Microsoft

REALIZING A SUSTAINABLE FUTURE

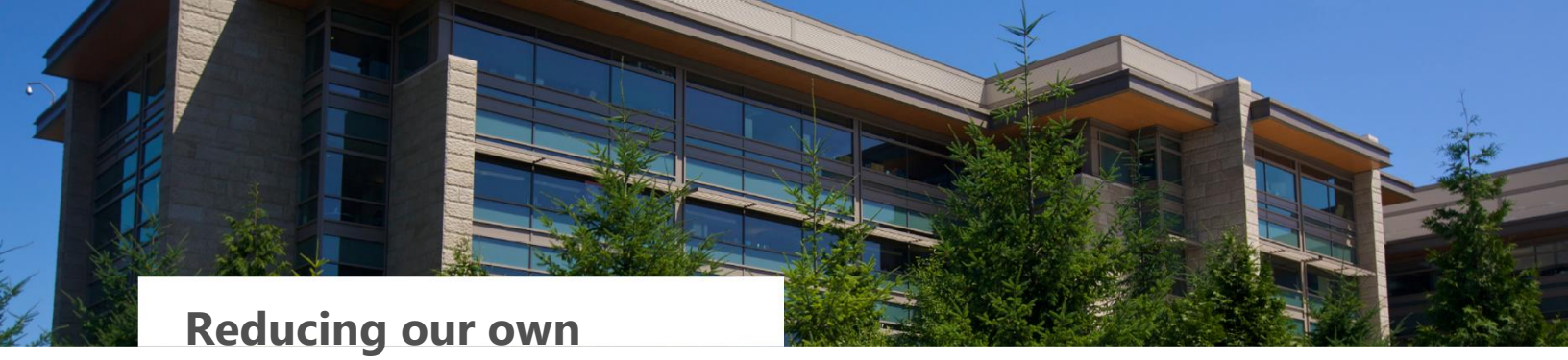
An overview of Microsoft's approach

At Microsoft, we are committed to driving sustainable business practices and to catalyzing technology innovations that help people and organizations around the world realize a sustainable future. We've made tremendous progress toward our company's environmental sustainability goals. Our Carbon Neutral program—with the first-of-its-kind internal carbon fee—has been recognized for its success at integrating the environmental impact of carbon into business decisions. With the invested funds generated from the carbon fee in wind farms that enable our electricity to be 100 percent renewable, in energy-efficiency projects around the world with anticipated savings of 31,000 mtCO2, and in carbon-offset projects that reach more than 3 million people. Our investments in green energy earned us recognition as the second-largest green power purchaser in the United States.

While reducing our carbon footprint helps our own bottom line, technology innovations—from efficient datacenters to smart cities—can provide an even greater benefit for society. We believe that IT-enabled solutions could reduce annual greenhouse gas emissions by more than 15 percent—equating to annual economic impact of US$1.9 trillion. Microsoft and our partners are using the power of the cloud, data analytics, machine learning, distributed sensor networks, and mobile devices to enable governments, businesses, and scientists to better understand and manage environmental and resource limitations, while still driving economic growth.

There is little doubt that technology can enable significant efficiency gains in any and all sectors of society. As more information is required to manage increasingly large and complex resource challenges, data will be the core component that promotes sustainable and responsible economic growth.

Table of Contents



Reducing our own environmental impact

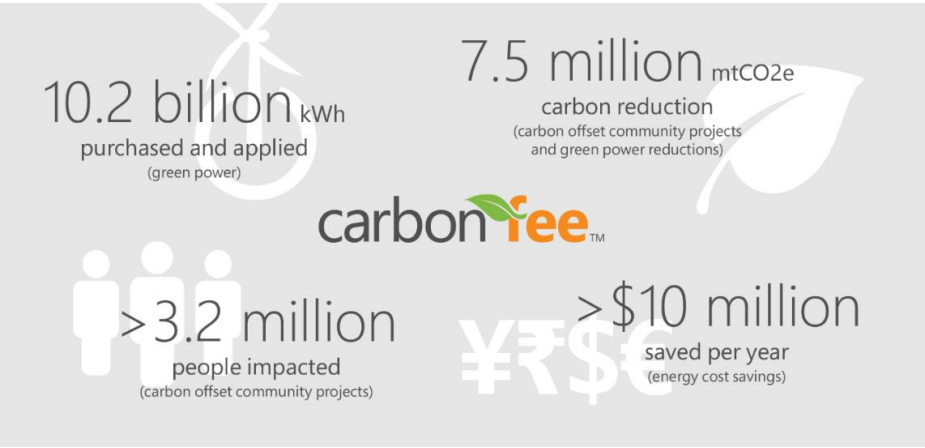
At Microsoft, we believe environmental sustainability is both a responsibility and an opportunity to create business value in how we operate, how we serve our customers, and how we contribute to society. Our environmental principles and climate change policy statement illustrate our deep commitment to the environment, and sustainability is integral to our corporate policies for how we run our business. This commitment is evident in our environmental compliance specifications for hardware and our policy on responsible sourcing of raw materials.

From a governance perspective, to reduce environmental impact of our own operations, we use a framework called "Be lean, be green, and be accountable" to achieve carbon neutrality for the operation of our datacenters, labs, and offices, and for air travel.

- **Be lean** by reducing operational energy use, water use, and waste.
- **Be green** by increasing our purchase of renewable energy and carbon offsets.
- **Be accountable** by quantifying the carbon impact of our operations and driving responsible business decisions around energy use and air travel.

This section provides a small collection of examples of how we are reducing the environmental impact of our own operations.

Driving accountability with environmental principles, policies, and management



Our strategy includes a corporate carbon neutrality goal as well as goals for specific areas of our business, ranging from datacenter efficiency to energy and waste reduction at Microsoft campuses to the use of recycled content in packaging. With the funds collected through our internal carbon fee over the past two years, we have purchased more than 10 billion kilowatt hours of green power, reduced 7.5 million metric tons of carbon dioxide equivalent (mtCO2e), and impacted more than 3.2 million people in emerging nations. We have also saved more than $10 million per year and invested in more than 250,000 megawatt hours of clean, renewable electricity from wind projects. To share more detailed insights and lessons learned from implementing the carbon fee, we published a guide for organizations considering the model.

In FY14 we took a major step forward by gaining a cross-company ISO 14001 certification for our hardware and packaging manufacturing supply chain. Although we have had a long-standing commitment to supply chain sustainability—including a Supplier Code of Conduct that requires Microsoft suppliers to demonstrate social and environmental responsibility—this level of certification represents a new commitment to minimizing the environmental footprint of our hardware and packaging.

Setting and achieving energy efficiency targets

Buildings

All new buildings that Microsoft owns are built to LEED standards, and they use 20 percent less energy and less water than traditional buildings. Over the past two years, we have cut energy use by 10 percent at our 125-building, 500-acre Redmond campus with our Energy Smart Buildings initiative. The initiative uses an interconnected data-driven energy management system that analyzes 500 million data transactions per day from 30,000 pieces of equipment to flag problems and prioritize fixes in real time. The system has quickly paid for itself, saving $2 million a year in energy costs. We have been sharing what we've learned with business, government, and industry leaders from around the globe and making similar solutions available to our customers through partners (such as through Microsoft CityNext offerings).

Datacenters

We continue to make significant changes in our datacenter design in an attempt to drive innovative energy-saving approaches into our datacenter operations. Some examples include using outside air cooling and airside economizers that dramatically cut the energy and water used for cooling. These measures have helped us achieve a goal set by our datacenter team that all new datacenters have an average of 1.125 Power Usage Effectiveness, which means we are using one-third less power use than the industry average.

We are focused not only on efficiency inside the datacenter, but also how to create dramatically more efficient systems, from the power plant to the chip. Examples of our work include a pilot datacenter that will run completely independently of the grid using energy generated from biogas, a byproduct of a nearby water treatment plant. We've also pioneered a new concept to integrate fuel cells directly into server racks, stripping out most of the infrastructure found in the traditional datacenter energy supply chain, which we expect will effectively cut energy use in half. At an operational level, we are building energy-saving features into our cloud services, such as enabling developers to automatically scale their resource use to demand.

Increasing our use of renewable energy

In order of preference, we use renewable energy by:

1. Connecting facilities directly to renewable energy sources where feasible.
2. Signing long-term renewable power purchase agreements in regions where we have operations and those projects are viable.
3. Investing in renewable energy certificates (RECs) to match our total electricity usage.

Addressing environmental challenges through technology and partnerships

Beyond reducing our own footprint, we are helping our customers and the world at large address the environmental challenges of today and into the future. We do this by building more efficient products and services and by investing in research that accelerates breakthroughs in science and resource management. We also collaborate with other technology companies, government agencies, nonprofit organizations, public policy advocacy organizations, and the scientific community to better understand and measure environmental factors and to deliver solutions that enable a sustainable future.

Building the cities of tomorrow

In our experience, environmental challenges also present significant business opportunities. Some of the areas where there is a tremendous opportunity to boost efficiency and promote innovation can be seen in many of the Microsoft CityNext scenarios we are working on with our partners. Cities that take advantage of Microsoft technologies and partner solutions are improving operations and reducing consumption by using software to collect and analyze both real-time and historical data from a wide range of sources. By using information, cities are able to cut power costs, improve forecasting, detect impending equipment failures, improve energy efficiency, reduce pollution, and drive greater efficiency in transportation and core city infrastructure. Some examples include:

Buildings, infrastructure, and planning

Microsoft partners are using both design and embedded technology to lower energy consumption and improve performance of buildings at a city scale.

City of Seattle

For example, the City of Seattle worked with Microsoft, Accenture, its local electric utility, and a local nonprofit to create a Smart Building program that aims to reduce downtown power usage by up to 25 percent for the entire city. The Smart Building solution uses cloud services to gain deeper insight from data generated by building management systems, sensors, controls, and meters. This insight translates into actionable changes that can significantly reduce energy use with no negative impact on productivity.

Air Quality Monitoring

Microsoft and our partners are leveraging big data and the power of real-time analysis to more accurately predict the air quality over the next few hours or days.

For example, using big data on fine-grained air quality from diverse sources, the Urban Air application monitors and helps predict air quality in more than 20 cities throughout China.

Energy and water

In another example, IssyGrid is using digital technology to integrate and manage distributed energy supply and demand data across Issy-les-Moulineaux, France. The demonstration project is run by a consortium of corporate partners and local utilities. About 200 test homes and four commercial buildings in the community have been outfitted with energy consumption monitoring devices. Through the experiment, they have reduced energy consumption—and bills—by 10–20 percent. The project uses Microsoft public cloud resources to store data and Microsoft data management software to analyze it and yield insights.

Transportation

Finland relies on a strong public transportation system to help residents and visitors get to where they need to go. The city-owned bus system, Helsingin Bussiliikenne Oy, worked with Microsoft to expand its data warehouse solution to collect and analyze data from bus sensors in order to reduce fuel consumption and improve driver performance. The initiative helps make bus rides smoother and safer, which results in a 5 percent reduction in fuel costs and a 7 percent improvement in rider satisfaction.

Designing energy efficiency into our services and devices

Increasing the amount of computation for a given unit of energy is a high priority for Microsoft on client, server, and cloud technologies. Each new version of Windows offers enhancements to energy efficiency and power management tools. Through products like Microsoft System Center, we provide IT administrators with controls to apply energy-saving power management settings across all the computers on their network. Every two years, we are seeing computation almost double in our cloud for a given unit of energy.

Accelerating research breakthroughs

Microsoft invests in and drives environmental research, which advances how cloud services and mobile devices can help solve some of society's biggest environmental challenges. Microsoft Research's Computational Ecology and Environmental Science projects focus on the development and adoption of technologies for scientific visualization and data management—especially technologies that accelerate insight into the environmental and earth sciences.

Creating new computational methods and tools

Microsoft Research experiments with many prototype software tools covering all parts of the scientific process. This includes generating new environmental data; storing, finding, and analyzing existing data; defining new models; setting parameters and refining models into predictive tools; running model simulations at scale; and packaging computational tools for stakeholders. A few examples are:

- The world's first fully data-constrained global terrestrial carbon model, CCF1.0, is now complete and has been submitted to the scientific journal *Nature*. We hope that it will be included in the next Intergovernmental Panel on Climate Change (IPCC) report and that it will have a long-lasting effect on the way carbon modeling is carried out.

- The result of a collaboration between Microsoft and the United Nations Environment Programme–World Conservation Monitoring Centre (UNEP-WCMC), the Madingley Model is the world's first end-to-end, process-based model of global ecosystem function. It keeps track of life histories, population abundances, body sizes, what eats what, energetics of individuals, reproduction, and other ecosystem attributes across the globe.

- The Microsoft Research Computational Ecology and Environmental Science Program develops novel computational tools and methods to predict and mitigate the rapid changes occurring in the environment.

- Microsoft is developing an online search engine called SciScope to help scientists find and retrieve meteorological, hydrological, and water and soil quality data from numerous data repositories. With SciScope, researchers can search multiple environmental data repositories simultaneously and retrieve information in a consistent format.

- Fetch Climate is an intelligent, environmental information-retrieval service for past and present observational data and climate prediction—available for adoption by members of the research community. The tool provides ready access to complex geographical information including, but not limited to, climatological information.

- Microsoft Research is collaborating with hydrology scientists at the University of California's Berkeley Water Center and the Lawrence Berkeley National Laboratory to build a "digital watershed." The project is designed to help researchers gain an accurate picture of the health of a watershed by acquiring existing hydrologic data to understand historic conditions on key watersheds in California. Scientists also use Microsoft Virtual Earth technology to help visualize spatial data sources and their relation to the landscape.

Modeling the impact of climate change

General ecosystem models are mathematical models that mimic the physics and chemistry of the planet's land, ocean, and atmosphere. Scientists use these models to better understand how the earth's climate systems work, but they are also used to make predictions about climate change and inform public policy. Because these models have been so successful, Microsoft Research is using and building models to improve our understanding of biodiversity and the impact of climate change on our planet. A few examples are:

- Scientists at Microsoft Research Cambridge are working with the United Nations Environment Programme World Conservation Monitoring Centre to develop a model and tools that will help scientists and policy makers address the loss and degradation of ecosystems. In particular, they want to determine—given population growth and expanding resource use per capita—how to balance the need for increased food, timber, and textiles production; the industrial use of natural resources; and the healthy functioning of natural, semi-natural, and artificial ecosystems.

- Microsoft Research Cambridge is also studying how an improved understanding of forest dynamics is needed to better predict environmental change. The research suggests that a new generation of realistic forest modeling, which is urgently needed and now within reach, will significantly improve an understanding of how forests work, how tree species respond to deforestation, and how forests affect climate and environmental change.

- Microsoft Research has released a new way to convey earth-science concepts. It's called Layerscape, a data visualization engine adding, among other things, a careful construction of the Earth, textured with fine-scale imagery courtesy of Bing Maps.

Conclusion

At Microsoft, we are committed to driving sustainable business practices and to catalyzing technology and scientific innovations that help people, organizations, and communities around the world realize a sustainable future. As our customers look to thrive in an increasingly resourced-challenged world, we believe Microsoft is the carbon-neutral business partner that can best enable sustainable growth.

We see tremendous opportunities for technology to help people, organizations, and communities improve operating efficiencies, while enabling a new understanding about the resources and systems on which we depend. No single organization can address the scale of global climate change alone. We look forward to new collaboration opportunities that will allow us to work with customers and partners to promote an environmental and economically sustainable future for everyone.