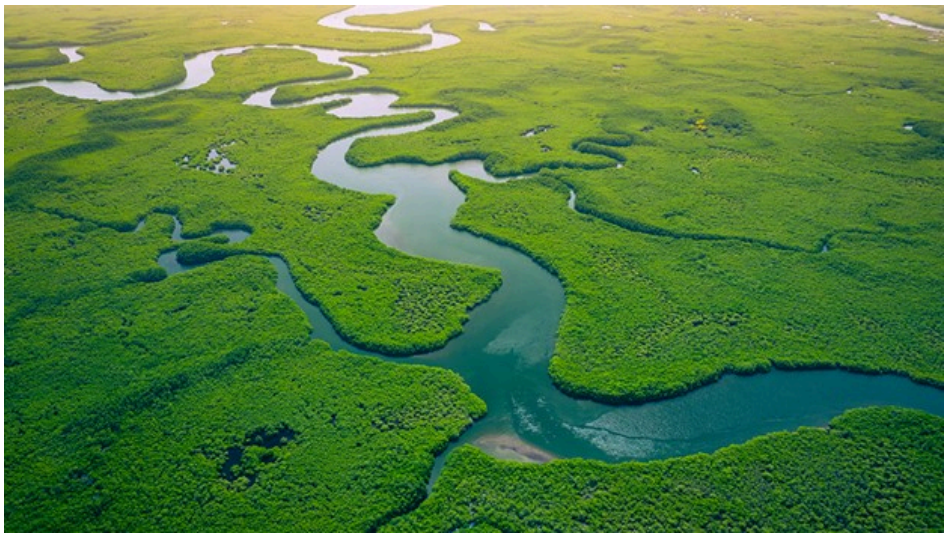
Accelerating Sustainability with AI: A Playbook

Nov 16, 2023 | Brad Smith, Vice Chair and President, and Melanie Nakagawa, Chief Sustainability Officer



11.29.2023: This blog was updated to make a cited example more accurate.

Today, Microsoft published a playbook for accelerating sustainability solutions with AI. You can read the foreword below and explore the piece in its entirety here.

AI is an essential tool for accelerating sustainability

Given the urgency of the planetary crisis, society needs to push harder on the AI accelerator while establishing guardrails that steer the world safely, securely, and equitably toward net-zero emissions, climate resilience, and a nature-positive future.

This year the world experienced the impacts of climate change like never before, from devastating wildfires to extreme weather. We are seeing and feeling the impact of climate

Related Stories

Oct 27, 2023 | Natasha Crampton
Progress with our AI commitments: an update ahead of the UK AI Safety Summit ›

Oct 26, 2023 | Microsoft Corporate Blogs
Microsoft's AI Safety Policies ›

Oct 16, 2023 | Kevin Miller
Leveraging AI capabilities to build community trust with law enforcement agencies ›

Related Blogs

Nov 7, 2023 | Brad Smith, Microsoft Vice Chair and President, and Teresa Hutson, Corporate Vice President, Technology for Fundamental Rights

change in our communities every day, and the science is clear: we need to act at an unprecedented scale and pace to address this crisis. It's an enormous challenge and an enormous opportunity for the world to accelerate climate progress.

At Microsoft, we believe that for our company to do well, the world also needs to do well. We are at a critical moment for environmental sustainability, and we need government leaders, businesses, and civil society working in tandem. We also need to use every tool at our disposal to aid us in this journey, including AI.

AI is a vital tool to help accelerate the deployment of existing sustainability solutions and the development of new ones – faster, cheaper, and better.

In this paper, we outline the opportunities that AI provides for accelerating sustainability and the actions needed to ensure that we unlock the full potential of AI for sustainability.

AI's three game-changing abilities

On the journey to net zero, the world has faced many bottlenecks to progress. AI has three unique abilities that can help society overcome key bottlenecks to this progress. These include the ability to:

1) Measure, predict, and optimize complex systems.

2) Accelerate the development of sustainability solutions.

3) Empower the sustainability workforce.

Measure, predict, and optimize complex systems

AI can enable people to discern patterns, predict outcomes, and optimize performance in systems that are too complex for traditional analytic methods. Sustainability practitioners are increasingly using AI's analytical power for measuring and managing systems. Consider wildfires, which release about 7 gigatons (Gt) of carbon dioxide a year to the atmosphere. Wildfires are difficult to predict because of the complex interplay of many factors, including weather, vegetation, and

Microsoft announces new steps to help protect elections ›

Nov 2, 2023 | Brad Smith

A new world of security: Microsoft's Secure Future Initiative ›

Oct 19, 2023 | Amy Hogan-Burney

Microsoft, Amazon, and international law enforcement join forces to fight tech support fraud ›

More Cybersecurity Stories

Standing up for democratic values and protecting stability of cyberspace: Principles to limit the threats posed by cyber mercenaries ›

April 11, 2023

Digital Crimes Unit: Leading the fight against cybercrime ›

May 3, 2022

land use. AI is enabling better wildfire prediction and making better management possible. At Microsoft, we are working with partners to use AI to help communities reduce wildfire risk.

Accelerate the development of sustainability solutions

AI can accelerate the discovery and development of sustainability solutions such as low-carbon materials, renewable energy production and storage, and climate-resilient crops. While AI is already contributing to sustainability-related discoveries, its transformative potential is only beginning to be realized. However, AI's game-changing potential has already been demonstrated in other sectors. For example, AI was instrumental in accelerating the development of vaccines that mitigated the severity of the COVID-19 pandemic. AI was used to screen candidate messenger RNA (mRNA) molecules, which allowed Moderna to produce an effective COVID-19 vaccine in only six weeks, compared with the four years it would have taken with traditional methods.

Empower the sustainability workforce

AI can empower the sustainability workforce by enabling targeted training and assistance, while amplifying the efforts of sustainability professionals. We are working with partners to use large language models (LLMs) to access and distill the vast archives of sustainability science and policy documents so that sustainability professionals can easily find the information they need to understand and manage complex sustainability challenges.

In Part 1 of this report, we explore each of these three game-changing abilities in more detail.

Given the urgency of the planetary crisis, society needs to push harder on the AI accelerator while establishing guardrails that steer the world safely, securely, and equitably toward net-zero emissions, climate resilience, and a nature-positive future.

Microsoft's AI & Sustainability Playbook

The global technology, energy, and policy landscape is ripe to be primed to unlock AI's transformative potential for sustainability. This white paper introduces our five-point playbook for creating the needed enabling conditions.

Keeping your vote safe and secure: A story from inside the 2020 election ›

June 22, 2021

1. **Invest in AI** to accelerate sustainability solutions
2. **Develop digital and data infrastructure** for the inclusive use of AI for sustainability
3. **Minimize resource use** in AI operations
4. **Advance AI policy principles and governance** for sustainability
5. **Build workforce capacity** to use AI for sustainability

These actions can unleash a flywheel for progress. AI can enable the development and deployment of sustainability solutions that accelerate decarbonization, which can enable the development of more sustainable AI operations, which in turn can enable AI to scale the deployment of more sustainability solutions. In Part 2 of this report, we describe this five-point playbook, summarized here.

1. *Invest in AI to accelerate sustainability solutions*

AI has numerous applications that can enhance efficiency, optimize business operations, and provide game-changing breakthroughs to sustainability bottlenecks. AI can help to expedite the integration of renewables onto electric grids, develop energy storage solutions, reduce food waste, foster the creation of high carbon-absorbing materials, and enable accurate weather forecasting weeks or even months in advance of current capabilities.

At Microsoft, through our AI for Good Lab, Microsoft Research's AI4Science Lab, and Microsoft Climate Research Initiative (MCRI), we are already applying AI to overcome large sustainability bottlenecks. For example, in one MCRI project, we are partnering with researchers at the Massachusetts Institute of Technology (MIT) and University of California, Berkeley (UC Berkeley) to use generative machine learning models to develop new materials and system engineering approaches for applications such as carbon capture. Through the Microsoft Climate Innovation Fund, we are investing in companies like LineVision that are using AI to expand the capacity of transmission lines.

2. *Develop digital and data infrastructure for the inclusive use of AI for sustainability*

Data is the foundation on which AI operates, shaping its insights, predictions, and decision-making capabilities. Yet, there are major gaps and accessibility challenges that constrain the development of accurate and representative AI models for sustainability. For example, while AI is critical for optimizing the world's electricity distribution networks, its use is limited by the availability of detailed, real-time data, which is lacking in many regions. Or, consider biodiversity data, where 80 percent of data in the Global Biodiversity Information Facility (GBIF) comes from just 10 countries.

Even when data exists, it can be inaccessible or difficult to use because it is locked in institutional silos, not digitalized, or in incompatible formats. Data standards, sharing mechanisms, and platforms are needed to increase the usability of sustainability data in AI models.

To use the full potential of AI, sustainability solution providers need access to the internet and compute capacity. The Microsoft Airband Initiative is working with our global ecosystem of partners to bring internet access to 250 million people in unserved and underserved communities around the world by 2025, including 100 million in Africa.

3. *Minimize resource use in AI operations*

As the infrastructure needed to support AI models expands, demand for resources such as energy and water will rise. History suggests that innovation can curb that demand. Take datacenters, for example. Between 2010 and 2020, global datacenter workloads increased by approximately 9x, while datacenter electricity demand increased by only 10 percent.

At Microsoft, we are continuously researching and innovating ways to make our datacenters and AI systems ever more energy and water efficient. We are reducing our dependence on freshwater from municipal sources for datacenter cooling and investing in water replenishment in water-stressed basins. We have also been developing advanced cooling methods such as liquid cooling to support AI chips with lower energy and water overheads. We have partnered with the Green Software Foundation to develop and advance carbon-aware software practices, such as software designed to run at times and locations that use the least carbon-intensive electricity sources available. These principles apply to all software workloads, including AI.

4. *Advance AI policy principles and governance for sustainability*

AI technologies can have a positive impact on both the environment and society by accelerating sustainable business practices and the energy transition. The infrastructure that hosts the computing power needed to yield these benefits may affect resource use too, such as by increasing power needs while reducing water reliance. Governments have an opportunity to enable the positive impacts of AI by crafting policies that harness its capabilities to benefit and ensure alignment with sustainability outcomes while also mitigating the resource impact that will result from the increased demand for AI.

At Microsoft, we will continue to use our voice to support grid decarbonization and carbon reporting, reduction, and removal policies. In September 2022, we outlined the priorities and principles that guide our advocacy on carbon and electricity policy around the world to accelerate carbon reporting, reduction, and removal and to expand carbon-free electricity. We also intend to expand our advocacy for extending existing sustainability policy frameworks to include AI and aligning government policies to incentivize the use of AI to enable sustainability outcomes.

We also persist in our efforts to strengthen AI governance, helping to ensure trust among users, stakeholders, and the wider public—an indispensable basis for AI's integral role in advancing sustainability. As the application of AI expands into critical sustainability infrastructure, including power grids and water utilities, the safety, security, and reliability of these AI systems become paramount. We are committed to building and using AI responsibly, as recently outlined in our Governing AI report.

5. *Build workforce capacity to use AI for sustainability*

To harness the transformative power of AI for sustainability requires a solid foundation of human capacity to use AI tools.

Building a workforce prepared to use AI for sustainability requires holistic learning pathways that cultivate AI fluency within the context of sustainability. To help people and communities around the world learn how to harness the power of AI, Microsoft recently launched a new AI Skills Initiative. We have also committed to bringing these AI skills to the

sustainability workforce. Last year, we partnered with the global nonprofit INCO to launch a new Green Digital Skills certificate program to educate workers and jobseekers on the foundations of sustainability in technology and green design principles and practices. To date, 30,000 people from 140 countries have engaged in the certificate program.

Tracking AI's impact on the global race to net zero

To ensure that AI is on track to accelerate sustainability progress, it will be essential to continually assess AI's expected impact on the race to net zero. But this is not an easy task, as it requires projecting a range of interacting and uncertain factors, such as socioeconomic, policy, and technological developments.

Currently, AI compute accounts for only a fraction of the electricity used by datacenters, which collectively use about 1 percent of global electricity supply. How much this increases and how AI growth affects the global race to net zero will depend on many factors. Innovations that drive efficiency gains in both the computing infrastructure and AI operations will have a large impact on future AI energy use. The carbon emissions implications of increased energy demand will depend on the broader policy context in which AI operates and how rapidly electric grids are decarbonized. And finally, AI's mpact on the global race to net zero depends on how much it enables sustainability solutions.

In Part 3 of this report, we explore what is needed to better assess and track AI's impact on the global path to net zero. In particular, we highlight the importance of using scenario analysis to help inform and guide AI development for sustainability.

Understanding AI's impact on the global race to net-zero emissions requires answering three questions:

1. How much energy is the global expansion of AI compute likely to consume?

2. How fast will the world's electric grids decarbonize?

3. To what extent will AI enable sustainability solutions?

To use AI effectively to accelerate sustainability, businesses, governments, and civil society must work together to create the enabling conditions while continually monitoring the factors that will determine AI's impact on the world's race to net zero.

When we use it ethically and responsibly, AI can be an essential tool to accelerate progress toward sustainability. Together, we have the opportunity to ensure that it does. We invite you to join us in unlocking the accelerating power of AI for sustainability.

Tags: AI, Responsible AI, sustainability