Data Center + IT Collaboration To Cut Carbon

Addressing the ESG, decarbonization and sustainability challenges to providing net zero data centers and IT.
A paper for CTOs, CIOs and Data Center Professionals

serverfarm™

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If you are CIO, CTO, DC leader, cloud GM or corporate officer of any type with an interest in cutting GHGs from the delivery of digital services – this informational white paper is for you.

CIO / CTO Sustainability Checklist #1

- ☐ 1. What part does data currently play in decarbonizing the digital activities of your business?
- ☐ 2. How much data about data center and IT operations can you access?
- ☐ 3. Is that data easily captured?
- ☐ 4. How is it reported/presented?
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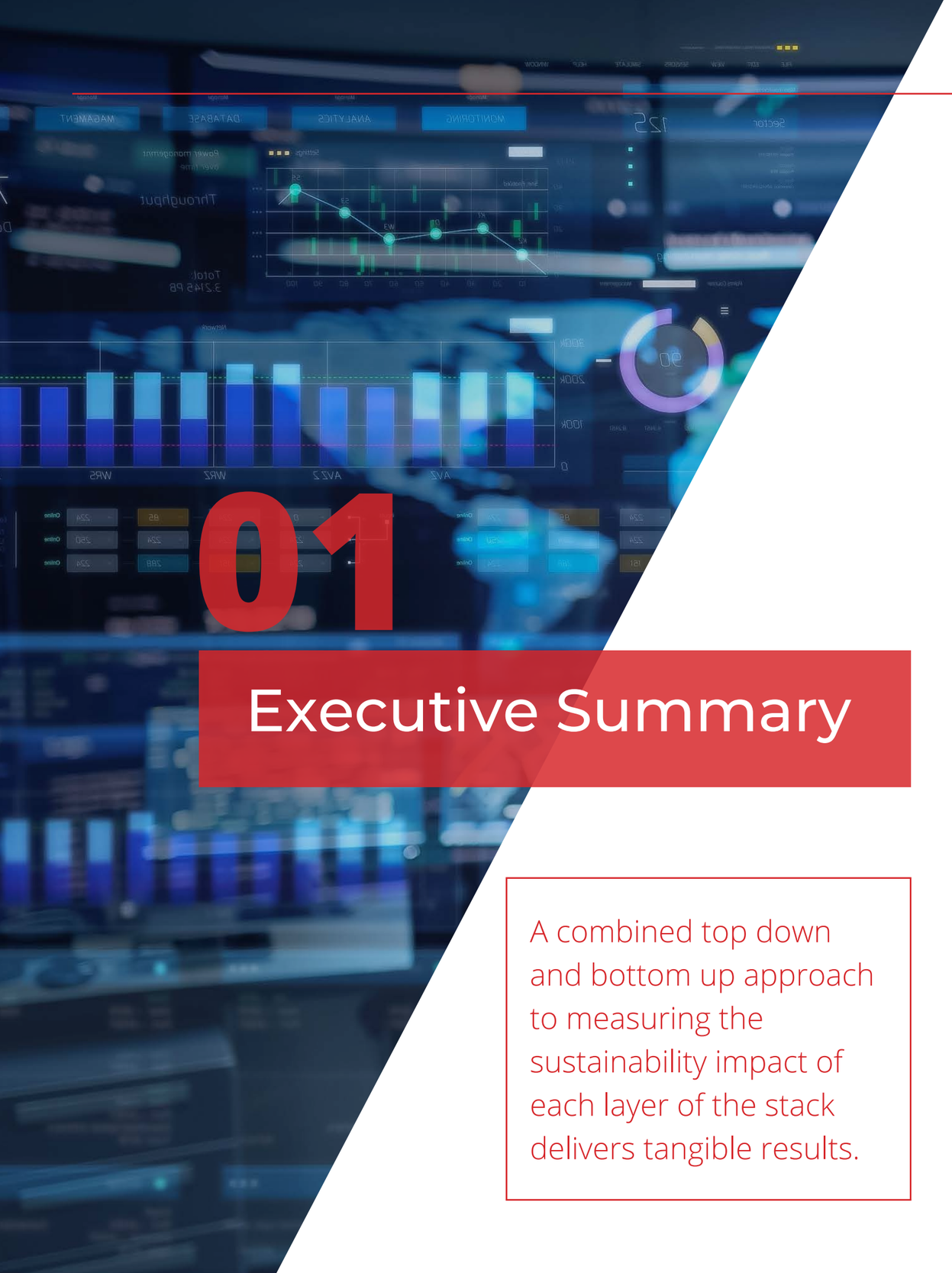
- ☐ 8. Are you using science-based methods to measure:
  - (a) Energy use ***Yes / No***
  - (b) Energy reduction ***Yes / No***
  - (c) GHG emissions ***Yes / No***



01

Executive Summary

A combined top down and bottom up approach to measuring the sustainability impact of each layer of the stack delivers tangible results.

CIOs set strategy – CTOs invest in technology – Data Center Leaders provide infrastructure

CIOs and CTOs who need to gain an understanding of the energy and carbon emissions profile of their digital infrastructure and operations have traditionally evaluated the top few layers of the IT stack.

These layers include the apps, development methodologies, software architectures, processor architectures and server, storage and networking infrastructure.

CIO and CTO thoughts might then turn to the best cloud strategy for their business. In today's world, carbon tracking and power use have been added to the requirements and evaluation list in addition to costs, SLAs, flexibility, and lock in considerations.

At this point, this is usually where a different part of the organization would evaluate the physical infrastructure layers of the stack.

The physical infrastructure on which IT runs is the building in which it is housed, the power infrastructure (backup generators, switchgear, UPSs, power generation, energy storage, racks and power distribution units) and the cooling infrastructure (chillers, pumps, pipes, valves, CRACs and CRAHs) on which it depends to keep operating.

In sustainability and energy efficiency conscious times this all needs management, monitoring, measurement of where the electricity originates, grid distribution, behind the meter power chain, where it goes, how it gets to the IT load and how much is used or goes to waste.

For a CIO or CTO this is often uncharted territory. Given the hybrid nature of where IT resides, an assessment of the power and GHG profile of the physical infrastructure must be done across legacy on prem data centers, directly purchased commercial colocation, and across multiple cloud platforms (which themselves may be hosted in colocation data centers.)

Even with responsibilities separated into IT and M+E, it presents a complex set of criteria.

We believe a combined top down and bottom up approach to measuring the sustainability impact of each layer of the stack can start to deliver tangible results.

At a minimum measure the following:

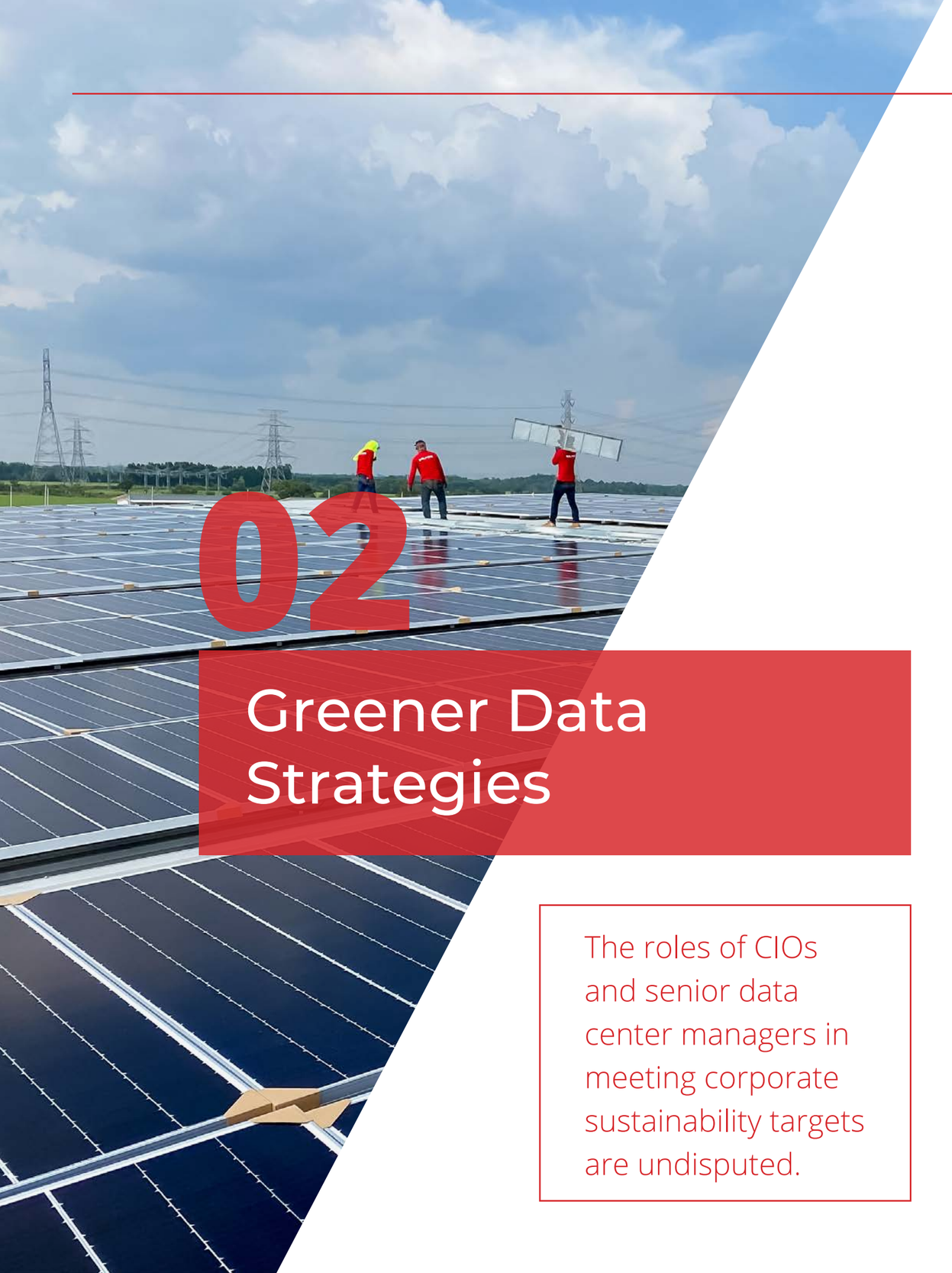
- Building
- Energy Supply
- M+E design
- M+E Operation [Power, Space, Cooling]
- IT infrastructure [Server, Storage, Network]
- Chip architecture
- Operating Systems
- Software Architectures
- Software Development Methodologies
- Applications
- Cloud Strategy
- Cloud Platforms

For each layer of the stack, consideration must be given to understanding power performance and the carbon footprint of the underlying infrastructure.

Gathering and understanding such data will inform strategy and save on resources in energy use, space and time. The end goal is cutting the digital carbon footprint while opening the way for broader digital services that will drive business growth while improving corporate sustainability.

If you are a CIO, CTO, DC leader, cloud GM or corporate officer of any type with an interest in cutting GHGs from the delivery of digital services, this informational white paper is for you.

This paper sets out some of the considerations faced by digital stakeholders and some advisory notes. There is much to evaluate.



02

Greener Data Strategies

The roles of CIOs and senior data center managers in meeting corporate sustainability targets are undisputed.

CTO	Shared	CIO
Strategy	Innovation	Supply Chain Management
Operations	Data Privacy	Workforce Engagement & Productivity
Architecture	Ecosystem	End-user Experience
	Software Development Lifecycle	Workplace Enablement
	Cybersecurity	Business Continuity
	C-Suite & Board Advisory	Sustainability Agenda
		Data Governance & Compliance

Source:
IBM CTO Responsibilities Study 2021

A Walk Through

Data centers are where the physical infrastructure of the internet intersect with digital services which drive economic efficiencies and act as sustainability enablers.

Digitalization is a major driver of decarbonization. According to a 2022 Accenture survey, “Delivering on the sustainability agenda will be impossible without technology. Every respondent in the survey of 560 companies with over $1 billion in revenue said technology was either ‘important’ or ‘very important’ for achieving their sustainability targets.”

Within this, the roles of CIOs and senior data center managers in meeting corporate sustainability targets are undisputed.

But they cannot act by separately looking at half the picture. Greater collaboration based on shared data is vital.

Ending the Silo Effect

Smart CIOs and CTOs should look to reduce and eradicate the separation between IT, FM and M+E to find sustainability and carbon cutting benefits.

Data center facility infrastructure is often managed by a single team that is responsible for everything from the power utility down right down to the rack based PDU (Power Distribution Unit).

On the IT side, things are often more complicated. The IT value chain in the data center whitespace can be delineated across different teams in network, storage, server, sysadmins, cyber security and other disciplines.

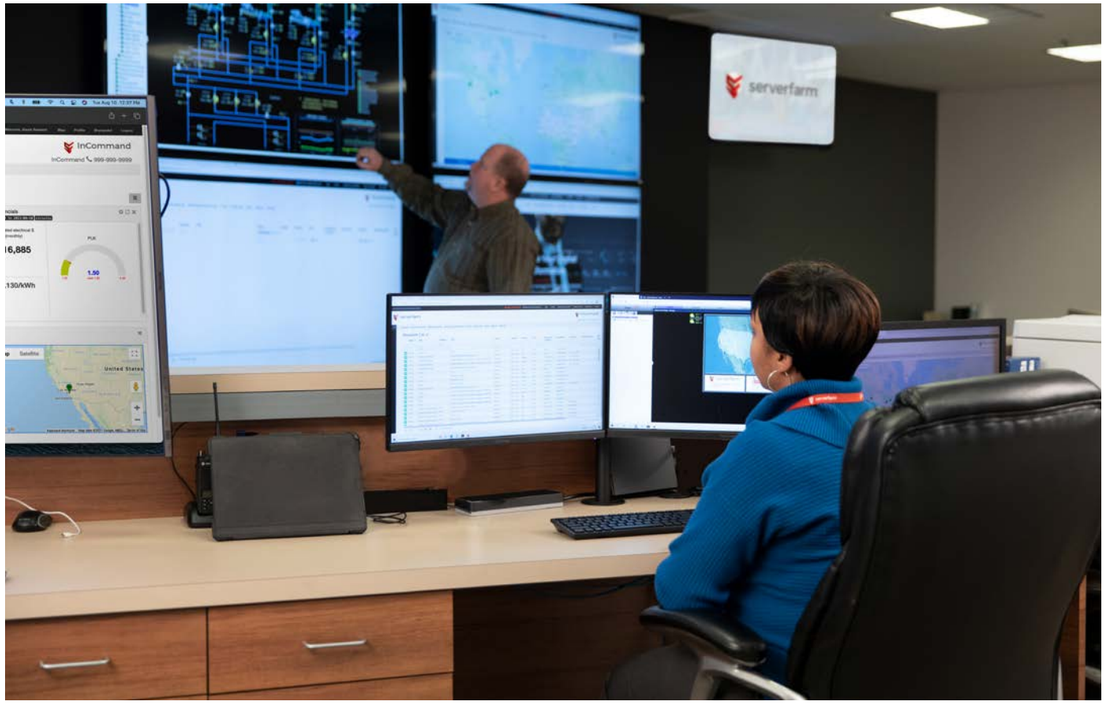
In such an ecosystem, each team might choose and use different tools to manage and make the most of their resources.

As we seek to build bridges driven by ESG considerations, it is important not to underestimate the challenge of building collaboration across IT and DC operations.

However, when it comes to addressing a topic as big as GHG emissions, there is a strong argument that the only viable solution begins with gaining an understanding of the carbon profile of the full digital infrastructure stack.

This can be achieved through collaboration, setting a common set of goals, agreeing standards, measurement procedures, processes, and even platforms. This relies on the accuracy and timeliness of data.

It means wherever possible using a common approach to measuring everything from the carbon impact of the data center to the IT, how it is powered and how infrastructure is operated.



5 Power Sustainability Areas Where CIOs and DC Leaders Can Collaborate

1

Establishing a baseline for the power used by IT

2

Measuring the carbon footprint of the IT estate

3

Setting energy efficiency targets for IT use

4

Auditing the IT and data center estates and using data to align efforts to do a better job of utilizing existing infrastructure

5

Ensuring rack and power infrastructure data is available to IT and data center operatives through a common platform

Common Gaps

It is said that no commercial data center company has control over what its third party customers do inside the white space.

And where CIOs choose external commercial colocation providers, they do not cede control of the white space. Their white space planning teams will have their own set of procedures and thresholds.

However, in planning capacity management terms, a smart customer will look for a data center supplier with who they can work closely throughout the lifetime of their engagement by spending a lot of time maximizing investment in space and power through utilization and efficiency while decarbonizing their digital footprint.

Are you a signatory to the Science Based Targets Initiative (SBTi)?

According to SBTi guidance for the period 2020 – 2030, the main strategy to decarbonize the ICT sector, at the pace necessary to align with 1.5°C trajectories, includes the implementation of simultaneous, vigorous and urgent actions in the following fields:

- Continued implementation of energy efficiency plans
- Switch to renewable / low carbon electricity supply
- Encouragement of carbon consciousness among end-users

To decarbonize the ICT sector at this speed requires the sector to utilize all of these mechanisms. To continuously improve energy performance is fundamental.

Source: https://sciencebasedtargets.org/

Additional resource for using Science Based Targets to measure carbon in IT and Data Centers: https://sciencebasedtargets.org/resources/legacy/2020/04/GSMA_IP_SBT-report_WEB-SINGLE.pdf

03

Sustainability of DC and IT Layers

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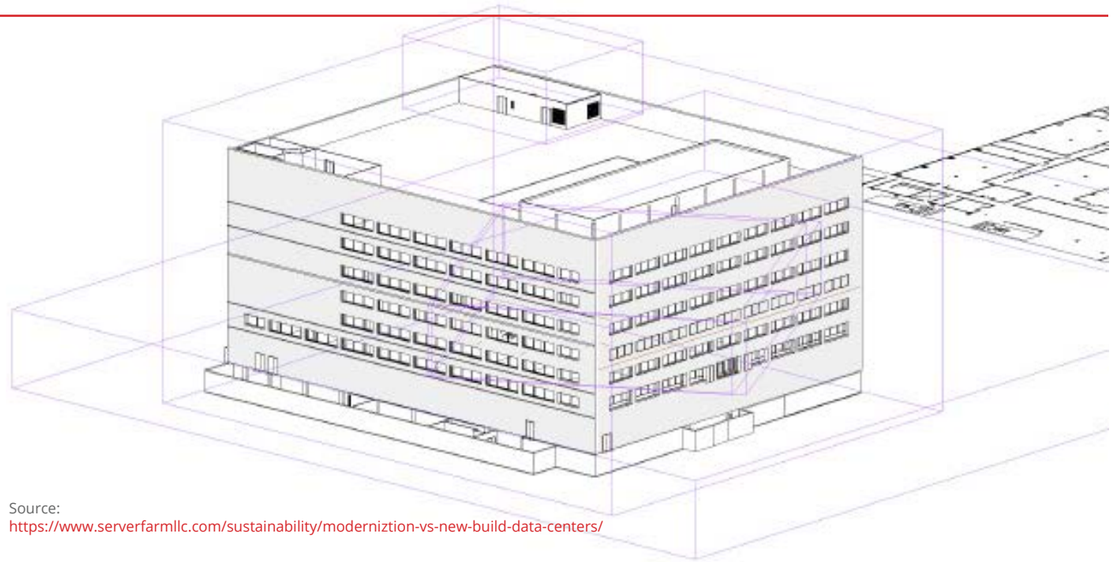


Source:
https://www.serverfarmllc.com/sustainability/moderniztion-vs-new-build-data-centers/

i. Buildings: New Build / Modernizing

For large enterprises, commercial data center providers, and cloud companies, GHG emissions reduction should start with an evaluation of the design and construction of the buildings from which digital services are provided.

It must also be considered that a new data center is not always a greenfield project.

Smart developers avoid additional embodied carbon costs by making use of modernization and upgrades to existing buildings, including those that are not currently data centers. In existing aging data centers that are suitable for modernization the shell remains the same and is retrofitted with the latest power and cooling infrastructure using design thinking that provides best ratings for GHG carbon emissions.

An independent study of Serverfarm's Chicago data center was carried out by consultants HKS. With a capacity for housing more than 4,000 server cabinets, and a rack consumption of 61,320 kWh, the building consumes 25MW of power annually. Were such a building to be constructed today using standard materials, the carbon cost, carbon dioxide equivalent or CO2e, would be 9,425,673kgs. The study calculated that by using the existing building, this data center can mean an enterprise gains 4 years of operation before it adds to its carbon footprint (accounting for both operational and embodied).

Source:
https://www.serverfarmllc.com/wp-content/uploads/2021/11/Serverfarm-Whole-Building-LCA-Report.pdf

Common Metrics

The most established sustainability metric for data center power is PUE – Power Usage Effectiveness – which since around 2008 has been used as a measure of the power entering the building divided by the electricity reaching the IT equipment to do 'useful work.' In PUE terms the perfect number is 1.

By now CIOs will have heard of the PUE, CUE, and WUE metrics. Respectively Power, Carbon and Water Usage Effectiveness metrics.

The best PUE, CUE and WUE outcomes are all a result of IT and M+E environments working in harmony, further emphasizing the need for ending the silo effect.

ii. Greening Data Center Power

Software defined power is a set of solutions that will enable full utilization of the data center capacity as opposed to the excessive over provision often found in existing data centers.

End to end software defined power may one day encapsulate sustainability metrics covering measurement of everything from true green PPAs (Power Purchase Agreements), grid losses, behind the meter adaptable power provision right down to dynamically maximizing server power performance per watt. However, there remains a long way to go.

Power Utilization

Following on from the success of the PUE metric, the data center industry is becoming focused on power capacity utilization – one suggestion being a new metric of Power Capacity Effectiveness, being Total Power Consumed divided by Total Power Capacity installed.

For CIOs seeking sustainability options this is where things may get interesting. Commercial data centers provision power is based on meeting a capacity requirement where the data center operator has no control over whether that power is utilized. Once power enters the data hall a commercial data center provider has no control over how much electricity is actually used.

From a commercial colo provider lens, it is as if once the power enters the technical white space the power goes to the moon. In this case the end user dictates how much of the available power is utilized. Put simply, currently if 40 or 50% of available power is not used or goes to waste, then so be it.

Smart data center clients use all (and sometimes more) of the power they have paid for and been assigned. Other end users may be comfortable with 40% - 60% utilization of available power. There may be perfectly valid reasons for this – but there are questions over how sustainable such operations are in the long term. Hence a wider and deeper discussion between the provider, the end user data center buyer and the IT department is called for.

Renewables

Serverfarm's renewable energy purchasing sustainability strategy aims at 100% renewable energy purchases plus continual evaluation and securing of sustainable energy generation, fuel and power storage alternatives.

> Once power enters the data hall, a commercial data center provider has no control over how much of it is actually used. It is as if when the power enters the technical white space it has gone to the moon.

Generation

Other elements of the sustainable journey are changes to back up power generation strategies including moving away from 24-hour diesel back up. Most diesel generator providers are mapping a path to hydrogen. This involves a step change conversion of liquid fueled engines through moving diesel generators to HVO (Hydrogenated Vegetable Oil), to Liquid Natural Gases (LNG), LNG/Hydrogen, and ultimately to Pure Green Hydrogen (when available).

> **0** carbon, **0** emissions, **0** waste and **0** water are the four pillars of a sustainable data center.

Hydrogen

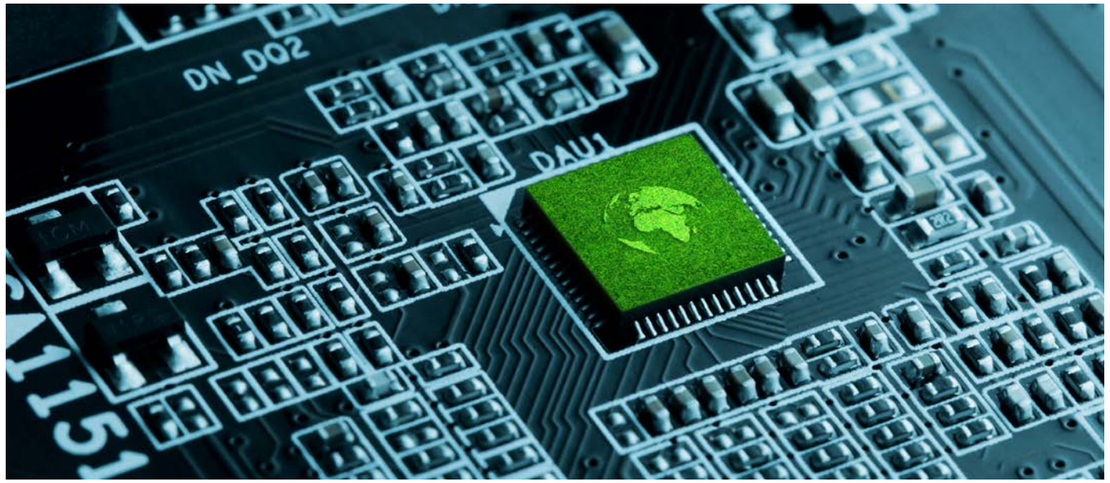
The use of hydrogen fuel cell technology in various markets, particularly ones that are power constrained and where power price increases make it economical is growing. Planning for fuel cell deployments today can have the additional benefit of securing power for 2, 3, or 4 years out when they come on stream. This can also aid the data center planning process in different locations.

Batteries

An evaluation of the sustainability characteristics of alternative battery technologies to Lithium-ion such as Nickel Zinc is also showing Green House Gas emission and full lifecycle benefits.

Serverfarm engineers evaluate battery energy stores by addressing cradle to grave sustainability:

- raw materials extraction, processing, manufacturing and transport
- stability and safety
- charging and discharging efficiency
- energy environmental requirements – ie. cooling
- scalability to MW+ discharge for 5, 10 or 15 minutes
- maintenance requirements
- lifetime of operations
- disposal and reuse



iii. Sustainable Chips and Servers

Chip Architectures

There is no doubt that the microprocessor market is being disrupted.

Some cloud companies are designing their own chips for use in their data centers using Reduced Instructure Set Computer (RISC) architecture. It has been reported that Amazon is using ARM architecture as the processor for its server designs and that this is saving up to 60% in electricity for similar computational power compared with older architectures.

Microsoft is developing its own Ampere Altra processor which it says was architected for scale-out cloud environments to deliver efficient performance and help reduce overall environmental impact. However, most server processors still run on x86 architecture.

According to an analysis in www.theregister.co.uk, "After re-establishing itself in the data center over the past few years, AMD is now hoping to become a big player in the AI compute space with an expanded portfolio of chips that cover everything from the edge to the cloud.

Source:
https://www.theregister.com/2022/06/13/amd_ai_ strategy/

AMD plans to expand the AI capabilities of its CPUs future by making use of the advanced AI engine technology from its 2022 $49 billion acquisition of FPGA outfit Xilinx.

AMD says "Our goal is to deliver a 30x increase in energy efficiency for AMD processors and accelerators powering servers for HPC and Artificial Intelligence (AI)-training from 2020-2025. These important and growing computing segments represent some of the most demanding workloads. This goal represents more than a 2.5x acceleration of the industry trends from 2015-2020 as measured by the worldwide energy consumption for these computing segments."

Intel has a sustainability road map having already committed to achieve net-zero greenhouse gas emissions in global operations by 2040 and to building more sustainable chips.

5 Monitoring and Measurement Sustainability Areas CIOs, CTOs and DC General Managers Can Collaborate On

1

Use science-based methods used to measure:
(a) Energy use (b) Energy reduction (c) GHG emissions

2

Agree on emissions reduction targets for all IT, data center and digital operations and set a target year been for IT and data center infrastructure to achieve Net Zero operation.

3

Apply scorecards to measure efficiency and the sustainability of your DC and server operations.

4

Bring granular asset management to IT and M+E data center operations right down to the device level, locally and globally through process driven monitoring of all relevant location data, status data on halls, rack and row numbers and real time metrics of all electrical and mechanical behavior.

5

Act at different ends of the scale by measuring and sharing data on Performance per Watt at the server level and the annual MW hours used for IT across every data center of every type:
(a) In third party clouds (b) In colocation data centers (c) In owned and operated facilities

AMD says, "*Our goal is to deliver a **30x** increase in energy efficiency for AMD processors and accelerators powering servers for HPC and Artificial Intelligence (AI) training from 2020-2025*".

In January 2023 Intel announced its 4th Gen Xeon Scalable processors as its most sustainable data center processors, saying it is delivering a range of features for optimizing power and performance, making optimal use of CPU resources to help achieve customers' sustainability goals.

When compared with prior generations, Intel said 4th Gen Xeon customers can expect a 2.9x average performance per watt efficiency improvement for targeted workloads when utilizing built-in accelerators.

In every future scenario the power draw of the chosen chip design is becoming a sustainability consideration.

Server Strategies

The picture becomes more complex still. CIOs are choosing server designs and chip architectures for a variety of workloads hosted in a variety of different environments.

From an IT perspective, for many applications the infrastructure choice has traditionally been performance based. Power use was considered a price worth paying.

The days when a CIO is told by the business 'we need *x* level of performance' and the CIO could turn to the data center operator and say:
'I need *x* power. You find the sustainable, GHG free way to supply it,' are gone.

In operations terms, the Green Software Foundation (see next page) advises "Servers are usually not configured for aggressive or even minimal power-saving.

Many server use-cases demand full capacity as quickly as possible in response to rapidly changing demands. This can leave many servers in idle modes during low demand periods.

The days of '*I need x power. You find the sustainable, GHG free way to supply it,*' are gone.

An idle server has a cost both from embedded carbon and its inefficient utilization. The most efficient and green approach is to run your work on as few servers as possible with the highest rate of utilization."

Refresh Strategies

Lastly, in this subsection we come to Server Refresh Cycles – which from a GHG emissions perspective is another complex consideration.

For any CIO with thousands of servers, measuring Scope 1 and 2 operating carbon cost and Scope 3 embodied and total carbon cost of every component in the supply chain of every server is a huge but necessary undertaking.

Some advise that faster refresh cycles – upgrading every three years – provides clear benefits in terms of power use, maintenance, support, and performance, saying it is possible to achieve much more performance for the same power footprint.

Serverfarm does not advise on chip architecture. But it does work closely with customers to ensure maximum power efficiency is achieved across every part of the physical technology stack.

This can only be done through greater collaboration across every discipline in the value chain.

iv. Sustainable Software

All software architectures, development methods, and code choices have sustainability implications.

The Green Software Foundation is a collaboration between some of the world's largest software firms and consultants. These include Microsoft, Github, Thoughtworks and Accenture. It is a nonprofit organization established with the Linux Foundation and the Joint Development Foundation Projects LLC, that aims to build a trusted ecosystem of people, standards, tooling, and leading practices for building green software.

It sets out 8 principles:

1. Build applications that are carbon efficient.
2. Build applications that are energy efficient.
3. Consume electricity with the lowest carbon intensity.
4. Build applications that are hardware efficient
5. Maximize the energy efficiency of hardware.
6. Reduce the amount of data and the distance it must travel across the network.
7. Build carbon-aware applications.
8. Focus on step-by-step optimizations that increase the overall carbon efficiency.

Source:
https://https://greensoftware.foundation/

5 Software Sustainability Areas Where CIOs and Data Center Leaders Can Collaborate

1

Ensure your Data Center Management as a Service platform data is available to server, network and software teams so that power utilization data is a consideration for decisions on where workloads should reside.

2

Use that data to help IT and M+E practitioners to direct moves, adds and changes.

3

If running resource intensive Microservices measure the carbon profile of the power being supplied to the data center and seek to move them to regions of lower carbon intensity.

4

Work to build trust between software teams and IT and M+E through accurate data from a single song book so a culture of shared data is developed.

5

Collaborate on step-by-step optimizations that increase the overall carbon efficiency such as reducing the distance between that data must travel across a network.

04

Sustainable Strategies And Cloud Platforms

How Green is My Cloud

There are many questions that owners and operators of legacy IT and data center infrastructure are asking as they seek sustainability models for hybrid cloud.

Where do I start?

Should I move to the cloud to reduce the power consumption? Any move to the cloud also presents opportunities for collaboration between IT and data center teams.

5 Sustainable Strategies

1

Dig into the data and discuss whether any cloud move will reduce the power consumption over time.

2

Establish trust by questioning the data timeliness and veracity on power use, power sources, and carbon emissions.

3

Gather accurate data on existing operations to establish if moving to the cloud will reduce the overall amount of power needed by the IT estate and whether it will result in fewer GHG emissions than running on prem infrastructure?

4

Get IT and M+E input in testing the carbon measurement tools available from each of the large public cloud providers (see below).

5

Be an intelligent customer by establishing a 360° view of your cloud provider through combined IT and M+E questions including about application design, cloud data center locations, sustainability metrics and reporting, energy management, waste heat capture, future plans for dynamic workload shifting to run on the greenest available power.

Enterprise Cloud Providers

Given the enterprise adoption curve driven proliferation of cloud regions across the globe measurement of GHG reduction efforts from providers are likely to move up the CIO agenda.

For example, there are 35 separate cloud regions run by Google, Oracle, and Microsoft in Europe alone with another 17 already announced.

Each organization pursues its own data center emissions reduction strategy. The providers deliver their cloud services from a blend of self-owned and operated and/or commercially run data centers.

Cloud providers are taking different approaches to providing data to enabling customers to calculate the carbon cost of cloud services. Each provides a wealth of information.

The cloud providers have started their journey to net zero. The question is: What can commercial data center providers do to help create greener clouds?

Enterprise CIOs and CTOs can take advantage of what the data center operators have learned about cutting GHG emissions.

AWS, Azure, and Google Cloud provide measurement tools for users.

Click each logo to try their tool:

aws

Azure

Google Cloud

Digital Ocean

One cloud provider using software to build a cleaner world is Digital Ocean. A US based cloud services provider it operates regions across the world from data centers in New York, London, Amsterdam, Frankfurt, Singapore, Bangalore and Sydney.

Through its regional availability matrix the company provides a range of cloud options from self-managed IT infrastructure to serverless compute, app platform, block and object storage, Platform as a Service and networking. Its software products include open source managed databases, Kubernetes, containers and images.

The company has a community of more than one million developers. Its approach to information on sustainability include tutorials on best engineering practices in times of transition. It recently added thousands of tutorials, guides and educational content through the acquisition of CSS-Tricks and JournalDev.

It is a publicly listed Pledge 1% organization that sees better, more efficient software development as key to environmental management across digital infra-structure and in every business action. The company recently announced its Green DigitalOcean plans to 'bring understanding to our carbon footprint and identify key Environmental, Social, and Governance focus areas.'

Oracle Cloud

Oracle has committed to "providing customers globally with a zero-emissions cloud by 2025. It has committed to cutting greenhouse gas emissions across operations and supply chain by 50% by 2030 and achieving net-zero emissions by 2050."

In 2021 Oracle earned a fifth consecutive Gold Sustainability Rating from ecovadis.

The company says it has achieved 55% decrease in emissions intensity per unit of energy since 2015; 47% decrease in total emissions since 2020; and 37% increase in renewable energy use since 2019.

In terms of Water conservation, it "pursues a variety of water-saving strategies across our facilities and data centers—including rainwater harvesting, xeriscape gardening, and condensate reclamation, to reduce our total potable water use."

In Europe the company says its data centers are 100% powered by renewable energy.

IBM Cloud

IBM Cloud (formerly *Softlayer*) emphasize the holistic approach that IBM as a company takes to allow customers to measure IT carbon footprint starting at the application layer. IBM uses and offers IBM Cloud Paks - AI powered integrated hybrid cloud software.

The company says it is treats climate related data with the same rigour as financial data and provides strong evidence of commitment to using data to reduce energy consumption across its cloud IT infrastructure. IBM is ecovadis platinum rated.

The majority of IBM's data centers reside in third-party managed locations. The company says it has developed and negotiated lease terms that enable IBM to engage and collaborate with landlords to improve the efficiency of support infrastructure toward meeting its goals.

IBM calculates the power usage effectiveness (PUE) at many of the data centers the company manages and obtains PUE data from landlords of multi-tenant colocation data centers.

Using this approach, IBM had a calculated 2021 weighted average PUE of 1.53. This puts the company on track to achieve its goal to improve the average cooling efficiency of its data centers by 20% by 2025 against a base year of 2019.

05

Conclusion

InCommand is a platform which enables our customers to take advantage of the data to make better DC sustainability decisions.

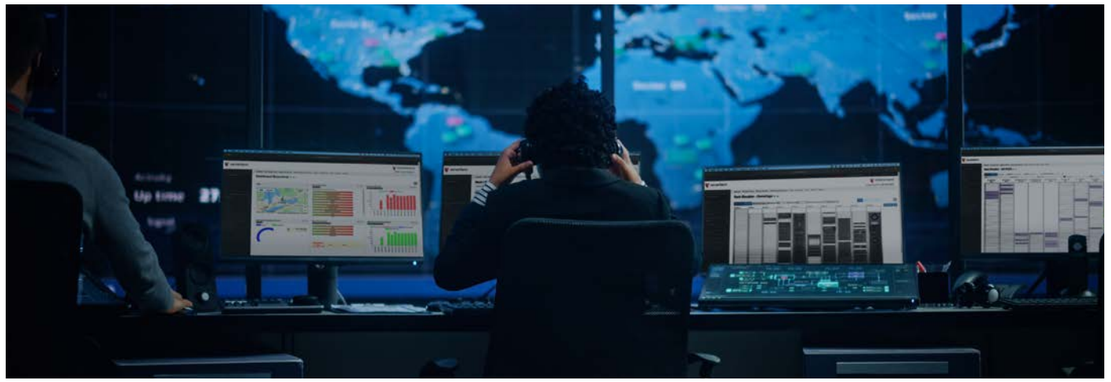
Collaboration on Measurements, Monitoring, and Management

2023 is the year when CIOs, CTOs and data center operators must consider the sustainability outcomes of every decision.

At the same time, aligning digital sustainability and financial benefit are inseparable. Asset utilization is not separate from investing in the right platforms.

A hybrid digital infrastructure strategy built on making each platform more sustainable through utilization and efficiency can deliver best of breed and integrated (collective) measurable sustainability.

Creating a combined facility infrastructure and IT digital infrastructure sustainability strategy can appear daunting for even the most experienced CIO leading the most mature, collaborative teams. The key to success is data.



What Serverfarm Does

By developing **InCommand Data Center Management as a Service** with capacity and power management tools, Serverfarm is bringing to the table a platform which enables our customers to take advantage of the information they need to make better sustainability decisions.

Serverfarm is continuously seeking ways to push sustainability so that our clients are more efficient and do a better job of utilizing their infrastructure.

Serverfarm's model is to remediate and retro fit wherever possible to make data centers more efficient from a facility standpoint.

Serverfarm is a data center company with its own efficiency platform offering to clients that will make deployments more sustainable and cost effective with higher utilization and efficiency improvements.

As an operator and developer of such a tool set, Serverfarm can provide help to better utilize capacity and infrastructure, to minimize carbon footprint through consultation that goes beyond 'here are the tools, can you please take advantage of them.'

The ultimate goal is real time tracking and reducution of your carbon footprint.

Serverfarm always explores district heating or other opportunities for waste heat use.

Serverfarm works closely with partners who show deep interest in sustainability actions through design and operation to deliver efficient and measurable GHG emissions cuts.

Serverfarm's Global Reach

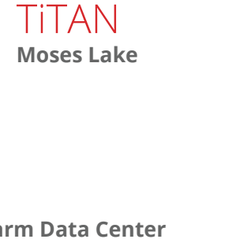
TiTAN
Moses Lake

CH1
Chicago

CH2
Oak Brook

TOR1
Toronto

AMS1
Amsterdam



LAX1
Los Angeles

ATL1
Atlanta

LON1
London

ISR1
Tel Aviv

About Serverfarm

Serverfarm is a unique IT and data center developer and operator with a pioneering approach to accelerating digital transformation for service providers and enterprises.

With InCommand Services, our integrated platform of real estate, data center and IT management solutions, we maximize our customers' infrastructure efficiencies, providing them with end-to-end visibility and control over their IT and data center environments. As a result, our customers and their teams gain agility, reliability and efficiencies, allowing them to focus on innovation.

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