfillment.

# Appendix D (continued)

## 1.2 Energy

Table 6

### Energy consumption within the organization (MWh)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Total Energy Consumption[12] | 6,756,779 | 7,781,383 | 9,249,361 | 10,757,166 | **13,481,863** |
| Non-renewable fuel consumed | 362,408 | 358,760 | 439,589 | 449,304 | **446,417** |
| Natural Gas | 107,687 | 110,863 | 196,644 | 218,557 | **249,443** |
| Crude Oil/Diesel | 164,324 | 152,915 | 152,034 | 147,297 | **143,370** |
| LPG/Propane/Jet Fuel | 43,402 | 50,378 | 47,437 | 40,450 | **4,245** |
| Gasoline | 46,996 | 44,604 | 43,474 | 43,000 | **49,359** |
| Electricity, heating, cooling, and steam | 6,394,370 | 7,422,624 | 8,809,772 | 10,307,861 | **13,035,446** |
| Electricity | 6,344,700 | 7,357,636 | 8,744,834 | 10,244,377 | **12,969,393** |
| Cooling (Chilled water) | 30,121 | 52,775 | 52,937 | 51,026 | **54,953** |
| Hot water/Steam | 19,549 | 12,213 | 12,001 | 12,458 | **11,100** |
| Total Renewable Electricity Consumption[13] | 6,104,758 | 7,357,636 | 8,744,834 | 10,244,377 | **12,969,393** |
| Renewable Energy Credits and Power Purchase Agreements | 6,104,340 | 7,357,235 | 8,744,247 | 10,244,059 | **12,969,246** |
| On-Site Renewable Energy | 418 | 400 | 587 | 318 | **147** |
| Percentage of Renewable Electricity | 96% | 100% | 100% | 100% | **100%** |

12 Only reported categories and values are applicable to Microsoft's energy consumption. Renewable fuels, electricity sold, heating sold, cooling sold, and steam sold categories are currently not applicable. In gigajoules, total energy consumption equals 48,534,706 GJ, and total fuel consumed equals 1,607,101 GJ.

13 Reported values represent Microsoft's total renewable energy consumption expressed in MWh from on-site, renewable energy credits, and power purchase agreements (PPAs). Specific to PPAs, in FY21 new agreements for approximately 5.8 gigawatts (GW) of capacity were signed, totaling more than 8 GW of renewable energy via PPAs or long-term contracts.

Table 7

### Energy intensity (MWh/Revenue M$)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Electricity consumed within the organization (MWh) | 6,344,700 | 7,357,636 | 8,744,834 | 10,244,377 | **12,969,393** |
| Revenue (M$) | 96,571 | 110,360 | 125,843 | 143,015 | **168,088** |
| Electricity Consumption Normalized by Revenue (MWh/M$) | 66 | 67 | 69 | 72 | **77** |

# Appendix D (continued)

## 1.3 Water

Table 8

### Water and effluents (megaliters)[14]

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Total Water Withdrawals[15] | 5,148 | 6,719 | 7,505 | 7,618 | **7,657** |
| Third-party water | 5,040 | 6,586 | 7,367 | 7,513 | **7,600** |
| Surface Water | 91 | 104 | 104 | 89 | **41** |
| Ground Water | 17 | 29 | 34 | 16 | **16** |
| Total Water Discharges[15, 16] | 3,236 | 3,393 | 3,559 | 3,651 | **3,179** |
| Third-party water | 3,236 | 3,393 | 3,559 | 3,651 | **3,179** |
| Total Water Consumption[15] | 1,913 | 3,326 | 3,946 | 3,967 | **4,478** |

14 In FY18 the water data collection methodology was adjusted to include more accurate data center withdrawal estimates. FY17 withdrawal estimates were not retroactively adjusted. 50% of the change from FY17 to FY18 is from the methodology adjustment, and the other 50% is from organizational growth. For FY21 total water withdrawal from areas with water stress was 1,698 ML (22%) and was primarily sourced from third-party water; total water discharge to areas with water stress was 915 ML (29%); and total water consumption from areas with water stress was 783 ML (17%). Water risk assessment conducted using WRI's Aqueduct tool and reported values consider high or extremely high baseline water stress.

15 Brackish surface water/seawater and produced water categories are not relevant to Microsoft since there is no withdrawal or discharge of water from and to these sources. For withdrawals, data breakdown between 'freshwater' and 'other water' categories, and withdrawal sources is currently unavailable and will be part of data improvements going forward. For consumption, gathering data around water storage will also be part of our future data improvements.

16 Only discharges to third-parties are relevant since water that is not consumed at Microsoft sites is discharged to local municipal treatment plants. Discharges to surface water, groundwater, seawater and volume sent for use to other organizations are not applicable. For discharges, data breakdown between 'freshwater' and 'other water' categories is currently unavailable and will be part of data improvements going forward. Primary treatment of water is not relevant because there are no onsite water treatment plants in Microsoft operations, as there is no requirement to conduct onsite primary treatment of discharge by any environmental regulation or standard.

# Appendix D (continued)

## 1.4 Waste

Table 9

### Waste generated, diverted, and directed to disposal (metric tons)[17]

| | | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|---|
| Non-Hazardous | | 23,870 | 17,661 | 31,644 | 31,101 | **20,768** |
| Diverted | Reused | 325 | 40 | 715 | 1,136 | **2,171** |
| | Recycled | 14,955 | 9,824 | 10,460 | 8,452 | **9,589** |
| | Composted | 5,920 | 5,883 | 8,358 | 10,104 | **1,776** |
| | *Subtotal* | *21,200* | *15,747* | *19,533* | *19,691* | ***13,536*** |
| Directed to Disposal | Landfilled | 2,044 | 1,599 | 11,713 | 10,848 | **6,957** |
| | Incinerated[18] | 626 | 316 | 398 | 562 | **275** |
| | *Subtotal* | *2,671* | *1,915* | *12,111* | *11,410* | ***7,232*** |
| Hazardous | | 2,188 | 1,405 | 14,534 | 9,469 | **1,750** |
| Diverted | Recycled | 2,122 | 1,376 | 6,184 | 7,581 | **1,742** |
| | Reused | – | – | 1,096 | 1,880 | **0** |
| Directed to Disposal | Other[19] | 66 | 29 | 7,254 | 8 | **8** |
| *Diverted Subtotal* | | *23,322* | *17,123* | *26,813* | *29,152* | ***15,278*** |
| *Directed to Disposal Subtotal* | | *2,737* | *1,944* | *19,365* | *11,418* | ***7,240*** |
| Total waste generated | | 26,059 | 19,066 | 46,178 | 40,570 | **22,518** |

17 Starting in FY19, reported values encompass global data across Microsoft's direct waste footprint, including estimates where needed, except for waste from construction and deconstruction and GitHub which is currently not reported and will be part of data improvements going forward. Waste generation values and classifications have been updated for FY19 and FY20 to be consistent with data collection, reporting boundary, and estimation methodology improvements established in FY21. Reported data back to FY19 was adjusted to represent waste streams only within Microsoft's operational control boundary, and as such, properly exclude disposition of packaging from our sold products. Data for reuse or other diversion methods besides recycling for hazardous waste, and other disposal operations besides landfilled and incineration for non-hazardous waste is currently not applicable and will be part of data improvements going forward if they become applicable. As waste accounting continues to improve, reported values may change. Reported waste data is mainly directed for disposal offsite.

18 Incinerated category under non-hazardous includes incineration with and without energy recovery.

19 'Other' category under hazardous includes landfilled and incinerated with and without energy recovery waste.

## 1.5 Ecosystems

Table 10

### Land protection

| | FY21 |
|---|---|
| Total size and country location of all habitat areas selected for protection for which contributions were made | US: 4,998 acres<br>Belize: 12,270 acres |
| A description of partnerships for which contributions were made that exist with third parties to protect habitat areas | Since making this commitment in April 2020, Microsoft identified two leading land protection organizations, the National Fish and Wildlife Foundation (NFWF) within the United States and The Nature Conservancy (TNC) globally, to partner with to achieve the commitment to protect more land than we use. A data-informed approach to identify ecosystems most at risk was used, using TNC's last chance ecosystem framework and NFWF's national landscape conservation framework.<br>Within each of the two partnerships the following organizations will hold the conservation easement/ own the protected land:<br>• The Nature Conservancy: Belize Maya Forest Trust<br>• National Fish and Wildlife Foundation: Montana Department of Fish, Wildlife, and Parks; New Mexico Land Conservancy, Rocky Mountain Elk Foundation for the US. |
| Total acres categorized by the status at the close of the reporting period as either (i) funded or (ii) protected | 17,268 acres (funded) |
| Period in which funding occurred | As of the fiscal year ended June 30, 2021 |

# Appendix D (continued)

## 1.6 Management's assertion

Management of Microsoft Corporation is responsible for the completeness, accuracy, and validity of the disclosures included in this Section 1 of Appendix D. Management is also responsible for the collection, quantification, and presentation of the specified information included in Section 1 of Appendix D and for the selection or development of the criteria, which management believes provides an objective basis for measuring and reporting on the specified information. Management of Microsoft Corporation asserts that the specified information included in Section 1 of Appendix D as of, and for the fiscal year ended June 30, 2021 is presented in accordance with the criteria set forth in Section 1.10, *Reporting criteria*.

## 1.7 Description of the company and inventory boundary

Microsoft's environmental sustainability data, which includes GHG emissions, energy, waste, water, and ecosystem metrics, reported for FY21 has been prepared following a fiscal year basis as the reporting period covering the timeframe of July 1, 2020 to June 30, 2021. The Corporate External & Legal Affairs (CELA) Sustainability team within Microsoft under the leadership of the Vice President and Chief Environmental Officer holds the responsibility to monitor and report sustainability environmental data.

For setting organizational boundaries and for corporate reporting of GHG emissions, energy, waste, and water metrics in Tables 1-9 above, Microsoft uses the operational control approach. This includes global wholly owned and partially owned subsidiaries over which Microsoft has management and operational control, including Microsoft owned and leased real estate facilities.

## 1.8 Information on metrics

Microsoft announced in January 2020 that they will be carbon negative by 2030 and by 2050 they will remove from the atmosphere an equivalent amount of all the carbon the company has emitted either directly or by our electricity consumption since being founded in 1975. This will be achieved by reducing Scope 3 emissions (market-based) by more than half; and by reducing Scope 1 and 2 (market-based) emissions to near zero by the middle of the decade through energy efficiency work and reaching 100 percent renewable energy by 2025. The baseline year is 2020, which was the year when the announcement was made.

Microsoft has a metrics recalculation policy for historical data (including base year) to ensure consistency whenever year-over-year structural changes, methodological changes , or other accuracy improvements are significant. Structural changes include acquisitions and divestitures. Methodology changes include changes in a calculation methodology or new activity types. Accuracy improvements include the correction of significant errors or cumulative small errors that together are significant and/or updates to available supplier reported data. Footnotes under each table will highlight specific adjustments made.

Microsoft's GHG inventory includes five of the seven GHGs addressed by the Kyoto Protocol—carbon dioxide ($CO_2$), methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), and sulfur hexafluoride ($SF_6$). Microsoft does not currently use or emit perfluorocarbons (PFCs) and nitrogen trifluoride ($NF_3$).

The following is a more detailed list of activities included in the GHG inventory:

- Scope 1 direct GHG emissions from onsite fossil fuel combustion (including natural gas, propane, fuel oil, and diesel), executive air travel, ground transportation (Microsoft owned and directly leased), hydrofluorocarbon (HFC) refrigerants, and $SF_6$ used at some facilities.
- Scope 2 indirect GHG emissions from purchased electricity, chilled water, and steam. The location-based method is based on average emission factors for the electricity grids that provide electricity to our datacenters, buildings, and campuses. The market-based method includes consideration of contractual arrangements under which Microsoft procures power from specific suppliers or sources, such as renewable energy. In the market-based method, we also capture the impact from direct renewable energy and the purchase of unbundled energy attribute certificates (EACs).
- Scope 3 indirect GHG emissions for the following categories identified as relevant for Microsoft:
  - Category 1 – Purchased Goods & Services
  - Category 2 – Capital Goods
  - Category 3 – Fuel- and Energy-Related Activities (Location-Based and Market-Based)
  - Category 4 – Upstream Transportation
  - Category 5 – Waste
  - Category 6 – Business Travel
  - Category 7 – Employee Commuting
  - Category 9 – Downstream Transportation
  - Category 11 – Use of Sold Products
  - Category 12 – End of Life of Sold Products
  - Category 13 – Downstream Leased Assets

Reported data for water, waste, and ecosystems support the monitoring and tracking of our progress associated with the commitments under each program.

For carbon removal, the following Microsoft criteria is used to select carbon removals that we contract: Microsoft Criteria for High-Quality Carbon Dioxide Removal. Both third-party certified and uncertified tons are purchased in an effort to help develop the market, and only certified tons are applied to the carbon neutrality scope (Scope 1, Scope 2 market-based, and business air travel). For the certified portion, the following validation and verification bodies have provided the certification: Voluntary Carbon Standard (VCS), American Carbon Registry (ACR), Climate Action Reserve (CAR), and California Air Resources Board (CARB). The reported carbon removal contracted value total also includes future tons that have not yet been delivered.

For renewable energy, the impact is captured from on-site generation, renewable energy certificates (RECs) and from power purchase agreements (PPAs). The purchases of RECs include: RECs (Green-e certified), guarantees of origin (GO), renewable energy guarantees of origin (REGO), I-RECs, tradable instrument for global renewables (TIGR), J-Credits, large scale energy certificates (LGC) and PowerPlus. Microsoft procures enough renewable energy to match 100% of its electricity consumption. In the case that renewable energy is not procured in the markets where they operate, enough renewable energy from nearby markets is purchased to ensure we maintain the 100% renewable electricity commitment is maintained.

Microsoft's water inventory includes the withdrawal, consumption, and discharge associated with assets under its operational control. These volumes represent global enterprise-wide operations including offices, datacenters, labs, and retail. This data supports progress tracking against current Water Positive program commitments, as well as future reporting against the newer commitment announced in October 2021 of reducing water waste in datacenter operations by 95 percent by 2024.

# Appendix D (continued)

Similarly, the waste inventory includes the mass of waste generated from operations within Microsoft's operational control that are landfilled, incinerated, recycled, reused, and composted for both non-hazardous and hazardous categories. This waste inventory supports progress tracking against the commitment of diverting 90% of operational waste at datacenters and campuses.

Reported data for ecosystems includes the total area of land that has been funded and protected based on the presented definition in table 1.10 for reporting criteria. Microsoft's land protection commitment was established in FY20 therefore reported data for FY21 represents progress for the first year.

Currently the waste inventory does not include waste from construction and deconstruction activities. Reported operational waste does not include impact from business group GitHub. Data across metrics currently excludes impact from the ZeniMax acquisition completed in March 2021. Both GitHub and ZeniMax impacts are estimated to be under the significance threshold and will be included in the next report. These items are part of Microsoft's continuous data improvement activities and will be included and highlighted accordingly in the next reporting cycle.

## 1.9 Methodology and emission factors

### Carbon

#### Scope 1 and 2

Primary data is used to calculate emissions for both Scope 1 and 2 emissions. Estimates are used where primary data is not available. Activity data is collected internally and stored in an internally developed data platform which then applies the corresponding emission factors to calculate emissions. Microsoft uses the IPCC Fourth Assessment when it comes to applying global warming potential values.

| Scope and source | Emission factor source |
|---|---|
| Scope 1 (all fuels) | EPA Emission Factor Hub. March 2018. |
| Scope 2<br>Electricity (US) | Year 2019 eGRID Subregion Emission Factors: eGRID 2019, February 2021. For market-based emissions the factors presented are used as needed. For regions where residual emission factors are available we have 100% renewable energy purchases, therefore not currently applicable. |
| Scope 2<br>Electricity (international unless otherwise sourced) | IEA (2021), Emission Factors |
| Scope 2<br>Electricity (Australia) | Year 2020 factors from "Table 46: Scope 2 and 3 emissions factors - consumption of purchased electricity by end users", emission factors for Scope 2. National Greenhouse Gas Accounts (NGA) Factors, August, 2021. |
| Scope 2<br>Electricity (Brazil) | Year 2020 factors from the Brazilian Ministry of Science, Technology, Innovation and Communication: Fator médio - Inventários corporativos. |
| Scope 2<br>Electricity (Canada) | National inventory report 1990-2019. Annex 13. Year 2019 factors. From 2021 release. |
| Scope 2<br>Electricity (India) | $CO_2$: Baseline Carbon Dioxide Emission Database, Version 16.0. India Central Electricity Authority. March 2021.<br>$CH_4/N_2O$: "CO2 Emissions from Fuel Combustion (2021 Edition)." IEA. Paris. |
| Scope 2<br>Electricity (UK) | 2021 Government GHG Conversion Factors for Company Reporting: Methodology Paper for Emission Factors. Year 2019 factors from June 2021 release. |

# Appendix D (continued)

### Scope 3

Microsoft calculates and reports Scope 3 emissions for all relevant categories. The following table summarizes which categories are relevant and a description of the methodology and emission factors used.

| Scope 3 category | Emissions calculation methodology | Supplier data percentage* |
|---|---|---|
| Purchased goods and services | This category includes emissions from upstream purchasing of goods and services, including direct and indirect goods. Microsoft uses its suppliers' CDP Supply Chain responses to determine Scope 1, Scope 2, and upstream Scope 3 emission factors ($mtCO_2e$/$ revenue). The latest available responses are used, so this report's inventory considers 2021 submissions (i.e. 2020 data). Microsoft estimates emissions from CDP Supply Chain respondents by multiplying the CDP-derived factor by the annual spend with the supplier. All other spend is mapped to corresponding industry sectors and then multiplied by cradle-to-gate emission factors by sector from UK Defra's "UK Defra, Table 13 – Indirect emissions from the supply chain. March 2014"—updated per the latest inflation and currency conversion rates. Corporate-wide expense data for all company divisions is obtained from the finance department. Industry sectors already included in Scope 1 and Scope 2 (such as electricity purchases) and other Scope 3 categories (such as capital goods) were removed to prevent double counting. Global warming potentials (GWP) values are derived from the underlying CDP Supply Chain-based responses and Defra data sources. | 79 |
| Capital goods | This category includes emissions from upstream purchasing of capital goods, including server equipment and other long-term assets. Microsoft uses its suppliers' CDP Supply Chain responses to determine Scope 1, Scope 2, upstream Scope 3 emission factors ($tCO_2e$/$ revenue). The latest available responses are used, so this report's inventory considers 2021 submissions (i.e. 2020 data). Microsoft estimates emissions from CDP Supply Chain respondents by multiplying the CDP-derived factor by the annual spend with the supplier. All other spend is mapped to corresponding industry sectors and then multiplied by cradle-to-gate emission factors by sector from UK Defra's "UK Defra, Table 13 – Indirect emissions from the supply chain. March 2014"—updated per the latest inflation and currency conversion rates. Corporate-wide expense data for all company divisions is obtained from the finance department. Industry sectors already included in Scope 1 and Scope 2 (such as electricity purchases) and other Scope 3 categories were removed to prevent double counting. GWP values are derived from the underlying CDP Supply Chain-based responses and Defra data sources. | 45 |

* Represents the percentage of emissions calculated (by category) using data obtained from suppliers or value chain partners.

# Appendix D (continued)

| Scope 3 category | Emissions calculation methodology | Supplier data percentage* |
|---|---|---|
| Fuel-and-energy-related activities (not included in Scope 1 or 2) | Starting in 2019, Microsoft has been reporting this category as calculated using the 'market-based' approach, which includes Microsoft's investment in renewable electricity. Fuel- and energy-related activities (not included in Scope 1 or 2) include three emission sources. First, upstream emissions of purchased electricity were calculated by multiplying electricity use by emission factors from lifecycle analysis tools for the US and UK Defra 2015 Guidelines for non-US countries. Factors for upstream emissions resulting from global renewable electricity generation are from lifecycle assessment tools. Second, fuel consumption was multiplied by emission factors from the GREET and Ecoinvent lifecycle analysis tools. And third, transmission and distribution (T&D) losses (by energy use type) were multiplied by emission factors from the EPA's eGRID2019 database for the United States and from IEA (2021) emission factors for other countries. GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. | 97 |
| Upstream transportation and distribution | This category includes emissions from upstream transportation of goods, including all transportation of goods that Microsoft finances. Microsoft uses its suppliers' CDP Supply Chain responses to determine Scope 1, Scope 2, upstream Scope 3 emission factors ($tCO_2e$/$ revenue). The latest available responses are used, so this report's inventory considers 2021 submissions (i.e. 2020 data). Microsoft estimates emissions from CDP Supply Chain respondents by multiplying the CDP-derived factor by the annual spend with the supplier. All other spend is mapped to corresponding industry sectors and then multiplied by cradle-to-gate emission factors by sector from UK Defra's "UK Defra, Table 13 – Indirect emissions from the supply chain. March 2014"—updated per the latest inflation and currency conversion rates. Corporate-wide expense data for all company divisions is obtained from the finance department. Industry sectors already included in Scope 1 and Scope 2 (such as electricity purchases) and other Scope 3 categories were removed to prevent double counting. GWP values are derived from the underlying CDP Supply Chain-based responses and Defra data sources. | 81 |
| Waste generated in operations | The waste figure represents emissions from waste disposed via landfilling, incineration, recycling, and compost. Emissions from waste are calculated using methodologies and emission factors from the EPA's Waste Reduction Model (WARM), version 15. This model bases its emissions calculations on a lifecycle analysis, including emissions from the long-term decomposition of waste in a landfill or from upstream sources/sinks. GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. | 37 |
| Business travel | Historically, this category has included emissions from commercial air travel only. FY20 (reporting year) was the first year that additional business travel emissions sources were included, including hotel night stays, rail travel, reimbursed mileage, rental cars, and taxi/rideshares. For commercial air and rail travel, Microsoft Corporate Travel provides flight/ride-level airport codes and cabin class data. The airport/rail station codes are used to calculate distances to determine whether the flights/rides were short, medium, or long haul. Using the distance-based method, flight distances and cabin class are used to calculate CO2e emissions, using the appropriate emission factors from: 2020 Guidelines to Defra/DECC's GHG Conversion Factors for Company Reporting). For hotel night stays, Microsoft's preferred hotel vendors provided emissions per hotel night stay coefficients. For other hotel chains, emissions were estimated based on nights stayed and the emission factors from the EPA's Greenhouse Gas Inventory Guidance: Indirect Emissions from Events and Conferences (Dec 2018). For rental cars, mileage, fuel, and emission data was provided from each rental car company. For taxi/rideshare and reimbursed mileage, emissions were estimated based on spend using emission factors from EPA Emission Factor Hub. March 2018. GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. | 64 |

* Represents the percentage of emissions calculated (by category) using data obtained from suppliers or value chain partners.

# Appendix D (continued)

| Scope 3 category | Emissions calculation methodology | Supplier data percentage* |
|---|---|---|
| Employee commuting | This category captures emissions from commuting by all employees and contractors that work in Microsoft buildings. Microsoft conducted a survey in May 2019 to capture detailed commuting habits from employees and vendors at our Puget Sound campus, representing ~36% of global Microsoft headcount. The survey is typically conducted annually but was not performed in 2021. The results were scaled to estimate global commuting emissions for Microsoft. CO2 emission rates for passenger vehicles (single occupancy vehicle [SOV] and carpool) are based on fuel consumption and miles travelled. A weighted average fuel economy using the 2012 EPA Fuel Economy Trends Report 1975–2012 was derived, which provides combined fuel economy for cars and trucks by year, and a set of car and truck age fractions provided by the Puget Sound Regional Council. This data was used to develop a weighted average fuel economy for the Puget Sound area. Emission factors are derived from the Inventory of US. Greenhouse Gas Emissions and Sinks: 1990–2010, Annex 2 (Methodology for estimating CO2 emissions from fossil fuel combustion). CO2 rates per passenger mile are based on Federal Transit Administration, 2010 (Public Transportation's Role in Responding to Climate Change, US DOT, Federal Transit Administration, January 2010). GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. As nearly all Microsoft employees worked from home during the COVID-19 pandemic, FY20 was the first year to include emission impacts from telework. Telework energy consumption is assumed to include workstation/plug-load energy usage, additional lighting and household cooling/heating consumption. 1 laptop, 2 monitors and 3 lightbulbs are assumed for each employee; other assumptions include 8 work hours/day and 250 days/year using the devices. Office/workspace floor area and cooling/heating intensity are assumed based on EIA's 2015 Residential Energy Consumption Survey (RECS) data. From these assumptions, a carbon emission intensity per employee is calculated, and total emissions are calculated by multiplying the intensity by number of employees during the period of remote work. | 10 |
| Upstream leased assets | Not relevant. Microsoft includes leased assets in our Scope 1 and Scope 2 emissions reporting boundary. | |
| Downstream transportation and distribution | Included in this category are the emissions from transporting and warehousing of devices Microsoft sold (including, but not limited to, Xbox devices, Microsoft Surface devices, HoloLens, keyboards, mice, and other peripherals) from Microsoft manufacturing sites to retailers and customers. Calculations are based on standard assumptions of distance between retailers and their distribution centers and warehouse floorspace from an MWPVL International analysis of Walmart's distribution center network. Assumptions about the energy intensity of warehouses come from the US Energy Information Administration (EIA)'s Commercial Buildings Energy Consumption Survey (2012). Emission factors for shipping come from the GaBi database. GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. | 0 |
| Processing of sold products | Not relevant. Microsoft did not have any physical intermediate products in the years reported. | |
| Use of sold products | Included in this category is the lifetime electricity use of devices Microsoft sold including, but not limited to, Xbox devices, Surface devices, HoloLens, keyboards, mice, and other peripherals. Lifetime electricity use per device is calculated based on standard product-use assumptions as included in our ISO 14040– and ISO 14044–compliant lifecycle analyses. This year updates to energy use assumptions that reflect latest understanding of device use via telemetry data are also included. Assumptions on total lifetime expected use (years) are used. Sales geography for the products sold is used to determine the electricity emission factor used to calculate emissions. GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. | 0 |
| End of life treatment of sold products | Included in this category is the end-of-life treatment of devices Microsoft sold during the reporting year including, but not limited to, Xbox devices, Surface devices, HoloLens, keyboards, mice, and other peripherals. End-of-life emissions for each product are based on modeling within our ISO 14040– and ISO 14044–compliant lifecycle analyses. To generate an estimate for this category, the model assumes that all devices are sent to landfills at the end of their useful life. GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. | 0 |

* Represents the percentage of emissions calculated (by category) using data obtained from suppliers or value chain partners.

# Appendix D (continued)

| Scope 3 category | Emissions calculation methodology | Supplier data percentage* |
|---|---|---|
| Downstream leased assets | Emissions associated with sublets are calculated using the intensities derived from data collected for the primary leased space (for example, kilowatt-hours/square foot [kWh/SF]) and prorated for the square footage of the sublet space. In this way, it is assumed that the emissions intensities of the leased spaces are the same as the overall buildings in which they reside. Estimated refrigerants are calculated using the same methodology and intensity as used to calculate refrigerant intensities for assets occupied by Microsoft. Electricity emission factors used are those appropriate to each location, as utilized in our Scope 1 and Scope 2 location-based inventory. GWPs are from the IPCC Fourth Assessment Report (AR4), 100-year average. | 0 |
| Franchises | Not relevant. Microsoft did not operate franchises in the years reported. | |
| Investments | Not relevant for reported years. Joint ventures, actively managed investments, and direct equity investments totaled less than 2 percent of Microsoft's market capitalization at the end of the reporting period. Microsoft has not engaged in the long-term financing of projects and the proceeds for each debt issuance have been for general corporate purposes. | |

* Represents the percentage of emissions calculated (by category) using data obtained from suppliers or value chain partners.

# Appendix D (continued)

### Water and Waste

Primary data is used to calculate water withdrawal, discharge and consumption, and waste generation where Microsoft operates. Estimates are used where primary data is not available.

Water withdrawals are based on data from utility bills from our largest sites and, in some cases, estimations. An estimation methodology for sites where primary data is unavailable that considers square footage, electricity consumption, and cooling type is used. Where discharges and consumption are not metered, amounts are estimated annually as part of the global water inventory aggregation process. Most of the sites do not have discharge meters. A low water consumption at many of the sites is estimated, unless there are specific water consuming activities present. Where there is water consumption (such as for landscaping, evaporative coolers, cooling towers, settling ponds), it is estimated that discharge equals the difference between withdrawals and consumption. Microsoft continues to work on improvements for water consumption data collection.

Operational waste mass is based on data from invoices and/or vendor/third party reports. In the absence of actual data, there is an extrapolation methodology. Depending on the type of site, the methodology uses capacity (MW) based coefficients by region or attendance to extrapolate waste for those locations where primary data is unavailable. This year's extrapolation represents an improved methodology, previously capacity based coefficients by equipment technology type and floorspace were used.
All extrapolated waste is assumed to be landfilled in cases where the disposal or diversion method is unknown. The extrapolation excludes e-waste and is conservative by making landfilled the default assumption for disposition method. Year-over-year, waste data continues to improve in that there is a continuous increase in the amount of actual data used in the inventory.

## 1.10 Reporting criteria

The summary table below defines the criteria for each specified metric included in Section 1 of Appendix D. Management is also responsible for the selection or development of the criteria, which management believes provide an objective basis for measuring and reporting on the specified information referenced in the table below.

| Area | Specified Information | Criteria | Tables |
|---|---|---|---|
| **Carbon** | The Statement of GHG Emissions | Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition) and the Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard published by the World Resources Institute/World Business Council for Sustainable Development (collectively the "GHG Protocol") | 1, 2, 3, 4, 5 |
| **Energy** | Energy consumption within the organization | Disclosure 302-1: Energy consumption within the organization from the GRI Standard: 302 Energy 2016 | 6 |
| | Energy intensity | Disclosure 302-3: Energy intensity from the GRI Standard: 302 Energy 2016 | 7 |
| | Microsoft-specified indicator:<br>100% Renewable electricity disclosure | Management's Criteria: Total renewable electricity consumption in megawatt hours and the percentage of renewable electricity.<br>Renewable electricity is defined as energy sources that are capable of being replenished in a short time through ecological cycles or agricultural processes.<br>The scope of renewable electricity includes renewable electricity the entity directly produced and renewable electricity the entity purchased, if purchased through a renewable PPA that explicitly includes RECs or GOs, a Green-e Energy Certified utility or supplier program, or other green power products that explicitly include RECs or GOs, or for which Green-e Energy Certified RECs are paired with grid electricity.<br>- For any renewable electricity generated on-site, any RECs and GOs must be retained (that is, not sold) and retired or cancelled on behalf of the entity in order for the entity to claim them as renewable energy.<br>- For renewable PPAs and green power products, the agreement must explicitly include and convey that RECs and GOs be retained or replaced and retired or cancelled on behalf of the entity in order for the entity to claim them as renewable electricity.<br>- The renewable portion of the electricity grid mix that is outside of the control or influence of the entity is excluded from the scope of renewable electricity.<br>The percentage renewable electricity is calculated as total renewable energy consumption in megawatt hours divided by total electricity consumption (as disclosed in Disclosure 302-1(c)(i) Electricity consumption from the GRI Standard: 302 Energy 2016). | 6 |

# Appendix D (continued)

| Area | Specified Information | Criteria | Tables |
|---|---|---|---|
| **Water** | Water withdrawal | Disclosure 303-3: Water withdrawal from the GRI Standard: 303 Water and Effluents 2018 | 8 |
| | Water discharge | Disclosure 303-4: Water discharge from the GRI Standard: 303 Water and Effluents 2018 | 8 |
| | Water consumption | Disclosure 303-5: Water consumption from the GRI Standard: 303 Water and Effluents 2018 | 8 |
| **Waste** | Waste generated | Disclosure 306-3: Waste generated from the GRI Standard: 306 Waste 2020 | 9 |
| | Waste diverted from disposal | Disclosure 306-4: Waste diverted from disposal from the GRI Standard: 306 Waste 2020 | 9 |
| | Waste directed to disposal | Disclosure 306-5: Waste directed to disposal from the GRI Standard: 306 Waste 2020 | 9 |
| **Ecosystems** | Microsoft-specified indicator:<br>Land Protection | Management's criteria:<br>At the close of the reporting period,<br>a. The total size in acres and country location of all habitat areas selected for protection for which contributions were made.<br>b. A description of partnerships for which contributions were made that exist with third parties to protect habitat areas.<br>c. Total acres categorized by the status as either (i) funded or (ii) protected.<br>d. Period in which funding occurred.<br>Size of habitat areas is calculated as Microsoft's contribution amount divided by the cost per acre of the habitat protection project as determined by the partner organization. These amounts are net of overhead costs.<br>Funded is defined as where agreements have been signed and contributions have been made.<br>Protected is defined as areas that are legally designated as permanently protected by government regulation. | 10 |

# Appendix D (continued)

## 1.11 INDEPENDENT ACCOUNTANT'S REVIEW REPORT

Deloitte.

Deloitte & Touche LLP
Suite 3300
925 Fourth Avenue
Seattle, WA 98104-1126
USA

To the Board of Directors of Microsoft Corporation

We have reviewed management of Microsoft Corporation's (the "Company") assertion that the specified information included in Section 1 of Appendix D of the accompanying 2021 Environmental Sustainability Report ("Appendix D") as of and for the fiscal year ended June 30, 2021 is presented in accordance with the criteria set forth in Section 1.10, Reporting criteria in Appendix D. The Company's management is responsible for its assertion. Our responsibility is to express a conclusion on management's assertion based on our review.

Our review was conducted in accordance with attestation standards established by the American Institute of Certified Public Accountants (AICPA) in AT-C Section 105, *Concepts Common to All Attestation Engagements*, and AT-C Section 210, *Review Engagements*. Those standards require that we plan and perform the review to obtain limited assurance about whether any material modifications should be made to management's assertion in order for it to be fairly stated. The procedures performed in a review vary in nature and timing from, and are substantially less in extent than, an examination, the objective of which is to obtain reasonable assurance about whether management's assertion is fairly stated, in all material respects, in order to express an opinion. Accordingly, we do not express such an opinion. Because of the limited nature of the engagement, the level of assurance obtained in a review is substantially lower than the assurance that would have been obtained had an examination been performed. We believe that the review evidence obtained is sufficient and appropriate to provide a reasonable basis for our conclusion.

We are required to be independent and to meet our other ethical responsibilities in accordance with the Code of Professional Conduct issued by the AICPA. We applied the Statements on Quality Control Standards established by the AICPA and, accordingly, maintain a comprehensive system of quality control.

The procedures we performed were based on our professional judgment. In performing our review, we performed analytical procedures and inquiries. For a selection of the specified information included in Appendix D, we performed tests of mathematical accuracy of computations, compared the specified information to underlying records, or observed the data collection process.

The preparation of the specified information included in Appendix D requires management to establish and interpret the criteria, make determinations as to the relevancy of information to be included, and make estimates and assumptions that affect the reported information. Measurement of certain amounts includes estimates and assumptions that are subject to substantial inherent measurement uncertainty resulting, for example, from accuracy and precision of conversion factors or estimation methodologies used by management. Obtaining sufficient, appropriate review evidence to support our conclusion does not reduce the inherent uncertainty in the specified information included in Appendix D. The selection by management of different but acceptable measurement methods, input data, or assumptions, may have resulted in materially different amounts or specified information being reported.

Information outside of the specified information included in Appendix D of the 2021 Environmental Sustainability Report was not subject to our review and, accordingly, we do not express a conclusion or any form of assurance on such information. Further, any information relating to periods prior to the year-ended June 30, 2021 or information relating to forward looking statements, goals and progress against goals, was not subject to our review and, accordingly, we do not express a conclusion or any form of assurance on such information.

Based on our review, we are not aware of any material modifications that should be made to management of Microsoft Corporation's assertion that the specified information included in Section 1 of Appendix D of the accompanying 2021 Environmental Sustainability Report as of and for the fiscal year ended June 30, 2021 is presented in accordance with the criteria set forth in Section 1.10, *Reporting criteria* in Appendix D, in order for it to be fairly stated.

Deloitte & Touche LLP

March 10, 2022

Appendix D (continued)

# Section 2: Additional environmental metrics

Table 11

**GHG emissions—Scope 1 regional detail ($mtCO_2e$)**

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Scope 1 – $CO_2$ | 82,448 | 81,263 | 95,667 | 96,700 | **94,292** |
| Scope 1 – $CH_4$ | 45 | 45 | 50 | 53 | **63** |
| $CH_4$ Emissions – Asia | 5 | 4 | 3 | 4 | **4** |
| $CH_4$ Emissions – Europe, Middle East, Africa | 16 | 15 | 26 | 28 | **36** |
| $CH_4$ Emissions – Latin America | 9 | 9 | 5 | 5 | **6** |
| $CH_4$ Emissions – North America | 16 | 17 | 16 | 16 | **17** |

# Appendix D (continued)

Table 12

## Other emissions (metric tons)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| $NO_x$ Emissions | 223 | 209 | 215 | 202 | **284** |
| $NO_x$ Emissions – Asia | 13 | 6 | 7 | 7 | **7** |
| $NO_x$ Emissions – Europe, Middle East, Africa | 152 | 145 | 144 | 137 | **226** |
| $NO_x$ Emissions – Latin America | 25 | 24 | 16 | 16 | **35** |
| $NO_x$ Emissions – North America | 33 | 34 | 49 | 41 | **16** |
| $SO_x$ Emissions | 13 | 13 | 12 | 12 | **18** |
| $SO_x$ Emissions – Asia | 2 | 1 | 1 | 1 | **2** |
| $SO_x$ Emissions – Europe, Middle East, Africa | 7 | 7 | 7 | 7 | **11** |
| $SO_x$ Emissions – Latin America | 1 | 1 | 1 | 1 | **2** |
| $SO_x$ Emissions – North America | 3 | 3 | 4 | 4 | **4** |
| VOC Emissions | 199 | 184 | 185 | 170 | **248** |
| VOC Emissions – Asia | 10 | 3 | 5 | 5 | **4** |
| VOC Emissions – Europe, Middle East, Africa | 148 | 141 | 133 | 124 | **208** |
| VOC Emissions – Latin America | 24 | 23 | 15 | 16 | **35** |
| VOC Emissions – North America | 17 | 16 | 32 | 26 | **2** |
| PM Emissions | 7 | 7 | 8 | 8 | **11** |
| CO Emissions | 1,860 | 1,704 | 1,721 | 1,584 | **2,392** |
| Ozone Depleting Substances | 1 | 1 | 1 | 0 | **0** |

Table 13

## Other emissions normalized by revenue (metric tons/M$)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| $NO_x$ Emissions | 0.0023 | 0.0019 | 0.0017 | 0.0014 | **0.0017** |
| $SO_x$ Emissions | 0.00014 | 0.00011 | 0.00010 | 0.00009 | **0.00011** |
| $CH_4$ Emissions | 0.0005 | 0.0004 | 0.0004 | 0.0004 | **0.0004** |

Table 14

## Electricity consumption (MWh)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Total Electricity Consumed | 6,344,700 | 7,357,636 | 8,744,834 | 10,244,377 | **12,969,393** |
| Electricity Consumed – Asia | 682,713 | 804,024 | 1,066,033 | 1,225,534 | **1,473,254** |
| Electricity Consumed – Europe, Middle East, Africa | 971,073 | 1,265,961 | 1,654,384 | 2,102,486 | **2,801,332** |
| Electricity Consumed – Latin America | 90,929 | 106,936 | 117,222 | 113,456 | **174,762** |
| Electricity Consumed – North America | 4,599,985 | 5,180,715 | 5,907,195 | 6,802,901 | **8,520,045** |
| Non-Renewable Electricity Purchased & Consumed – Asia | 204,937 | – | – | – | – |
| Non-Renewable Electricity Purchased & Consumed – Europe, Middle East, Africa | 17,391 | – | – | – | – |
| Non-Renewable Electricity Purchased & Consumed – Latin America | 3,603 | – | – | – | – |
| Non-Renewable Electricity Purchased & Consumed – North America | – | – | – | – | – |
| Non-Renewable Electricity by Source – Coal | 42,746 | – | – | – | – |
| Non-Renewable Electricity by Source – Petroleum | 34,058 | – | – | – | – |
| Non-Renewable Electricity by Source – Natural Gas | 148,643 | – | – | – | – |
| Non-Renewable Electricity by Source – Nuclear | 484 | – | – | – | – |

# Appendix D (continued)

Table 15

## Renewable energy consumption (MWh)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Renewable Energy Purchased & Consumed – Asia | 466,243 | 804,024 | 1,066,033 | 1,225,534 | **1,473,254** |
| Renewable Energy Purchased & Consumed – Europe, Middle East, Africa | 941,343 | 1,265,961 | 1,654,384 | 2,102,486 | **2,801,332** |
| Renewable Energy Purchased & Consumed – Latin America | 85,935 | 106,936 | 117,222 | 113,456 | **174,762** |
| Renewable Energy Purchased & Consumed – North America | 4,611,239 | 5,180,715 | 5,907,195 | 6,802,901 | **8,520,045** |
| Renewable Energy Purchased & Consumed – Wind | 5,974,762 | 6,919,601 | 7,742,416 | 8,588,040 | **10,761,621** |
| Renewable Energy Purchased & Consumed – Landfill Gas | – | – | – | – | – |
| Renewable Energy Purchased & Consumed – Biomass | 61,029 | 47,129 | 2,347 | – | **22** |
| Renewable Energy Purchased & Consumed – Hydro | 33,174 | 186,434 | 309,873 | 440,834 | **289,996** |
| Renewable Energy Purchased & Consumed – Geothermal | – | 72,000 | 461,586 | 409,511 | **1,069** |
| Renewable Energy Purchased & Consumed – Solar | 35,795 | 132,472 | 228,612 | 805,992 | **1,916,686** |

Table 16

## Other energy consumption (MWh)

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Total Non-Renewable Energy Purchased & Consumed | 412,078 | 423,748 | 504,527 | 512,788 | **512,470** |
| Non-Renewable Energy Purchased & Consumed – Asia | 34,096 | 20,440 | 21,975 | 24,877 | **26,712** |
| Non-Renewable Energy Purchased & Consumed – Europe, Middle East, Africa | 187,087 | 177,234 | 266,221 | 287,890 | **324,329** |
| Non-Renewable Energy Purchased & Consumed – Latin America | 23,996 | 23,239 | 13,977 | 13,906 | **15,151** |
| Non-Renewable Energy Purchased & Consumed – North America | 166,899 | 202,835 | 202,354 | 186,116 | **146,277** |
| Fuel and Energy related activities (Transmission and Distribution Losses) | 510,000 | 600,000 | 730,000 | 850,000 | **750,000** |
| Downstream Leased Assets | 1,700 | 4,100 | 1,900 | 19,500 | **50,398** |

# Appendix D (continued)

Table 17

## Water withdrawal, consumption, and discharge detail (megaliters)[20]

| | FY17 | FY18 | FY19 | FY20 | FY21 |
|---|---|---|---|---|---|
| Total Water Withdrawal | 5,148 | 6,719 | 7,505 | 7,618 | **7,657** |
| Water Withdrawals – Asia | 973 | 1,244 | 1,482 | 1,533 | **1,841** |
| Water Withdrawals – Europe, Middle East, Africa | 711 | 851 | 1,116 | 1,434 | **1,170** |
| Water Withdrawals – Latin America | 93 | 115 | 114 | 109 | **179** |
| Water Withdrawals – North America | 3,372 | 4,509 | 4,793 | 4,543 | **4,467** |
| Total Water Consumption | 1,913 | 3,326 | 3,946 | 3,967 | **4,478** |
| Water Consumption – Asia | 422 | 617 | 824 | 933 | **1,129** |
| Water Consumption – Europe, Middle East, Africa | 190 | 383 | 524 | 698 | **614** |
| Water Consumption – Latin America | 27 | 66 | 71 | 73 | **125** |
| Water Consumption – North America | 1,275 | 2,259 | 2,527 | 2,262 | **2,610** |
| Water Consumption - Third-party | 1,885 | 3,292 | 3,913 | 3,940 | **4,469** |
| Water Consumption – Surface water | 25 | 30 | 30 | 25 | **4** |
| Water Consumption – Ground water | 3 | 4 | 3 | 2 | **5** |
| Total Water Discharges – Municipal Treatment | 3,236 | 3,393 | 3,559 | 3,651 | **3,179** |
| Water Discharges – Asia | 551 | 627 | 658 | 600 | **712** |
| Water Discharges – Europe, Middle East, Africa | 521 | 468 | 591 | 735 | **556** |
| Water Discharges – Latin America | 67 | 48 | 43 | 35 | **54** |
| Water Discharges – North America | 2,097 | 2,250 | 2,266 | 2,281 | **1,857** |

20 For more information on water data, please see Microsoft's CDP Water Security response at www.cdp.net.

Table 18

## Verification/Assurance

| | |
|---|---|
| FY17 – FY20 | Data for this period of time was third party verified by APEX using a limited level of assurance. Below please find the criteria used to measure the carbon, energy and water information:<br><br>**For carbon and energy:** World Resources Institute (WRI)/World Business Council for Sustainable Development (WBCSD) Greenhouse Gas Protocol, Corporate Accounting and Reporting Standard, revised edition, including Scope 2 Guidance amendment (Scope 1 & 2); WRI/WBCSD Greenhouse Gas Protocol Corporate Value Chain (Scope 3) Accounting and Reporting Standard (Scope 3)<br><br>**For water:** CDP Water Security Reporting Guidance<br><br>For all years, the scope of the verification included GHG emissions for Scope 1, Scope 2, Scope 3 business air travel, total energy consumption, total electricity consumption, total renewable electricity consumption, total offsets purchased, total water withdrawals, total water consumption, and total water discharges. For FY19 and FY20, the rest of Scope 3 category emissions identified as relevant were also included. Latest data adjustments highlighted in this report made to historic data were outside of the scope of these previous years' review. |
| **FY21** | Deloitte & Touche LLP performed a review engagement on management's assertion that the specified information included in Section 1 of Appendix D as of and for the fiscal year ended June 30, 2021 is presented in accordance with the criteria set forth in Section 1.10, Reporting criteria. Deloitte & Touche LLP's review report is included in Section 1.11.<br><br>Information relating to periods prior to the fiscal year ended June 30, 2021, was not subject to Deloitte & Touche LLP's review and, accordingly, Deloitte & Touche LLP does not express a conclusion or any form of assurance on such information. |

## Appendix E

# Policy

Microsoft supports carbon, clean energy, and sustainability policy efforts at the state and national level in the United States, the European Union, and elsewhere. The table on pages 117-118 outlines key sustainability policy and advocacy actions Microsoft has taken since our last sustainability report. To see historical policy and advocacy actions, please refer to the January 2021 Sustainability Report.

| Date | Market | Description |
|---|---|---|
| Dec-20 | US | Participated in a statement encouraging US Congress and the President-elect to work together to enact ambitious, durable, and bipartisan climate policies. |
| Jan-21 | US | Expressed public support for the US rejoining the Paris Climate Accord. |
| Feb-21 | Illinois | Signed onto letter supporting policy in Illinois accelerating a transition to 100 percent clean energy. |
| Feb-21 | EU | Filed submission supporting increased EU GHG emissions reduction target in the European Commission public consultation on the Renewable Energy Directive. |
| Mar-21 | EU | Joined European Green Digital Coalition to demonstrate the role of digital technologies in advancing climate goals. |
| Mar-21 | EU | Joined letter supporting Green and Digital Transformation in the EU. |
| Mar-21 | EU | Filed comments to the EU Energy Efficiency Directive highlighting our work on energy efficiency, auditing, and management systems. |
| Mar-21 | Arizona | Joined letter supporting Arizona's 100 percent clean energy rules. |
| Apr-21 | US | Submitted comments to the US Department of Agriculture on ways to advance climate smart agriculture, carbon removal, and forestry strategy. |
| Apr-21 | Washington | Advocated for Washington state's Climate Commitment Act which sets a robust carbon price through a cap and invest program. |
| Apr-21 | Texas | Joined letter supporting resilient energy grid policies in Texas and opposing policies that penalize renewable energy. |
| Apr-21 | US | Advocated for ambitious climate targets for the US's national determined contributions (NDCs). |
| Apr-21 | US | Engaged and advocated for the US Growing Climate Solutions Act to advance high quality standards for nature-based carbon removal. |

## Appendix E (continued)

# Policy

| Date | Market | Description |
|---|---|---|
| May-21 | US | Filed comments to the Securities and Exchange Commission supporting the Commission's development and adoption of climate disclosure rules. |
| May-21 | US | Participated in US Congressional Climate Infrastructure Lobby Day to support robust domestic climate policy. |
| Jun-21 | US | Supported clean energy and climate provisions in the US Infrastructure Investment and Jobs Act. |
| Jul-21 | EU | Issued statement in support of the European Commission's Fit for 55 package. |
| Jul-21 | US | Participated in US Congressional Lobby Day for robust climate and energy investment in the bipartisan infrastructure and reconciliation packages. |
| Aug-21 | EU | Submitted comments to European Commission in support of a carbon removal certification mechanism. |
| Sept-21 | UK | Filed response to UK Financial Conduct Authority (FCA) consultation on carbon accounting. |
| Sept-21 | US | Submitted comments to the US Department of Defense on sustainability and climate-related disclosure. |
| Oct-21 | Global | Joined business letter in support of strong government commitments to climate action by national governments around the world. |
| Oct-21 | US | Issued public statement in support of strong climate and clean energy provisions in the US reconciliation and infrastructure bills. |
| Nov-21 | Global | Selected as a Principal Partner for COP26 in Glasgow. |

Microsoft

# Stay up to date on our progress

Visit our sustainability page and sign up for news and updates.