Going **Green**

Software could be the key to your biggest impact on carbon reduction

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It's the carbon you're **overlooking** that could kill us

Your company is almost certainly engaged in a carbon reduction effort. In many countries, monitoring if not reducing greenhouse gas emissions is the law. Legal requirement or not, it's typically a business imperative as well, one that drives down cost and, more importantly, boosts your brand.

For some companies, product improvement is one key to reducing carbon, minimizing and replacing product packaging is another. Other companies look to their supply chains, replacing distant suppliers with local ones or swapping less energy-efficient means of transportation for more efficient ones; think trains over trucks.

The most popular targets for greenhouse gas reduction generally have one thing in common: they're some form of hardware, of something physical. As a result, companies in many industries overlook what might be the biggest cause of their carbon emissions: their software.

Virtually every business runs on software, and for most, software is an increasingly important source of innovation, revenue generation, analytics, and competitive advantage. Remember the mantra of a few years ago that "every business is a software business"? In many cases, software already reduces a company's carbon footprint, for example, video conferencing replaces onsite meetings to which some team members must drive or fly.
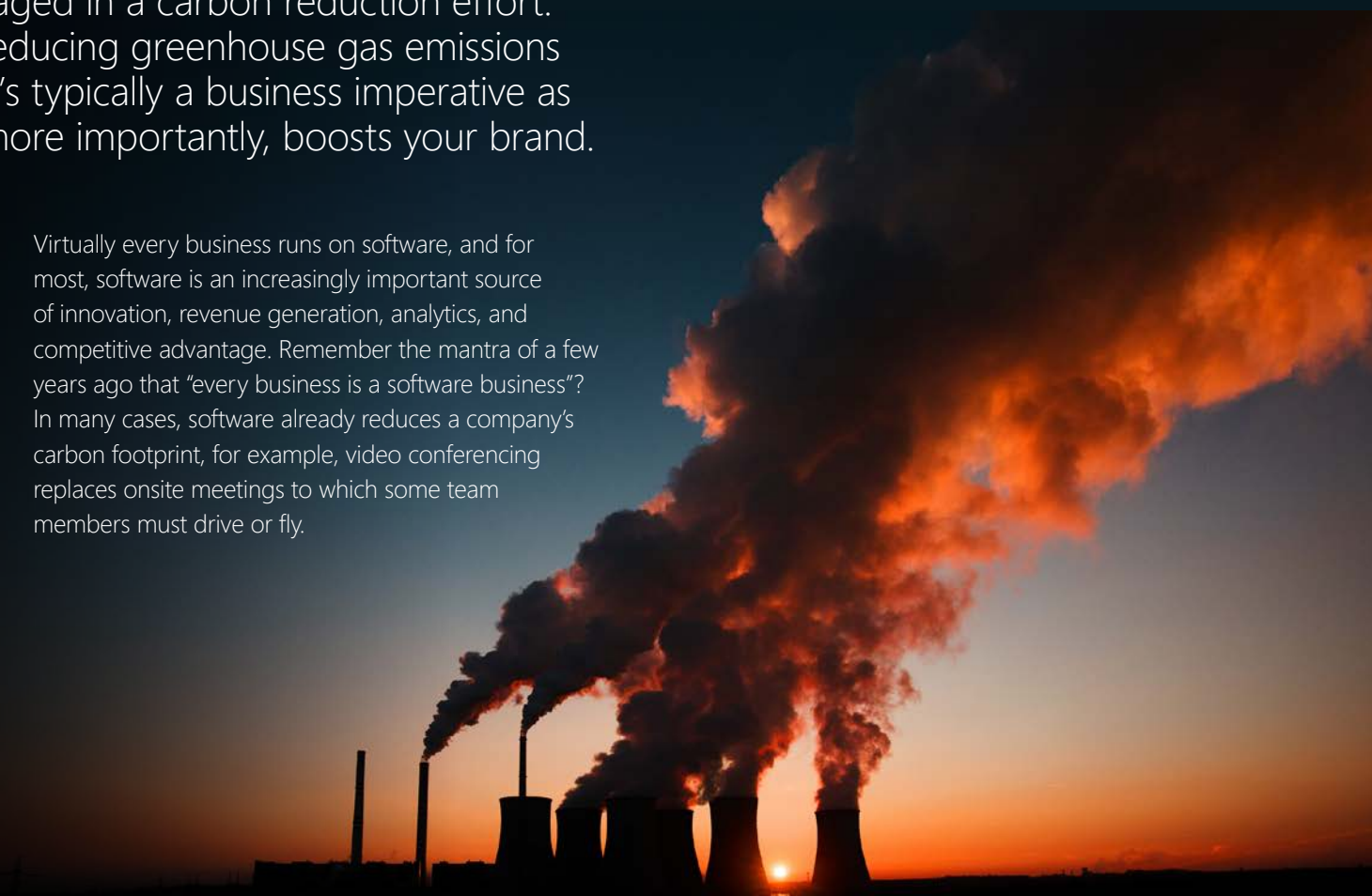
Unfortunately, software also causes businesses to increase their carbon footprint. Years ago, for example, software had to be energy efficient because the cost of hardware was so high, access to high-speed bandwidth was so limited, and running efficiently on hardware meant consuming less electricity.

Over time, with hardware costs plummeting and bandwidth growing, software no longer needed to be so efficient and developers became less attentive to this issue. Also, as off the shelf software (OTS) increasingly replaced custom code, that OTS software – unoptimized for energy efficiency – resulted in excessive electricity use and carbon emissions. In one division of a large enterprise alone, this could be the equivalent of keeping 26,000 fossil-fueled cars on the road for one year, according to modeling by Avanade and our partners.

How important is software to your company's carbon reduction? It depends largely on your industry. Those in which software plays the most central and extensive role – such as financial services and media – have the most to gain by reducing software-based carbon. But every company has a software-powered back office that can be better tuned to reduce emissions.

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The **green software** solution

If software is part of the problem, how do you make it part of the solution? By implementing a green software approach that identifies, targets and reduces the carbon emissions that software is responsible for emitting. Much work needs to be done to achieve that goal but progress has already been made and much more is on the way.

What's key here is the emphasis on green software as software that actually reduces carbon emissions, rather than software that merely neutralizes or offsets them. As the Green Software Foundation notes, actually reducing carbon is preferable – but also more difficult, riskier and more costly. The goal of the Foundation, and of the ecosystem of companies that participate in it, including Avanade, is to help overcome these challenges and promote the development of software that reduces emissions.

There are **three ways** for a company to reduce the carbon emissions generated by its software: use energy more efficiently, use hardware more efficiently, and make better decisions around carbon use.

Energy efficiency

Using energy more efficiently requires a way to catalog, track and measure the carbon output of the software you're using throughout your organization, and then to right size every line of code to minimize its electrical impact relative to the function it performs.

Hardware efficiency

Using hardware more efficiently means reducing the amount of hardware used (and powered) to perform any given function. Retiring hardware that's approaching end-of-life is important. Closing on-premises datacenters and migrating data and applications to the cloud – all at once or in hybrid stages – is often essential to optimizing hardware efficiency.

Carbon awareness

Greater awareness of how much carbon your software is producing, and where and when it's producing it, enables you to make better decisions to reduce those emissions. For example, you can shift the time or place that workloads are run to take advantage of clean, renewable or low-carbon sources of energy. The ability to run workloads anywhere in a global network to make use of the lowest-carbon option is another benefit of the cloud.

There's a new cloud in town

You can't do all this on your own. Reducing carbon emissions and addressing environmental equity requires collective measures to understand and mitigate environmental impacts. Measuring the overall environmental impact of an organization is particularly challenging.

Microsoft Cloud for Sustainability is designed to help companies measure, understand, and take charge of their carbon emissions, set sustainability goals and take measurable action.

You can use Microsoft Cloud for Sustainability to increase your reputation resiliency, agile and efficient operations, and people-first experiences.

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Making the business case for
green software

Reducing the carbon emissions generated by your software is an unalloyed societal good, resulting in cleaner, more breathable air and healthier populations.

Unalloyed but, fortunately, not unrewarded: it's also an important way to burnish your brand with investors, customers, employees and potential recruits. As such, it has an undisputable place in your companywide ESG (Environmental, Social and Governance) initiative.
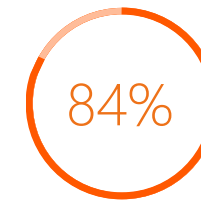
Virtue may be its own reward, but top executives and boards of directors still need to see a quantifiable business outcome from the carbon-reduction effort. That quantifiable outcome is now coming into focus. For example, calculations show you could save approximately USD130 per month per application – scale that up to an enterprise, and you're seeing significant cost-savings.

Migrating to a greener infrastructure is a key way to enable the software that runs on that infrastructure to operate more efficiently. Accenture estimates that migrating current applications to an infrastructure as a service (IAAS) cloud can reduce carbon emissions by more than 84%. Reductions can be pushed even higher – by up to an amazing 98% – by designing applications specifically for the cloud.

If all this suggests a simple equation – carbon-reduction equals business benefit – think again. There are almost always tradeoffs between business and environmental goals. For example, do you accept the carbon impact from the extra power you need to get sufficient accuracy for your AI model? That's why green software and carbon reduction isn't solely the province of IT. The business needs to provide IT with the guidance to identify and address these tradeoffs.

The business that looks to go greener needs to consider these tradeoffs, and sooner rather than later. It needs to identify the key inputs for its analysis and decision-making, and the guidance it will provide to IT.

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Measuring carbon use: the **Software Carbon Intensity** specification

Until now, we've talked in a very abstract way about "measuring carbon." It's easier said than done. Avanade is now working with the Linux Foundation's Green Software Foundation on a standard approach to turn a company's good intentions on carbon reduction into reality.

That standard is the Software Carbon Intensity (SCI) specification, which calculates the rate of carbon emissions for a software system and produces a globally recognized SCI score. Companies can analyze and compare the SCI scores for software, tools, architectures and services, from large, distributed cloud systems to products that utilize open source libraries, any on-premises application, and even a serverless function.

SCI scores aren't carbon offsets; they rate actual carbon use by looking at kilowatt hours over the time a software application or system runs, adjusted by a range of factors, such as the quality of the energy produced by the local grid. The result can be denominated per user, per API call, or by any other relevant factor.

With SCI scores in hand, companies can achieve the energy efficiency, hardware efficiency and carbon awareness mentioned above. Software engineers and data scientists can use SCI scores to write more carbon-efficient software. Business leaders can use SCI scores to measure the carbon intensity of their digital operations.

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Engineering **green** software

There are concrete steps that software engineers and data scientists can use today to write green software.

1.

First, they can **adopt green software engineering principles**, which call for them to optimize a range of factors that affect carbon intensity. These factors include network traffic, databases, and compute utilization, as well as reducing the number of microservices.

2.

Second, they can **measure SCI**, not as a single snapshot in time, but repeatedly to understand trends and have a firmer basis for action. They can use a carbon-aware SDK to instrument software, and measure cloud usage to justify the shift to optimal resources.

3.

Third, they can **take actions based on the SCI scores they identify**, such as improving the efficiency of software through refactoring. They can also optimize software use through improved business processes and work with partners to increase the lifespan of IT hardware.

How Avanade does it

Avanade has made green software and SCI integral to its broader ESG initiative. We embed SCI into Avanade not as an offering to clients, but as an essential element in how we design and deliver solutions – and how we conduct our own business. We decommissioned our on-premises datacenters, moving all compute resources to Azure (and local PCs). We created IP to measure our own carbon footprint and can use this technology to measure the carbon output of our clients.

We started our shift to green software with education and culture change, to make the most immediate impact on Avanade and our clients. As part of that change, we created both introductory and hands-on classes and have trained 3,200 of our software engineers and analytics professionals, with more being trained all the time.

We are one of just eight v committee members leading the Green Software Foundation. We chair its SCI Reporting Project, helping to draft the SCI specification and Working Group processes, and author a dedicated blog series on the GSF website to provide advice and guidance to the industry.

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Getting **started**

Many companies might set green software as a goal; far fewer are experienced in delivering the change required to achieve it. Where to begin? Avanade recommends these first steps:

Take a census of software across your environment. You can't devise a plan until you have a clear understanding of your current state. That includes not just your software applications but also your databases and software infrastructure, such as platforms, virtual machines and containers.

Build the case for change. Building and maintaining green software is a continuing process, not a one-off project. So first, build the medium- and long-term business cases for change, to help build institutional support.

Identify early wins. Walk before you run. Identify low-hanging fruit you can harvest to quickly validate the concept of green software to your organization. Early wins also give you the experience and knowledge to tackle more complex challenges.

Train your people. You can't succeed with green software if you don't bring your people along with you and empower them to reduce carbon emissions. Include both theoretical and practical training, on-demand and live. Make sure your training is flexible enough to support the different learning styles of your people.

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How **Avanade** can help

Especially because the green software movement is new, you may not have the expertise in house that you need to devise and implement a reduction in your software carbon emissions.

As a leader in the green software movement, **Avanade** is prepared to help you on your journey.

Here are four ways we can help:

1. ### Data

We can work with you to gather data from your applications and infrastructure to measure the carbon intensity of software, network traffic, and generate a SCI score for the overall environment.

2. ### Recommendations

We can make recommendations to simplify your applications and infrastructure, reducing the consumption of hosting resources and identifying components that are ripe for replacement.

3. ### Development practices

We can embed sustainable development practices into your DevOps process and application development lifecycle, as well as embed carbon measurement into your procurement process to support buy-or-build decisions.

4. ### Accelerate

And because no one has the time or money for years-long projects, we can get you from kickoff to in-depth recommendations in just eight weeks. Our green software approach includes data gathering and measurement, business case analysis, recommendations for DevOps, security, cost improvements and architecture, and a green software roadmap to direct you toward your mature state.

What to do now

For more information on our approach, see this **video** – and if you'd like to reduce your emissions – **please get in touch**.

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About Avanade

Avanade is the leading provider of innovative digital, cloud and advisory services, industry solutions and design-led experiences across the Microsoft ecosystem. Every day, our 56,000 professionals in 26 countries make a genuine human impact for our clients, their employees and their customers.

Avanade was founded in 2000 by Accenture LLP and Microsoft Corporation. Learn more at www.avanade.com.

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