



Carbon Quest: The Radical Shift in Sustainability Research

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What is sustainability?

Fifteen years ago, sustainability research was focused primarily on several areas: energy consumption, operational efficiency, material use, and carbon footprint. Today, sustainability spans many topic areas across environmental and social spheres, including, but not limited to, water, human rights, inclusion and diversity, substances of concern, the social applications of technology, and more.

However, due to the urgent risks and consequences of accelerating climate change, the top priority in environmental sustainability has shifted to reducing greenhouse gas emissions. While the sustainability aperture remains quite wide, there is a renewed and concerted effort to employ businesses to address the complex challenge of climate change rather than to address all sustainability themes equally and simultaneously.

At HPE, we have partnered across the business to better address the company's opportunities to provide not only sustainable IT but also IT that further enables sustainability. HPE's corporate sustainability team, Living Progress, has teamed up with Hewlett Packard Labs to articulate our current capabilities while keeping an eye on the horizon for the arrival of the necessary solutions for a net-zero, or even net-positive, future.

Tiffani Jarnigan is the Director of Sustainability Innovation and Partnerships on HPE's Living Progress team at Hewlett Packard Enterprise. She partners closely with business unit leaders and the Office of the CTO to define, and deliver against, a sustainability portfolio roadmap that will foresee and exceed customers' needs for sustainable and efficient IT solutions. Since joining HPE, Tiffani has spearheaded the expansion of the company's sustainability sales enablement team while incubating sustainability innovations to support our customers' transitions into the low-carbon economy. Prior to joining HPE, Tiffani worked as a data and business intelligence analyst for an organic produce company in San Francisco and served as an environmental specialist in the Peace Corps for the Dominican Republic.

Cullen Bash leads Hewlett Packard Labs' Systems Architecture Lab, that's focused on exploring novel system architectures that will support future workloads with a focus on performance, flexibility, and efficiency. A mechanical engineer by training, he's been studying energy throughout his career; how it flows, how it can be harnessed to do useful work, how to transform it, and how it can be efficiently dissipated when its utility has waned.

Energy is at the heart of climate change

Since the dawn of the industrial revolution, humans have sought to transform energy from a less-useful state into one that has greater potential to do work. In pre-industrial times, a river's energy was captured using water mills that transformed the kinetic energy in the river into rotational energy used to turn a mill to grind grain into flour or produce other useful goods. But the potential energy in a river can be difficult to capture and requires, of all things, a river.

Wood, a more flexible form of energy, was burned to transform chemical energy into heat for warming homes or industrial processes. Wood was substituted with coal, given its higher chemical potential and coal became the primary material for fueling the industrial revolution, including the generation of electricity. But coal is bulky and dirty and not ideally suited as the primary fuel for transportation and mobility. Oil was found to have even more flexibility due to its ability to be refined into numerous substances. With an energy density greater than coal, it became the foundation for transportation. Since both coal and oil are fossil fuels, a by-product of their combustion is carbon dioxide, a greenhouse gas.

Greenhouse gases build up a blanket of insulation in the earth's atmosphere. They block radiant energy from leaving the atmosphere and emit energy back to the surface, thereby warming the planet. The average temperature increase since 1981 has been 0.3 degrees Fahrenheit per decade, twice the rate per decade since 1880. If emissions continue at the same rate observed since 2000, the temperature will be 5-10 degrees warmer than in 1901-1960, resulting in environmental catastrophe.

Business growth and sustainability: An oxymoron or an opportunity?

So, the earth is warming, and the climate is shifting; what can be done about it? The answer seems straightforward — focus on the source and limit greenhouse gas emissions. But how? And by how much? And by when? Simple questions, right? Hardly. The more global a challenge becomes, the harder it is to reach a consensus across geopolitical boundaries.

To get a handle on these questions, the world convened in Paris, the City of Light, in 2015. The result of this gathering was the Paris Agreement, which stated that a maximum of 1.5 degrees Celsius temperature rise from the time of the Industrial Revolution was the limit to avoid the worst effects of climate change. While necessary, this was still insufficient in that it didn't answer the key question of "How much?" Three years later, the Intergovernmental Panel on Climate Change provided the answer: Greenhouse gas emissions would need to reach net-zero levels by 2050. Net zero means that the amount of carbon emitted must be removed such that no net carbon is released. But they didn't stop there. They also said that to have any chance of reaching the 2050 goal, emissions would have to be reduced by 50 percent over 2018 levels. By 2030.

Now we know how much, and we know when. We'll get to the how in a minute. The how much and the when are having a significant effect on global business. Companies are incorporating carbon reduction goals into their strategic business plans, many of which are net-zero goals. According to the [Energy and Climate Intelligence Unit](#), in March 2021, 21 percent of corporations had net-zero goals. Some companies have even started disclosing carbon emissions within their financial reporting, like [SAP®](#) and [Ford](#). Executive compensation is also being tied to carbon reduction performance. In 2022, [HPE](#) not only committed to being net zero by 2040 but also linked executive compensation to carbon reduction, which underscores the sea change underway. Accountability is moving from siloed organizations within the business to deeply embedded across business strategy, driving accountability within the executive suite and even the board of directors.

Goals are a good first step—but by no means are they the sole solution. They focus on action and provide a target against which to prioritize initiatives and drive accountability. Goals are a start, but to reach a goal, we first need a method for gauging progress towards the goal, which requires calculating and estimating carbon emissions from various sources and activities.

While the World Resources Institute published the [Greenhouse Gas Protocol](#) to provide standards around carbon accounting, it is not a simple undertaking. Companies spend months calculating and, for some parts of their value chain, estimating greenhouse gas emissions. There are frameworks and guidelines around **avoided carbon**, **low-carbon**, **green revenue**, **clean revenue**, **embedded carbon** (which requires a lifecycle assessment), and more. The focus on carbon, while it narrows the sustainability aperture, still requires wading through a veritable acronym-and-standards soup, which can leave some wondering, are we all working toward the same goal?



Go back to the source

To get to net-zero carbon emissions, we need to look at energy again, how much of it we need, how we use it, how we transform it, and how we store it. Reaching net zero will require a multi-pronged approach.

Broadly speaking, progress must be made in four key areas.

1. **Reduce energy demand.** Reducing demand will help ease the transition to new sources of energy.
2. **Decarbonize the energy grid.** Move from carbon-based sources like coal to carbon-free sources like solar, wind (direct and indirect), hydro, geothermal, tidal, etc. This transition is non-trivial but critical.
3. **Longevity and circularity.** Extend the useful life of products, improve upgradeability, and develop means to fully recycle materials using low or no-carbon methods. This will result in less energy used to refine materials, manufacture finished goods, and transport them to their use destination.
4. **Carbon removal and capture.** Reaching net zero requires developing techniques to remove carbon after it's emitted or sequestering it before it's released into the atmosphere. Since reducing emissions to absolute zero is considered infeasible by 2050, effective and scalable carbon removal and capture are critical to reaching net zero. According to [Bruce Usher](#), professor and co-director of the Tamer Center for Social Enterprise at Columbia Business School and an expert on carbon offsets, in order to address climate change, "at some point, you have to start incorporating either offsets or some other negative emissions technology."

Measure twice, cut once

To reduce carbon emissions, we must measure carbon emissions. This is a fundamental starting point. In IT infrastructure, energy is used to deliver power to the IT gear, to operate it, and to remove the waste heat that's discharged. By understanding how energy is used and where it's used, we can identify inefficiencies and waste.

After working through the spring to set our net-zero goals, we at HPE are acutely aware of how challenging it can be to collect meaningful and accurate data. To collectively reduce our global emissions to achieve a [1.5-degree scenario](#), we **must** take a full value-chain approach. Suppliers and customers must enable data visibility and sharing. To pursue this type of transparency at HPE, we've developed a [proof of concept](#) to provide emissions data relating to our customers' infrastructure. The dashboard provides visibility for information like energy consumption, carbon emissions, and resource utilization to allow customers to investigate and uncover inefficiencies and further enable them to prioritize actions to achieve their sustainability goals.

The problem is immense. This means that the solutions must be equally vast. It all starts with dialogue—how do we define and measure? But also, how do we imagine these solutions? And even more fundamentally, how do we partner in their pursuit?

All is not lost, yet...

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