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The sustainability challenge

A guide to creating actionable sustainability strategies to implement efficient design, optimize operations, introduce renewables and decarbonize supply chains

Schneider Electric

Chapter 1:
Robust sustainability strategies

A framework for achieving sustainability in data centers
Kevin Brown, senior vice president, EcoStruxure Solutions, Secure Power Division, Schneider Electric explains the key elements to the Schneider Electric Sustainability Framework

Beyond PUE
DCD editor Claire Fletcher provides a more holistic view of the sustainability metrics you should be looking at and benchmarking against

A framework for achieving sustainability in data centers

Kevin Brown is senior vice president, EcoStruxure Solutions, Secure Power Division for Schneider Electric

It's becoming clear that our industry will need to take a strong position on sustainability

A recent 451 Research report surveyed 800+ data center providers worldwide and discovered the majority of respondents (57 percent) view sustainability as a competitive differentiator and cite customer expectations as a major driver. But only 43 percent said they have strategic sustainability initiatives and efficiency improvements in place for their infrastructure.

That means that the majority of data center providers across the globe lack a strategic plan for sustainability at a time when customers are demanding it and regulations may soon require it.

I recently had the pleasure of speaking about sustainability at DCD's Towards Net-Zero event and my resounding message was to organize and prioritize around data center sustainability. It's a big undertaking but it's one that we can successfully achieve together. Schneider Electric addresses this challenge with a five-pronged framework.

My presentation, *When There's no Plan B, A Framework for Achieving Sustainability in Data Centers*, dove deep into the framework that will help your company move in the right direction. Of course, I encourage you to watch the full presentation to learn much more but here are the highlights:

1. Set a bold and actionable strategy
Everything starts with a strategy. Create one with clear objectives and prioritized action. You must align internal expertise and resources by having the teams for design, procurement, facility operations, and sustainability all working together.

Then, make a business case to justify and fund projects, which will require executive sponsorship and leadership...and most likely a strategy for placing a value on carbon whether through carbon pricing or caps on CO_2 emissions.

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2. Implement efficient designs
As an industry, we have eliminated 80 percent of energy losses with our data center designs, but we are hitting the point of diminishing returns. We must invest in technologies that improve energy efficiency and lower our carbon footprint like SF_6-Free switchgear and liquid cooling, which could reduce overall IT and infrastructure energy consumption by 15 percent.

And we also must prioritize circular design by designing for reduced size and weight, serviceability, and second life, which translates to fewer raw materials, less land use, lower transportation emissions, and so on.

3. Drive operational efficiency
When it comes to operations, they must be efficient and sustainable, and we have done a lot of work in this area. There are connected systems to collect data to provide visibility, track energy usage, and benchmark performance. Predictive maintenance services help drive operational efficiency and reliability while maximizing lifespan through connected services.

Software and analytics are used to monitor and report through dashboards, to help make informed decisions and track sustainability progress. Also, we need to start implementing resource dashboards to track our carbon footprint. After all, you can't manage what you don't measure.

4. Buy renewable energy

You can accomplish this in three main ways – credit, on-site build, and off-site build.

Energy attribute certificates or renewable energy credits are a simple and immediate way to offset your carbon footprint and support clean energy. For onsite/distributed generation, you can install renewable energy sources like solar panels on-premise.

The site can consume the clean energy that it's generated, or you can connect to the grid. Offsite generation is primarily for longer-term contracts that fund renewable power projects. Power Purchase Agreements or PPAs are most common.

5. Decarbonize your supply chain

This might be your biggest challenge. Your vendor's supply chain is a part of your carbon footprint. So, it makes good business sense to use vendors that embrace the circular economy with circularity designed into products.

Vendors must be transparent about the sustainability impact of their products and should produce either a Product Environmental Profile (PEP) or an Environmental Product Declaration (EPD) with detailed information about the materials, and their compliance, recyclability, and more.

Decarbonizing the supply chain is a complex and challenging topic, but if a vendor is doing the right things, they will be able to produce the documentation.

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Where is your company on its climate journey?

If you are interested in sustainability in data centers, I really encourage you to check out the presentation, *When There's no Plan B, A Framework for Achieving Sustainability in Data Centers* as a first step. Then, take a cold, hard look at where your company really is on its climate change and sustainability journey.

Maybe your organization is leading the way, or maybe it is just beginning. Either way, Schneider Electric has demonstrated success in helping many companies at all stages of this journey.

Beyond PUE

There was a time when the Power Usage Effectiveness (PUE) metric was the industry standard for measuring the energy efficiency of a data center. Undoubtedly, it is still a key efficiency metric but it's time to encourage a wider-lens and more comprehensive measurements of sustainability

PUE does a fantastic job of helping data center operators see how energy-efficient their facilities are and is still valued as a benchmarking tool. It was also the key metric that really got operators thinking about power use in relation to sustainability, playing a significant role in opening up that conversation.

Defined as, 'the ratio of total data center power to the IT load supported,' PUE captures the energy overhead associated with electrical distribution losses and cooling, and oftentimes ancillary functions such as lighting and security.

It does, however, have its limitations. PUE does not consider the efficiency of IT systems, but when used correctly, can be used to help inform investment decisions on efficiency improvements. Although PUE is an ISO standard (ISO/IEC 30134-2:2016), there's actually no oversight or enforcement of PUE outcomes, leading to some mistreatment of the metric. Finally, it is also restrictive when trying to analyze and compare data centers in different climates, or with differing levels of server utilization.

$$PUE = \frac{\text{TOTAL FACILITY POWER}}{\text{IT EQUIPMENT POWER}}$$

Operators are under increasing pressure to lower their facilities' PUE. This means powering ever-advancing technologies, servers, storage, the network itself and everything in between, whilst trying to keep it all from overheating – so you can see why engineers and operators may end up with rising temperatures themselves. But to help ease the pressure, operators should be looking beyond PUE.

By honing in on this singular metric, data center managers risk pigeon-holing themselves, and missing out on other opportunities to seize the day when it comes to sustained reductions in energy consumption.

PUE under the microscope

As far as buildings go, we know data centers are incredibly power-hungry, but with great power comes great responsibility and this has understandably placed data centers firmly under sustainable scrutiny.

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The drive to reduce PUE at all costs, whether this be through lack of understanding or environmental pressures, can actually have a negative impact, causing operators to potentially (and inadvertently) use more energy and as a result, increase costs.

Let's take a practical example; assume you have a data center with an input of 100kW, half of which (50kW) is being used to power IT equipment. This would carry a PUE value of 2.0. Now, suppose you virtualized some of those servers, and that virtualization was so effective, you were able to reduce the power to the IT equipment by 25kW and the overall power to the data center by the same. Where does that leave our PUE? Yep, higher than when we started. It may seem counterproductive, but any reduction in IT load without balancing out the infrastructure load will result in a higher PUE.

A useful analogy is perhaps the dreaded bathroom scales. Just because someone's number is higher or lower than yours, doesn't necessarily have a direct correlation to their health. There are many (many) other factors at play.

When it comes to PUE, there will always be tradeoffs between availability and energy efficiency. Redundancy, for example, will increase PUE, and data center equipment will run more

efficiently when more heavily loaded, it's important to view sustainability from a wider lens.

New and evolving metrics

When PUE first burst onto the scene via the Green Grid et al. back in 2007, the adoption of environmental and sustainability practices was less advanced than it is today. Most operators didn't even collect data or measure operational performance based on such metrics, let alone make technology choices that consider renewable energy. Today, the picture couldn't be more different, and there are now a myriad of ways data centers can help get themselves out from under sustainable scrutiny and improve energy efficiency.

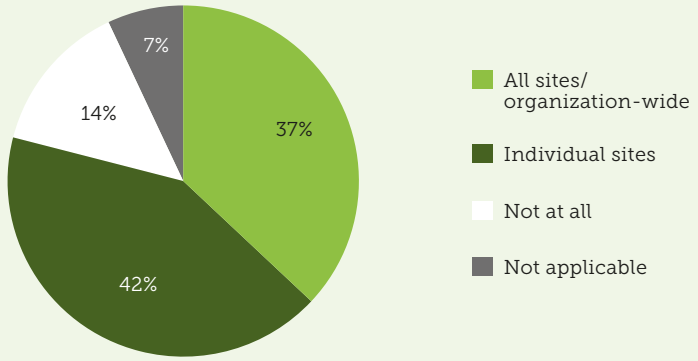
IT utilization

According to a recent 451 report, 'Multi-tenant data centers and sustainability: Ambitions and reality,' commissioned by Schneider Electric, we can see PUE is a metric that multi-tenant providers track widely, with almost 90 percent of respondents indicating they track PUE at some or all their sites.

And since PUE doesn't look at the IT equipment itself, it's somewhat comforting to know that a similar number of providers keep an eye on IT utilization, with two-thirds offering a mix of facility and IT services, which is generally a good proxy for efficiency. Utilizing servers more strategically not only makes good business sense, but can also dramatically improve the energy efficiency across the entire infrastructure.

But beyond the energy consumption of the infrastructure, what also needs to be considered is the way energy is generated – in other words, how much greenhouse gas is it accounting for? This leads us nicely to our next efficiency metric.

Figure 4: Grid carbon intensity tracking



Grid carbon intensity tracking

Carbon intensity is defined by the amount of carbon dioxide and equivalent gases produced per kilowatt-hour of electricity. Tracking the carbon intensity of the power grid is essential when calculating environmental impact.

Unfortunately, according to the report, only 37 percent of respondents said that they track carbon intensity across their entire organization. But, all is not lost, as 42 percent said that they tracked some of their facilities' carbon intensity, bringing the tally to a more respectable 79 percent. Of course, there is still room for improvement. After all, you can't measure what you don't monitor.

Water consumption and water usage effectiveness (WUE) tracking

This metric is slightly less-well known, but as sustainable demands mount and the climate crisis rages on, that is unlikely to be the case for much longer. WUE is another metric born from the Green Grid back in 2011, so a little later than PUE (2007), but it's still been around for more than a decade and operators are now embracing it.

Defined as the ratio of water usage and electricity consumption of IT, it is a worthwhile endeavor to track water consumption and water usage effectiveness, as water management is an issue set to become highly charged in various locations.

Weather incidents such as droughts, combined with unprecedented population growth are just a couple of the factors propelling this issue to the fore, particularly among those areas affected by climate change.

California, South Africa, and India are all prime examples of locations where water shortages can often be severe year after year. Water scarcity in water-stressed areas like these is beginning to become something that data center owners are increasingly having to report on and disclose, ensuring local watersheds are not negatively impacted by their activity.

Infrastructure efficiency and sustainability improvements

When it comes to infrastructure efficiency, power distribution topped the charts as the most popular area for improvement.

In recent years, power distribution has become highly efficient (above

They say age is just a number, and so is PUE if we don't know how to use it to measure changes within a facility

90 percent) across the load curve. But older equipment may suffer major efficiency degradation once utilization drops below 50 percent – all too typical in many data centers due to capacity over-provisioning practices. However, there are plenty of opportunities to be gained in reequipping or refurbishing existing facilities.

But power efficiency is not all about new or upgraded equipment; it is also about balancing the load across power systems and reevaluating power capacity requirements based on actual load measurements, as opposed to taking the nameplate (or arbitrarily dated nameplate) power of servers and storage systems. All these steps should free up stranded power, defer investments in new capacity and increase utilization over time.

Cooling also deserves an honorable mention, coming in a close second to power, with upgrades to cooling systems only just pipping optimization to the post. Of course, there have been vast swathes of innovation when it comes to data center cooling over the last ten years due to its historically high demand for energy, but that was mostly driven by a (bad) habit of overcooling, via fans and compressors working overtime.

The good news is, the multi-tenant sector has led much industry change already with better designed facilities and cooling architectures, that require dramatically less energy through relaxed temperature settings, variable-speed fans and, crucially, reduced use of compressors.

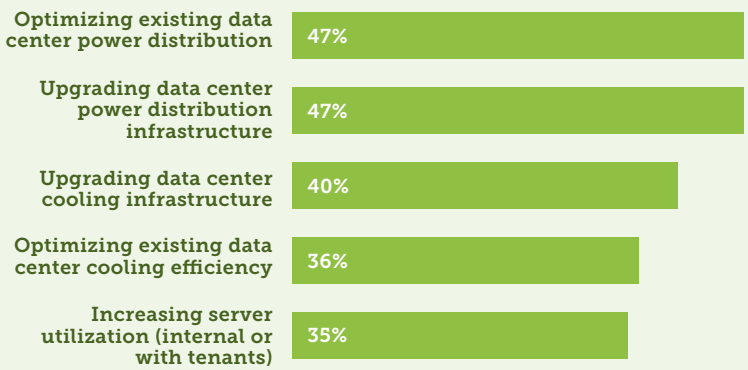
Conclusion

We can clearly see from DCD surveys across the year and the 451 report that there are many other metrics providers can explore beyond PUE to help improve the efficiency of their infrastructure and make it more sustainable.

The primary motivation behind these initiatives is to meet customer requirements, most of which now expect contractual commitments. The data indicates that this will become even more powerful, as large technology companies and major enterprises mount pressure on their multi-tenant providers in their pursuit of reducing carbon and water footprints. A combined approach is necessary, using methods fitting for the individual facilities we are operating.

One size doesn't fit all. Therefore, in a time where data centers are firmly under the sustainability spotlight, the use of multiple (relevant) metrics really is the only way to ensure your facility stays ahead of the curve.

Figure 5: Infrastructure efficiency and sustainability improvements. What efficiency and sustainability improvements is your organization actively considering within the next two years?



Committing to sustainability by setting actionable measurements

Schneider has identified 23 sustainability metrics that apply to the data center across several metric categories. These categories represent a holistic approach to addressing environmental sustainability.

Energy: Reporting energy consumption, energy efficiency, and renewable energy use is important for data center operators to show their progress on efforts to minimize their carbon footprint.

Greenhouse gases (GHG) emissions: CO_2 and other gases such as CH_4, PFCs, and HFCs are classified as greenhouse gases. According to GHG Protocol and ISO 14064, there are three categories of GHG emissions: Scope 1, Scope 2, and Scope 3, which are covered in more detail later in this eBook. Reporting GHG emissions is important for data center operators to show their efforts on controlling climate change.

Water: Water is one of Schneider's five metric categories. Reporting water usage is becoming more important for data center operators as a part of their overall sustainability goals.

Waste: Data centers generate significant waste during construction and operations. Minimizing waste generation from the supply chain and diverting waste out of landfills through reuse and recycling is a key strategy for being more environmentally sustainable. Circular economy design methodologies and processes support improvements in this area.