Environmental Sustainability
EXECUTIVE STRATEGY BRIEF

Driving Greater Efficiency and Lower Carbon Emissions

Microsoft is committed to software and technology innovations that help people and organizations around the world improve the environment. Our goal is to reduce the impact of our operations and demonstrate responsible environmental leadership.

Environmental sustainability is a long-term business strategy for Microsoft, and we recognize that there is more work to be done to develop technologies, processes and partnerships that can be part of the solution.

In this strategy brief, learn about Microsoft’s environmental sustainability imperative, and how advanced technologies and smart business practices and strategic partnerships are helping us reduce our impact on the environment, and how we strive to provide solutions that help organizations around the world reduce their impact as well.
Microsoft’s Sustainability Commitment

Microsoft’s environmental strategy is based on three themes: Using information technology to improve energy efficiency, accelerating research breakthroughs, and demonstrating responsible environmental leadership.

Using Information Technology to Improve Energy Efficiency: Today society has the opportunity to use software to help eliminate more greenhouse gas emissions annually than are currently released by all sources combined in the United States. At Microsoft, we are working to accelerate technology breakthroughs that enable the transition to a cleaner, more energy-efficient economy. Our investments will focus on:

- Reducing the energy use of information technology: With energy efficiency gains, the IT industry can dramatically increase computing productivity without increasing the amount of energy consumed by computers.
- Enabling an ecosystem that uses IT to improve energy efficiency: Microsoft will work with other leading companies to use software to drive significant energy efficiency gains in everything from buildings and transportation to manufacturing and energy grids.
- Building applications and services to track carbon emissions: To effectively reduce greenhouse gases we need the ability to measure them accurately. Microsoft is developing solutions that will help businesses and governments track carbon emissions.

Accelerating Research Breakthroughs: Scientific research into the impact that humankind has on complex environmental and biological systems will help provide the insights needed for effective policy change in government and increased environmental awareness in people. It will also provide the foundation for technological advancements in energy usage, resource management, and environmental planning. Microsoft Research is working with leading scientists to expand the boundaries of our knowledge of the planet. We’re also working to create the tools, technologies, and models to help accelerate scientific understanding on a global scale. Our efforts include:

- Enabling fundamental advances in science: Microsoft is working with the scientific community to monitor environmental conditions and develop computational methods and tools to help scientists correlate and analyze data across research efforts.
- Modeling the impact of climate change: Microsoft is helping to create advanced modeling technologies that will improve our understanding of global and local climate changes and the environmental consequences of human activity on species and ecosystems.
- Providing access to computing power for the scientific community: Microsoft will work with leading scientists around the world to provide access to our facilities, research, collaboration tools, and computing power to help them advance scientific research.

Power Usage Effectiveness

One of the metrics used for measuring datacenter efficiency is Power Usage Effectiveness, or PUE. PUE compares the power consumption for the entire facility with the power consumed by the core IT components—servers, storage and network equipment. This ratio illustrates how effectively the power being consumed translates into net compute capacity. Mathematically, the calculation is PUE=Total Facility Energy/IT Equipment energy. The value of this metric is that it focuses on the non-value added use of power, which in a datacenter is anything that doesn’t compute or store information. Through careful design, innovative cooling strategies, and clever site selection, Microsoft has been able to reduce the PUE of our modular datacenters to a range of 1.2 to 1.5.
Responsible Environmental Leadership:
Microsoft will cut the rate of our carbon emissions and continue to invest in efforts to significantly reduce our use of natural resources. The steps we’re taking include:

- **Reducing Microsoft’s carbon footprint:** Our goal is to reduce our carbon emissions per unit of revenue by at least 30 percent compared with 2007 levels by 2012. Steps we’ll take to achieve this include improving energy efficiency in our buildings and operations, reducing air travel, and increasing our use of renewable energy.

- **Optimizing our supply chain:** We’ll focus on reducing the environmental impact of our supply chain—from how we deliver software to customers, to environmental practices in factories building our devices, to the food we serve.

- **Reducing our impact on the environment:** We’ll continue to invest in programs and search for opportunities to reduce the environmental impact of our operations, including our waste stream, our water use, and our use of materials.

Microsoft has initiated a number of programs to measure and reduce the impact our employees have on the environment:

- By holding virtual meetings with unified communications technology and online conferencing, our employees have helped eliminate the equivalent of 100 million miles of air travel each year.
- With a flex-work policy and unified communications and online collaboration tools, our employees can work from home effectively, helping cut back on daily commuting.
- In Puget Sound, WA, employees can take the Connector bus to and from work—helping eliminate ~32,200 miles of travel each day.
- In Shanghai, we have bi-electric hybrid coaches to shuttle employees to and from work.
- Each month we recycle an average of 208.78 tons of materials, including glass, plastic, aluminum, electronics, cardboard, paper, and organic waste.
- We have a full cafeteria recycling/composting program. We’ve even replaced our kitchenware (such as plastic cutlery) with compostable products made from corn and potatoes.

The IT industry is reportedly responsible for 2% of worldwide emissions, about the same as the airline industry. However, IT can have a significant impact on the other 98% by enabling more sustainable business practices, creating greater efficiencies and inserting smarter controls into everyday operations. Microsoft strives to be a leader in using technology to advance environmental sustainability, and to broadly share our best practices with companies and organizations around the world.

The Sustainability Imperative

Each year, Microsoft speaks with hundreds of customers, partners and stakeholders to better understand how our technologies and partnership can help them meet their environmental goals. In these discussions, several themes emerge:

**Reducing costs**—companies around the world are looking for ways to operate more efficiently, recognizing that reducing their consumption of energy and other resources will improve their financial performance while advancing their environmental sustainability goals.

**Risk mitigation**—governments and non-government organizations are asking businesses to act more environmentally responsible, and are backing these requests with strengthened regulations. Regulatory compliance has become a complex challenge, especially for multinational enterprises, and these organizations will look for technology solutions to help them mitigate this compliance risk.

**Growing share**—as customers place more emphasis on sustainability, businesses that provide greener products and services will gain a competitive advantage over their rivals, and those that ignore these trends will find themselves with a declining share of their respective markets.

**Social responsibility**—organizations continue to raise the bar around what it means to be “socially responsible.” Energy & Environmental commitments have proven to improve brand identity, drive thought leadership and make a positive impact in local geographies and economies.
**DATACENTER EFFICIENCY**

The Microsoft datacenter operations team continually seeks ways to drive more efficient use of power and cooling in datacenters. Our measurements of server performance under load and workload analysis has enabled us to right-size our server platforms. We have eliminated unnecessary components, use higher efficiency power supplies and voltage converters, and bounded the expandability of server platforms to achieve significant power savings.

We look at specific measures such as processor performance per-dollar per-watt to determine the optimum tradeoffs in processor selection. We have found that by using lower performance, lower watt processors we can deliver greater overall efficiency for both power utilization and deployment cost. We have also learned that we can widen the operating range of our servers and use free air cooling and water economization to improve efficiencies.

This continual measurement and analysis allows us to push the boundaries of datacenter efficiency, helping reduce operating costs while improving environmental sustainability.

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**Leveraging Technology to Reduce Global Impact**

Microsoft can help organizations achieve greater sustainability, while reduce this cost of operations. From the desktop to the datacenter and beyond, the latest generation of technologies and productivity tools enable a level of efficiency that wasn’t possible just a few years ago.

**Reducing energy demands**—On the desktop, the advanced power management capabilities in Windows 7 allows IT to centrally manage power settings through group policy, ensuring monitors aren’t left on overnight and PCs are put to sleep when idle. In the datacenter, Hyper-V in Windows Server 2008 R2 enables server consolidation through virtualization, requiring less hardware and supporting infrastructure, while maintaining workload security isolation and continuity. These technologies result in measurable reductions in energy consumption and carbon emissions.

**Managing environmental footprint**—The foundation of environmental management is measurement, and using the information to precisely understand where energy is being used and potentially wasted. Centralized control is a necessary component to allow IT to identify problems and curb excessive use. The metering and reporting on energy usage and carbon output available in Microsoft System Center R3 allows more informed control over both. Small and medium-sized businesses can measure and manage their carbon footprint from greenhouse gas emissions using Microsoft Dynamics AX and its integrated Environmental Sustainability Dashboard.

**Rethinking business practices**—Often the greatest strides involve not just reducing the impact of current practices, but changing the way people behave and work—replacing physical processes with digital processes, and using communication and collaboration tools, such as the Microsoft Business Productivity Suite and Office 365, that improve employee productivity while reducing the need to travel. In IT, it can mean moving workloads from on-premise resources to online, cloud-based services that take advantage of greater scale.

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ROB BERNARD
CHIEF ENVIRONMENTAL STRATEGIST,
MICROSOFT
Which is more sustainable: Cloud vs. On-premise IT?

Businesses and thought leaders around the world are asking “Is the cloud more efficient and sustainable than the cloud?”

To find out, we engaged our partners Accenture and WSP to conduct a study assessing the impact of moving Microsoft Exchange, SharePoint and our Dynamics CRM workloads from on-premise to a hosted cloud. What they found is that when organizations move these services to a Microsoft hosted cloud, they are able to reduce their per-user carbon footprint by at least 30%, and in the case of small businesses, this result was even more dramatic—a potential savings of up to 90%.

What is behind these efficiencies? Microsoft employs a number of technologies and practices in our datacenters that improve overall efficiency, many that are only available at large scale.

**Dynamic Provisioning**—when an organization plans its physical IT infrastructure, it generally must anticipate demand for several years out. Given the nature of large capital investments, it is not uncommon to overprovision capacity to ensure a comfortable margin for unexpected growth. And scaling back capacity when the expected demand fails to materialize is generally not an option. With cloud computing model, adding capacity does not require additional capital outlays, and equally important, scaling back in response to reduced demand is quite practical. Quickly matching server capacity to variable demand reduces waste.

**Multi-tenancy**—just as multiple tenants in an apartment building use less power overall than the same number of people living in individual homes, the multiple tenants of a cloud—provided infrastructure reduce their overall energy usage and carbon emissions. Cloud providers at scale have the ability to balance capacity among tenants with offsetting demands—such differing time zones or seasonal business spikes—allowing optimal resource usage.

**Server Utilization**—using virtualization technologies allows a datacenter operator to consolidate multiple workloads per server, while maintaining isolation of each workload. This drives up utilization from a typical 11-15% to 50% or higher, resulting in significant energy savings and reduced carbon output.

**Datacenter Design**—each generation of datacenter design is yielding major gains in efficiency and sustainability. Microsoft has pioneered the use of fresh air cooling and ultra-efficient water utilization in the latest modular designs, and uses recyclable materials for construction. Our latest modular datacenters use about 50% less energy than those from just three years ago, and we continue to seek out innovative designs and operating practices to reduce energy use even further. In addition, renewable energy sources factor heavily in site selection. Microsoft datacenters are among the most monitored and metered in the world, informing more efficient operations and identifying areas for future research.

How to Get Started

Make environmental sustainability a priority—understand your energy bills and think holistically about your IT energy consumption. Replace older hardware with EPEAT Gold or Energy Star PCs. Empower your employees to continually challenge the use of resources and think about more efficient business practices.

Leverage technology—consider adopting the latest software technologies that allow your organization to better manage PC power consumption and optimize server utilization in the datacenter. Plan, analyze and monitor your energy use with business intelligence software. And encourage your employees to utilize communication and collaboration tools to reduce their travel.

Adopt proven best practices—provide incentives that support efficiency and sustainability in operations. Invest in understanding application and workload behavior, and right-size your server platforms to meet these workload requirements with minimal waste.

Be proactive and involved—use recycled resources wherever practical, and renewable resources wherever available. Take part in industry environmental groups to continue to learn the best practices of others, and to share the best practices you discover.
Microsoft has extensive experience operating cloud services' infrastructures, with a history of innovation, operational excellence and industry leadership. As Microsoft’s cloud services portfolio and infrastructure continues to grow with new services and applications launching on a rapid basis, the company is making thoughtful investments to answer our customer’s needs for greater availability, lower latency, increased security, and lower costs.

Please visit www.microsoft.com/environment for more information.