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Decarbonizing the Data Center

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Learn the economics of sustainability

Achieve sustainability goals

Hitachi Vantara Special Edition

Brad Whittington

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Hitachi Vantara LLC, a wholly-owned subsidiary of Hitachi, Ltd., guides its customers from what's now to what's next by solving their digital challenges. Working alongside each customer, Hitachi Vantara applies its unmatched industrial and digital capabilities to its data and applications to benefit both business and society. More than 80 percent of the Fortune 100 trust Hitachi Vantara to help them develop new revenue streams, unlock competitive advantages, lower costs, enhance customer experiences, and deliver social and environmental value. Visit hitachivantara.com.

Decarbonizing the Data Center

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by Brad Whittington

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Introduction

The wine-dark waters of the Rio Negro originate in Columbia. The milk-chocolate brown Rio Solimões originates in Peru. The two rivers join in Brazil, where they continue to flow side-by-side for several miles before they finally blend into one flow — the Amazon River. This confluence of two rivers is good for life. The black water of the Rio Negro is rich with zooplankton, and the brown water of the Rio Solimões holds an abundance of fish larvae. Together, they form an ecosystem that supports fish and fishermen.

In many organizations, digitalization strategies and decarbonization strategies operate independently of each other, like two separate rivers. Some may say their missions could be in conflict. After all, ramping up data-center resources increases your demand for energy, while the goal of decarbonization is to reduce your carbon footprint. As a result, decarbonization often loses out to digitalization, especially when revenue is the deciding factor.

Not only is that a bad decision, but also it's unnecessary. In fact, decarbonization can actually accelerate your digitalization journey but only if you choose the right technologies and integrate them into the right architectures. Do this, and you increase the value of your data because it will be better connected, easier to enrich, and able to deliver more insights.

The good news is that when you begin to blend digitalization and decarbonization, the effort grows easier and more natural as time goes on — just like in the Amazon. And, like the Amazon, the confluent enterprise spawns benefits that far outweigh and outlast the individual efforts. And it doesn't even have to hurt.

About This Book

With its alphabet soup of regulatory agencies, standards, accords, metrics, and terminology, decarbonization can be confusing. Carbon offsets, carbon credits, carbon certificates, carbon capture — what's the difference among them, and which ones should you pay attention to? How disruptive will the whole process be? Will it derail your budget? Affect productivity? If these burning questions

are keeping you awake at night, anticipate a good night's sleep in your near future. The answers are all between the covers of this book.

You get the lowdown on agencies and regulations, the main components of the energy chain, the energy-hungry elements in the sustainability life cycle, and the most efficient ways to reduce your energy consumption while maximizing productivity.

You can read this book straight through from front to back if you want, but you can also jump around to the parts you think are the best for you.

Icons Used in This Book

In this book, I use two icons to alert you to the juiciest parts.

TIP

Tip icons offer concise, distilled nuggets of knowledge and wisdom you can use to smooth your path.

REMEMBER

Remember icons are the things you may tend to forget in the heat of the moment, but they're critical to success.

Beyond the Book

I squeezed all I could between the covers of this book, but there's always more. To discover more information on how others have decarbonized their data centers, check out the following resources:

- www.hitachivantara.com/co2footprint
- apps.hitachivantara.com/co2-estimator-tool
- www.hitachivantara.com/datacenter-solutions
- www.hitachivantara.com/sustainability-solutions

IN THIS CHAPTER

- Aiming to decarb the data center
- Creating authenticity
- Making opportunities for your customers
- Improving your top and bottom lines with sustainability

Chapter 1
Driving Sustainability and Decarbonization in IT Infrastructure

The 1987 World Commission on Environment and Development defined sustainability as meeting the needs of the present without compromising the ability of future generations to meet their own needs. In simpler terms, it's the application of The Golden Rule on a global scale.

Decarbonization of IT infrastructure is the reduction or removal of carbon dioxide (CO_2) output into the atmosphere from a process, system, or organization. It's achieved by switching to low carbon energy sources. Decarbonization takes the principle of "don't foul your own nest" and expands it worldwide.

In this chapter, you examine the opportunities, challenges, and processes involved in applying sustainability and decarbonization to the data center and beyond.

Focusing on the Data Center

Why this focus on the data center? Estimates of the global amount of electricity used in data centers range from 1 to 3 percent. That's 3 percent of the entire worldwide supply of electricity, so tackling the carbon footprint of data centers can make a big difference in emissions across the planet.

To decarbonize a data center, you must actually reduce the amount of carbon emitted during the construction, outfitting, and operation of that data center. While that may seem obvious, not everyone gets it right. Some companies exaggerate the sustainability of their products; others may even fake emissions reports. (Trust me, this has happened, but I'm not naming names.)

To track the emissions that you're responsible for, you should focus on three layers or *scopes* (as defined by the United States Environmental Protection Agency):

- **Scope 1:** Emissions from sources that an organization owns or controls directly, such as the fuel used in a fleet of legacy vehicles
- **Scope 2:** Emissions caused indirectly when the energy an organization purchases and uses is produced, such as the electricity purchased to run a facility
- **Scope 3:** Emissions from activities in the value chain, such as products from suppliers

  Scope 3 is the biggest slice of the emissions pie for any organization and the most difficult to track.

REMEMBER

Hitachi Vantara has committed to a two-step decarbonization schedule to achieve Scope 1 and Scope 2 by 2030 and Scope 3 by 2050.

COMPLYING WITH REGULATIONS

Sustainability: It's not just a good idea; it's the law.

In June 2021, Germany passed the Supply Chain Due Diligence Act. The act aims to strengthen global human and environmental rights by ensuring responsibility within supply chains for companies based in Germany.

In March 2022, the United States Security Exchange Commission issued the Enhancement and Standardization of Climate-Related Disclosures for Investors. It specifies the data to be reported, both inside and outside financial statements, such as attestation of disclosures. That same month, the EU passed the Ecodesign for Sustainable Products Regulation, which establishes a framework to improve the environmental sustainability of products. Nine months later, the regulation was expanded to include digital services.

Creating Authentic Value

In recent decades, the power of the consumer has exploded with the growth of social media, influencers, and investigative journalism. As awareness of the climate crisis increases, a growing number of customers in the private and public sectors is taking a deeper look at the products they buy and the providers of those products.

In the 21st century, consumers make buying decisions in favor of companies that follow sustainable and responsible business practices. Maximizing shareholder value not only requires competitive business performance but also credibility, transparency, and attention to a variety of environmental and social issues.

When it comes to respecting planetary boundaries, a two-fold approach has been developed:

- **Infrastructure (what you do):** Decarbonize your own operations and systems.
- **Products (what you sell):** Make your portfolio greener and more efficient.

This approach includes investing in projects that save energy, generate renewable energy, and reduce CO_2 emissions. You can accomplish this goal by realizing efficiency gains in value-chain management, product design, and customer engagement.


TIP

View acting sustainably not as a business cost or a duty but as a value creator both for your business and — more importantly — for the environment. Decarbonizing your data center offers you an opportunity to grow while also building a more resilient, sustainable, and equitable future. Embracing sustainable technologies, systems, and practices can also give you a competitive advantage that translates into more business. Aside from efficiency gains and the cost benefits that go with them, as an environmentally progressive company, you can enjoy a reputational lift that makes it easier for you to attract and retain talented staff.

Generating Opportunities for Customers

Climate tech is an umbrella term for an array of solutions to the problem of climate change:

- Technologies that reduce greenhouse gas emissions
- Technologies that remove emissions from the atmosphere
- Technologies that enable adaptation to an altered climate

In 2022, climate technology funding represented more than a quarter of every venture capital dollar invested. Going forward, in the near term, worldwide investment in expanding global data infrastructure is estimated at $1 trillion in capital. These investments include expanding global data center capacity. In the longer term, energy companies are expected to invest trillions of dollars over several decades in building renewable-energy-generating capacity to replace fossil fuels.

There has never been a better time for you to launch a sustainability initiative. A 2020 Cambridge Associates paper noted that since 2014, climate-tech startups have financially outperformed the rest of the startup world. As climate tech becomes more efficient, the associated cost reductions drive better returns, spurring increased investment. And the numbers are bearing out this observation.

In 2020, venture capital investment in climate tech grew five times the average growth in total venture capital. In 2022, United States climate-tech venture capital exceeded the combined investment of the previous six years combined, hitting $70 billion. This number represents an 89 percent year-on-year increase from 2021. By the end of 2023, the total investment in climate tech is expected to exceed $100 billion.

Decarbonizing while Cutting Costs

Consider that a direct link exists between sustainability projects and cost reduction. The more eco-friendly your data center infrastructure, the less you spend on energy. And the fewer emissions your facility is responsible for.

REDUCING EMISSIONS

The good news is that a focus on reducing data storage emissions is not only achievable but also has been achieved. Data storage emissions are quantified by the number of kilograms of CO_2 emitted per terabyte (TB) of storage in a year, noted as

((Kilograms–CO_2)/1TB) x 1 year

Over the space of eight years, Hitachi Vantara reduced its virtual storage platform (VSP) number from 27 to 4 by using external storage virtualization and software-defined storage, as shown in this sidebar's table.

VSP Emission Reduction

Model	Year	Emissions	Reduction
VSP G100	2014	27	
VSP G1500	2017	18	33%
VSP 5500H	2020	11	42%
VSP 5600H	2021	4	63%

(continued)

(continued)

The emission figures in this table take into account Scope 3 circular economics from product production, efficiency in the data center, and post production recycling.

In working toward realizing a decarbonized society, Hitachi Vantara has set an organizational goal of reducing carbon emissions by 30 to 60 percent by fiscal 2030 at all business sites, including factories and offices.

As you consider your sustainability journey, rest assured that the technology is ready, financial incentives are available, and your customers will reward you with their business. You have the "why." Are you ready for the "how?"

IN THIS CHAPTER

- Identifying the components of the energy ecosystem
- Using digital economics to get your energy in the green
- Building on the right architecture

Chapter 2
Driving Sustainability with Digital Economics

In 1980, the worldwide consumption of electricity was 7,232 terawatts. In 2021, that number more than tripled to 25,343 terawatts. To write it out, you must add nine zeros to make 25,343,000,000,000 watts. That's a lot of watts.

For comparison, the average United States household uses 10,632,000 watts in a year. That is 0.010632 terawatts. The global amount of electricity used annually in data centers ranges up to 3 percent. That is 76,029,000,000 watts.

What if you could help cut that number in half? And then cut it in half again? Would you be up for it? It's possible. Right now.

Mapping the Energy Ecosystem

From creation to use, the energy ecosystem has three major components: the sources, the grid, and the users.

The sources

Sources can be classified according to the amount of greenhouse gases they produce. In 2020, the primary greenhouse gases emitted by energy sources were

- Carbon dioxide (CO_2) at 79 percent
- Methane (CH_4) at 11 percent
- Nitrous oxide (N_2O) at 7 percent
- Fluorinated gases at 3 percent

In 2021, more than two-thirds of the global generation of electricity came from carbon-heavy (brown) sources — coal, natural gas, and bioenergy. The rest came from carbon-light (green) sources, such as geothermal, hydro, wind, and nuclear.

Incidentally, another significant power source contributing to CO_2 emissions is the internal combustion engine. The switch from gas-powered cars to electric vehicles will have a massive impact on sustainability but will increase the load on the grid (see the next section) by 20 to 40 percent between now and 2050.

The grid

The grid is a massive network of substations, transformers, and power lines that connects the sources (see the preceding section) to the users (see the next section). Simply put, the grid directs electricity from the source to the user.

Most of the devices you use regularly, such as your computer, your phone, and your electric car, run on direct current (DC). DC works fine over short distances. However, to transmit electricity across long distances, which is the job of the grid, higher voltages are required, and in the past, it was easier to use alternating current (AC) for high voltages.

Most of the efforts at sustainability have focused on the sources (brown versus green) and the users (consumption and efficiency). But that's changing.

Hitachi Energy has collaborated with governments and private companies worldwide on several projects using high-voltage DC (HVDC) technology. HVDC is a highly cost-efficient

and sustainable method for transmitting large amounts of electricity over long distances. Research suggests that a nationwide HVDC network built to support wind and solar resources could reduce carbon emissions by as much as 80 percent by 2030 without increasing electricity costs for consumers.

The users

The users of an electrical system include everything from individual households to public services to businesses. But for the purpose of this book, I focus on the special consideration of data centers and power consumption in business.

When it comes to reducing the power drain introduced by data centers, focus on a few areas of interest:

- **Application modernization:** Application modernization reduces both the operating system overhead and the size of the overall infrastructure footprint. Application modernization also helps break down data silos so information can flow freely throughout an organization, which gives you access to insights in the data that you can use to automate daily tasks.

  
  TIP

  You can increase savings even more by switching off access to application data when it's not required and offloading cold and unused data. All this contributes to efficiency, both from a workload and an energy perspective.
- **Data management:** Data management enables you to get more from your existing storage solutions and bring down energy consumption at the same time. For example, by using enhanced data compression technology, you can store more user data with the capacity you've already purchased. Storage virtualization can apply this technology to existing storage systems and reduce energy consumption and carbon emissions.
- **Infrastructure:** Going beyond apps and data (the preceding two bullets), you can find efficiencies in the infrastructure itself. The carbon emissions released when a storage product is manufactured are a huge part of its lifetime carbon footprint. More than 80 percent of the value chain carbon emissions of a storage product are related to its use after it's sold. Focusing solely on energy usage during production is no longer sufficient. Emissions must be monitored at every stage from cradle to grave.

Assessing Digital Economics

The digital economics framework assesses the economic factors that drive energy consumption in data centers and the costs and benefits associated with different strategies for managing that consumption. The framework builds on several principles:

- **Acquisition price doesn't equal solution cost.** In fact, the acquisition price is typically only 20 percent of the total cost of ownership (TCO), which can be affected by up to 34 different cost categories.
- **Econometrics are a requisite for success.** To improve efficiency of an IT infrastructure, you must measure on a consistent and ongoing basis.
- **Architectures aren't all created equal.** Superior architecture enables the optimum balance between performance and value.

Digital economics helps you create a virtuous cycle of cost reduction in which a successful solution leads to a desired result, which then generates still more desired results.

Defining the model

The digital economics framework uses a measurable gains assessment (MGA) process to examine every aspect of the data center that consumes electricity to create a comprehensive model of the performance and utilization across all levels. It links the application through to the virtual service, the hardware layers underneath, the underlying network, the SAN connectivity, and the physical data flows in the storage.

Defining the objectives

The MGA surveys the IT infrastructure and technological and operational components and links them to costs to provide a baseline for comparison to future architectural change. This is done by evaluating up to 34 metrics associated with costs, depending on the data center environment.

File classification shows the static data within the customer's data center, including file type, date of access, and footprint.

This analysis is useful for identifying objectives to reduce storage costs, such as a lower cost tier, type of media, or object storage instead of block storage, mapping out current costs to determine the overall cost benefit of moving to an alternative media type.

Collecting the data

The MGA is a light-touch process that avoids creating overhead on the platforms being scanned or creating additional load for administrators tied up with operational tasks. The process is automated at the component level through the management layers, keeping it simple with no cumbersome agents to be employed. The average result is a 30 percent reduction in TCO.

Choosing the Right Architecture

A successful deployment ultimately comes down to the architecture of the solution. Good architecture is invisible, easy to maintain, user-friendly, and effortless. Bad architecture is hard to maintain, lacks basic integration, and breaks when you try to change it.

When you're evaluating a solution for your architecture, you want to take a few steps:

1. **Identify your requirements and map them to the capabilities the solution must support.**
2. **Evaluate the scalability and robustness of the solution.**

   Can the architecture adapt to many changes while remaining robust?
3. **Consider flexibility and performance.**

   Does the architecture support multiple environments, such as on-premises, cloud, or a hybrid environment? Can it handle multiple providers? Can it scale in data volume, variety, and velocity?
4. **Determine whether the solution is simple to use and can be automated to optimize the performance — not only of the system but also of your staff.**

IN THIS CHAPTER

- Distinguishing the difference between a bandage and a cure
- Identifying effective steps toward sustainability

Chapter 3
Building Eco-Friendly Products and Services

When you drill down to the fundamentals of sustainability, the same principle resonates across continents and cultures and communities: Treat others the way you want to be treated. In this chapter, I describe the decarbonization of the product line.

Defining Eco-Friendly

Your business decisions have an impact on other citizens and other families across the globe. In the 21st century, the consequences of your business decisions can affect millions of families. An eco-friendly perspective acknowledges the global reality of your choices.

Eco-friendly processes are designed to have a minimal negative impact on the environment. This involves using renewable resources, reducing waste, and minimizing pollution and carbon emissions. The goal of eco-friendly initiatives is to promote sustainability, preserve natural resources, and reduce the adverse impact of human activities on the environment for the good of all families.

Focusing on efficiency

If you're looking for the magic bullet that has the most impact on sustainability, power efficiency is the answer. The more efficient a device is in using electricity to accomplish a task, the more eco-friendly it is.

Power efficiency can be expressed as the ratio of sourced power to usable power. If a device takes 100 watts of power from the source and delivers 75 watts of power to the components, it's operating at 75 percent efficiency.

Efficiency can also be measured by the power that components use to perform an operation. If a legacy disk array is replaced with a solid-state drive (SSD) that requires half as much power to perform the same operation, you've doubled your efficiency. However, the type of SSD that you choose is important. A storage-class memory (SCM) SSD uses twice the power of a serial attached small computer system interface (SAS) SSD.

Debunking offsets and green certificates

Carbon offsets remove carbon dioxide (CO_2) from the atmosphere. They're subtractive. Renewable energy certificates (RECs) represent a stake in an energy source that doesn't add CO_2 to the atmosphere. They're non-additive.

To put it bluntly, a carbon offset is an accounting trick to deflect attention from a failure to hit a key performance indicator (KPI). To put it in terms of budget, say a product isn't hitting its $1 million sales projections, and you need to fix the balance sheet. Instead of improving revenue, you cut spending in another area by $1 million or more and declare the underperforming product a success.

A carbon offset is the sustainability version of cooking the books. A company that has failed to reduce its CO_2 emissions pays another company to perform carbon capture and storage (CCS) somewhere else on the globe. The problem is that there is no protocol in place to verify a net reduction in emissions.

REMEMBER

In fact, untreated exhaust from a coal-fired power plant can contain 300 times as much CO_2 as the earth's atmosphere, which means capturing 90 percent of the CO_2 reduces the carbon footprint to 30 times the CO_2 in the atmosphere. For this reason,

Hitachi Vantara manufactures in Japan instead of China (which is powered by coal). Even if CCS could remove 99 percent of the CO_2 from coal plant exhaust, what's left would still have a CO_2 concentration of up to 3 times the CO_2 in the atmosphere.

By contrast, when a company buys an REC, they haven't reduced the CO_2 emissions from their power source or improved their power efficiency. They've just funded a reduced-emissions power source somewhere on the planet, most likely not a source they're using in their facilities. Otherwise, there would be no need for the REC because then they could claim the CO_2 emission reduction directly with no need to employ a certificate.


REMEMBER

To decarbonize a data center, you must actually reduce the amount of carbon emitted during the construction, outfitting, and operation of that data center. The time for half-measures and equivocating is long past.

Calculating CO_2

The first step in your journey to sustainability is to determine your current CO_2 footprint. To estimate your current CO_2 footprint, you need to gather metrics, such as the number and age of the arrays in your enterprise storage environment and the capacity split between SSD and disc storage for enterprise and midrange storage.


TIP

Use Hitachi Vantara's CO_2 emissions estimation tool by visiting `apps.hitachivantara.com/co2-estimator-tool`.

Making a Measurable Difference

Your business needs a short-, medium-, and long-term plan. Envision a modern infrastructure that's cloud-ready, secure, and easily scaled across a hybrid cloud environment. The key here is to make these three plans work together, and if you manage to do that, your plan can be powerful.

Move away from the old thinking of stratifying and delineating between business plans and sustainability plans. Your infrastructure and data are the biggest assets you have. It's time to begin managing and optimizing each sustainably. The more you do, the easier it gets.

PARTNERING FOR SUSTAINABILITY

Hitachi Vantara's strategy for sustainability includes a 50 percent reduction in carbon emissions by 2030 and a carbon-free supply chain by 2050. Hitachi Vantara also works with customers in energy, transportation, and digital engineering and collaborates across business units — Hitachi Energy, Hitachi Rail, Hitachi Astemo, Hitachi Vantara, GlobalLogic, Hitachi ZeroCarbon fleets, and Hitachi Ventures — to reach beyond internal operations and support clients to power zero carbon efforts in the circular economy, smart cities, smart buildings, mobility as a service, zero carbon fleets, and electric and battery trains.

Achieving sustainability

Achieving sustainability starts with a commitment to sustainability and an actionable plan for addressing environmental, social, and governance issues. In the data center, that means a strategy for green transformation for the core, focusing on the decarbonization of internal operations with targets for emissions.

Reducing CO_2 emissions

The most direct way to reduce carbon emissions is to reduce the amount of power required to run the data center. For example, some storage solutions use non-volatile memory express (NVMe) media, which consumes two-and-a-half times as much energy as SAS flash media. Making the switch from NVMe to SAS flash can reduce your CO_2 footprint without compromising performance.

Reducing hardware footprint

Another way to reduce carbon emissions is to shrink the hardware footprint required to run your systems by deploying virtualization and containerization technologies. This reduces the need for additional hardware and minimizes energy consumption.

With virtualization, you can run multiple virtual machines (VM) on a single physical server, which consolidates workloads and improves server utilization. Virtualization enables you to dynamically allocate resources (CPU, memory, and storage) based on the needs of each VM. It also simplifies administration tasks, improves scalability, and reduces operational complexity.

Containerization enhances efficiency and agility by providing a lightweight, isolated execution environment for applications. Containers have a smaller footprint compared to virtual machines, allowing more containers to run on a single physical server. They also enable faster application deployment and scaling because they encapsulate all necessary dependencies and configurations. This agility helps you respond quickly to changing demands and optimize resource allocation.

Container orchestration platforms simplify the management and automation of containerized applications, making it easier to deploy, scale, and monitor applications.

Reducing data footprint

Compression and deduplication techniques can reduce your storage footprint without compromising data integrity or quality. Compressed data occupies less storage space, allowing you to store more data on the same physical infrastructure and reducing the need to add storage. In addition, compressing data before transmission optimizes network bandwidth utilization, which means faster data transfers, reduced latency, and improved network efficiency. This translates to reduced storage costs and a better return on investment for your data center infrastructure.

The advanced adaptive data reduction technologies used on the Hitachi VSP 5000 series and the VSP E series provide a guaranteed 4:1 effective capacity on reducible data formats to provide both efficiency and performance.

REMEMBER

VSP 5000 series and VSP E series models give you the flexibility to turn compression and deduplication on or off by storage volume, giving you the ability to right-size your storage based on specific service levels. Every storage environment is different, so a one-size-fits-all, always-on data reduction strategy won't deliver the best balance of data efficiency and performance. The flexibility to turn on or off data reduction by data volume enables you to target and maximize data reduction on specific volumes, while allowing maximum performance and low latency on nonreduced data volumes. The result is an optimal balance of performance and data efficiency, helping you meet the most demanding service level agreements while keeping storage costs low.

Increasing efficiency

Another way to reduce emissions is to improve the efficiency of the system. For example, compression performance for read/write operations can be improved by up to 40 percent — when comparing between VSP 5200, 5600 and VSP 5100, 5500 — by automatically switching the technology used for compression processing based on control load conditions.

Under normal loads, the switching technology prioritizes response time and high performance. The benefit is low latency. However, when multiple processes place a heavy load on the system, throughput degrades. That's when the system changes gears. Under heavy loads, the switching technology prioritizes throughput performance. The benefit is high throughput performance for high-volume data updates. However, completion reporting after compression increases latency. When the latency exceeds a threshold, the system reverts back to prioritizing response time. VSP's patented automated switching process enables high performance and energy savings.

Data migration is another process that can have a severe impact on efficiency and productivity. Traditionally, during a storage system replacement, the old and new systems run in parallel throughout the migration phase. This process consumes a significant amount of power and requires additional cooling and floorspace, not to mention that it can take months to complete.

A sustainable alternative is the non-disruptive replacement of only the storage controller to next generation systems, leaving the data exactly where it is.

Extending the life cycle

An eternity design mindset extends the life cycle of systems throughout the value chain, lengthening system life cycles up to ten years. It also reduces the need to replace an entire system or transport it back to the recycling center every three to five years, or to recycle individual components at the end-of-life (EOL) cycle phase.

In some cases, the recycling process of compute, network, and storage has been optimized to the point where less than 0.02 percent goes to the landfill. The remaining materials are used in the electronic industry to create new products.

IN THIS CHAPTER

- Developing a plan for sustainability
- Turning words into action

Chapter 4
Sequencing through the Sustainability Life Cycle

Imagine an eternity design mindset that extends product life cycles up to ten years by offering renewable parts — products that reduce your carbon footprint, and systems and components that are recycled at the end-of-life (EOL) cycle phase. That's the circular economy: a model of production and consumption that involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products for as long as possible. No need to imagine that mindset. It's already here and growing.

Namihei Odaira founded Hitachi in 1910 and developed a 5-horsepower electric motor. Living in an island country with few natural resources, Odiara was always concerned about the environment, so Hitachi focused on sustainability and taking care of the environment from the beginning. In this chapter, you discover decarbonization efforts in the factory, and you see how Hitachi Vantara is doing it.

Reaching Energy and Carbon Reduction Targets

In 1992, ISO 14001 set the criteria for an environmental management system that could be certified. It mapped a framework to set up an effective environmental management system. As you map out your own sustainability journey, evaluate each new product to determine the impact of the certification on design, manufacturing, procurement, service strategy, recycling, environmental partnerships, eco-management, and reducing global warming. You can then go beyond developing eco-friendly products in eco-friendly factories and offices to examining the entire value chain, before and after your products are created and sold.

Certifying the carbon footprint


REMEMBER

The carbon footprint of products (CFP) is a method of documenting carbon dioxide (CO_2) equivalent emissions during the life cycle of a product from the raw material acquisition stage to disposal and recycling. By using CFP, you identify CO_2 emission hotspots and take steps to reduce them. CFP also helps consumers see the CO_2 emissions associated with purchasing, using, and disposing of or recycling the product, allowing them to play a major role in CO_2 reduction by choosing and purchasing CFP-certified products.

Defining the value chain

The supply chain focuses on the flow of goods and information, while the value chain emphasizes value creation throughout the entire product or service life cycle. One of the ways a partner adds value is to increase sustainability.


REMEMBER

The first step to increasing sustainability is to observe stringent internal protocols when designing and developing systems that consume less energy and emit less carbon with each new version. Then, after development but before launch, run each system through an eco-assessment. If it meets internal thresholds, it advances through the product life cycle. If it doesn't qualify, it goes back to design. Continue to revise until you can demonstrate significant energy savings and emissions reductions relative to the previous model.

LEVERAGING THE VALUE CHAIN

Between generations of storage solutions, Hitachi Vantara cut carbon emissions from 30 to 60 percent compared to previous models. This assessment spans the complete value chain from the procurement of raw materials to production, transportation, five years of use, and recycling.

Walking the Sustainability Talk

Decarbonizing a data center is a boots-on-the-ground effort that touches every aspect of the facility from the IT equipment to energy sources, water, heating and cooling, waste management, and even the building itself. In fact, it actually goes beyond the building to considerations regarding how the facility impacts the environment, both flora and fauna. And don't forget transportation. Having your data center with the proximity of public transportation and bicycle routes reduces the number of cars that drive to and from the facility, decreasing its carbon footprint. When it comes down to it, sustainability touches just about every aspect of a data center, or any other facility.

Mining the data

Between 2012 and 2018, artificial intelligence (AI) workloads increased more than 300,000 times and are now doubling every two months. Such workloads require a huge amount of energy. But what if you designed an AI workload to reduce the total fossil fuel for the transportation sector? It would be considered *green AI,* a kind of computational carbon offset. On the other hand, badly written AI that consumed energy in the data center without reducing fossil fuel emissions would be *red AI.* IT can help reduce emissions with application modernization, data management, and infrastructure modernization, but simplification, consolidation, and automation should come first.

Decarbonizing the data center is an opportunity for organizations looking to get control of their carbon footprint. In fact, it impacts purchasing decisions — most organizations are starting to include

environmental, social, and governance conditions in their technology and service requests for proposals.

Informing the customer

The carbon footprint of products (CFP) is the CO_2 equivalent of the total amount of greenhouse gases (GHGs) emitted over the entire life cycle of a product or service, from the procurement of materials through disposal and recycling. As a concrete indicator of GHG emissions, publishing CFP measurements encourages manufacturers and customers to reduce the amount of carbon emitted by products over their entire life cycle. For this reason, countries and regions around the world are adopting the CFP approach.

The EcoLeaf Environmental Labeling Program is working to expand its roster of approved CFP products. In accordance with program rules, CO_2 emissions are calculated and compared with those of conventional models to ensure the disclosure of highly specialized, transparent, and objective information on the effect of efforts to reduce CO_2 emission.

Setting an example

This section gives you a few examples of how Hitachi Vantara has blazed the trail for sustainable facilities.

Minimizing impact on natural resources

Blechwarenfabrik Limburg GmbH, a leading manufacturer of tinplate packaging, wanted to improve environmental sustainability and accelerate manufacturing processes by delivering insights faster. That meant using data about materials and outputs to optimize its operations. By adding sensors, real-time analytics, and automation, it could further accelerate its processes, reduce waste, and save money.

By combining smarter materials management and continuous energy reporting with anomaly detection, the company successfully streamlined its operations, making the company more sustainable. Its analytics solution knows exactly when each piece of equipment is needed and can determine when machines should be turned off. Automation based on these data insights reduces energy usage along the entire production line. Similarly, the monitoring of the compressed air systems helps identify small

leaks almost immediately, so the reaction time is quick and minimizes the waste of valuable resources.

Self-service reporting has also helped Blechwarenfabrik Limburg GmbH improve sales and customer service. The sales team can instantly get the latest reports, including margins, prices, and order volumes, for every customer, and customers automatically receive notifications about important decisions, including supporting documents, such as CO_2 certificates. For the full story, visit `www.hitachivantara.com/en-us/company/customer-stories/blechwarenfabrik-limburg-case-study.html#challenge`.

Sustainable design

Hitachi Vantara uses an eternity design mindset to extend the life cycle of its systems throughout the value chain, lengthening system life cycles up to ten years and reducing the need to replace an entire system or transport it back to the recycling center every three to five years.

Hitachi Vantara's storage products and individual components are also recycled at the EOL cycle phase. At its Europe, Middle East, and Africa (EMEA) distribution center, the recycling process of compute, network, and storage components has been optimized to the point that less than 0.02 percent goes to the landfill. The remaining materials are used in the electronic industry to create new products.

Electric vehicles

Optimise Prime uses Internet of Things (IoT) technology to track the charging activity of up to 3,000 commercial vehicles. It endeavored to unearth all the potential issues surrounding the large-scale uptake of electric vehicles (EVs) and develop solutions for smart depot and home charging.

With the backing of energy regulator Ofgem, Hitachi Vantara, UK Power Networks, Royal Mail, Centrica, Uber, and Scottish and Southern Electricity Networks worked together to collect and analyze data from the vehicles. Hitachi Vantara designed, built, and operated the project's IoT platform that managed all the data from the vehicles and helped develop the results. Hitachi Vantara also coordinated the project workstreams and developed solutions to optimize the charging of fleets of EVs at depots, allowing more vehicles to charge within the network's existing capacity.

The results created the world's largest commercial EV dataset, which helped the project partners devise practical ways of overcoming the upfront costs that currently prevent widespread commercial EV deployment, while reducing the cost of the EV transition for electricity bill payers. Further findings from this example are publicly available at static1.squarespace.com/static/5cbebf91e5f7d1647c065ce3/t/64523d6621ba466696c6a82e/1683111272056/OP_Key_Findings_v1.0.pdf.

Data centers

In 2010, Hitachi Vantara built a data center in Norman, Oklahoma. It uses wind-generated electricity, accounting for 85 percent of total consumption in 2018. Water-conserving valves on toilets, waterless urinals in the bathrooms, and a high-efficiency cooling tower reduce water usage, saving thousands of gallons of water and thousands of kilowatt hours of electricity annually.

The ratio of recycling to landfill exceeded 96 percent for 2018 and improves each year. The plant works with suppliers and packaging designers to convert to only recyclable materials (no plastic) to further reduce landfill. The center also partnered with The Nature Conservancy to create two ecosystem services maps of the property. The first map includes baseline data of the existing species and habitat prior to enrichment activities to establish the abundance and species richness on the property. The second map shows the differences after activities are implemented.

In 2013, Hitachi Vantara unveiled its new center in The Netherlands. It's energy neutral and the first building of its kind to limit its use of natural resources with no use of natural gas. Instead, the facility is powered with 6,200 solar panels covering 17,000 square meters on the roof of the building, with a capacity of 1.4 megawatts and uses geothermal for heating. Rooftop rainwater capture is used to flush toilets. LED lighting is connected to sensors that dim areas not in use. The facility segregates all waste for recycling with the goal of keeping 99.9 percent of the waste out of the landfill.

A global paperless lab delivers all manuals, drawings, and process instructions electronically when a worker scans the bar code on an item. The center is easily accessible via bike, train, and bus. For those who still drive cars, a rooftop parking deck houses them all,

with no additional footprint for parking. Outside the building, a data center warehouse worker, who's also a beekeeper, maintains beehives so the bees can take advantage of the flowers planted on the grounds. In addition, birdhouses attached to the building compensate for loss of habitat.

The facility has transitioned to reusable packing material, replacing foam with cardboard and introducing multi-pack boxes. Crates of fully installed racks are loaded into Hitachi Vantara EV trucks, driven to the customer site, and delivered to the floor where the solution is installed. Zero packing material has to be disposed. When customers return equipment, such as EOL cycle recycling, they send it back in the same rack.

IN THIS CHAPTER

- Identifying sustainability challenges
- Evaluating optimization strategies
- Putting the plan into action

Chapter 5
Putting a Plan into Action

When you set out to decarbonize your data center, you may feel like you're attacking a many-headed beast. You have to consider many things, such as dark data, red artificial intelligence (AI), and heat. To slay the beast, you need tools to measure your current conditions and a plan to optimize performance and emissions. In this chapter, you discover what you need and how to put a plan in action to decarbonize your data center.

Targeting Data Centers

While many industries are in desperate need of decarbonization, data centers rank among the greatest emitters and represent the fastest growing carbon footprint in the IT sector. What if you could reduce the amount of heat that you must mitigate in your data center? That would be a win for the planet and your bottom line.

Understanding dark data

The world is swimming in data, but for humans or systems to make sense of that data, they need structured and labeled data. A database arranges data into a grid where each row is a record, and each column contains information about a specific aspect of the record. For example, in a human resources database, each record has information about a single person, and each column has a specific kind of data, such as date of birth, job title, and so on.

Dark data is the data that's collected but not analyzed, enriched, or used. It unstructured and lacks labels. Examples include slide presentations, legal contracts, blogs, emails, images, and surveillance video.

The footprint of dark data in your organization can be 50 percent or more, taking up data storage space and incurring management costs. Dark data represents a significant portion of your carbon footprint, too. Why not turn that from a passive infrastructure debit to an active asset?

Consider a transmission substation, a high-voltage electric system facility that connects two or more transmission lines. More than 55,000 substations are spread across the United States alone. These facilities can be very large or small, with little more than a transformer and associated switches. They can be in the middle of a dense city or in a remote location.

Having people constantly watch over these facilities is difficult, so video surveillance is typically used. But you're still left with the problem of detecting issues in thousands of hours of video. Data and automation can also have a big impact on employee productivity. For example, look at an automobile manufacturer that wants to automatically examine the final engine assembly of a vehicle. Currently, workers look for correct installation of the plastic outlays and covers, spot alignment issues, read oil gauges, and avoid human error. AI can do this job faster and more efficiently, while humans oversee the task and have more time to devote to strategic duties.

Overcoming data center decarbonization challenges

Whether it's efficient transportation, financial applications, or just common business analysis, data is fundamental to any

industry. But with the rising importance of data and use of AI comes calls for more sustainable global practices.

AI workloads increased more than 300,000 times between 2012 and 2018 and are doubling every two months. AI requires a huge amount of energy to run, but if it saves fossil fuel, it can often be justified. An AI workload that reduces the total fossil fuel for the transportation sector can be considered as green AI, whereas badly written AI that consumes energy in the data center without bringing fossil fuel reduction should be seen as red AI.

While it's easy to think of the transportation or aviation sectors when discussing carbon footprint, because these elements exist in the physical world, data is much harder to virtualize and make tangible. Data doesn't have a physical mass, but it still exists in our data centers and cloud providers, taking up a carbon footprint, whether or not it's actively used. Data that will likely never be used or touched again can be transitioned to an archive platform for inactive data.

Measuring to reduce

The cost to power a single server rack in a data center in the United States can be as high as $30,000 a year, depending on its configuration. By this measure, an organization with 100 cabinets could spend more than $3 million per year on data center energy alone.

A data center has two main energy consumption sources: the operation of IT infrastructure and the use of cooling systems. Between 30 and 55 percent of a data center's energy consumption goes into powering its cooling and ventilation systems. But if you use an eco-friendly data storage system, you can improve your green profile by lowering both the amount of electricity needed and the amount of floor space needed, which reduces the amount of cooling required.

You need visibility into performance to make capital outlay decisions, as well as for data-to-day decision making to optimize operations. Analytics is one way to help the human in the loop make better and more timely decisions on how to improve power consumption, cooling costs, and space requirements.

Disparate storage can become inefficient when underutilized, wasting capital investment and unnecessarily consuming power, cooling, and space resources. The same can be true for legacy

storage systems that typically require and consume more energy than modern equipment.

Generally speaking, over the past ten years, IT equipment tolerated a much wider range of temperatures and humidity, which saves in cooling costs. And using sensors and controls can match cooling capacity and airflow with IT loads. Furthermore, DataOps practices can be applied to converge IT and building facilities functions so that energy, equipment, and floor space are used as efficiently as possible. In other words, analytics can allow you to right-size the infrastructure and reduce energy costs.

Measuring to Manage

Peter Drucker, a world-famous management consultant, once said that you can't manage what you can't measure. Sustainability is all about meeting targets and goals, such as the 1.5 degrees Celsius above pre-industrial levels emission reduction target established at the Paris Agreement on climate change. But to hit a target, you need a way of measuring your carbon footprint.

Adopting a carbon insights platform

Gijima is one of South Africa's leading information and communications technology companies, providing cloud infrastructure, IT, and outsourcing services for both enterprise clients and small-to-medium businesses. A 100 percent black-owned company with Level 1 BBBEE status, Gijima employs 3,000 people across 16 regions and serves over 1,000 satisfied clients.

Gijima's state-of-the-art, Tier-3 data center hosts business-critical systems for many of the company's biggest clients, but much of the storage was reaching end-of-life (EOL). Gijima decided that upgrading could dramatically improve performance and manageability. However, the company needed to find a way to migrate its data to new storage arrays without any disruption to its clients' systems. To do so, the company chose Hitachi Vantara as a trusted partner.

The company used Hitachi Vantara's non-disruptive migration tools. From a commercial perspective, the EverFlex model provided flexibility, and Gijima only pays for the storage capacity

it needs, and all the replication and management software is included.

The physical consolidation of the infrastructure resulted in a 66 percent reduction in power, cooling, and space requirements with a similar impact at the disaster recovery site. Energy efficient solutions are a priority for Gijima's clients, so the company can proudly highlight that its infrastructure supports sustainability goals.

Now, both technically and commercially, Gijima has a solution that works and enables the company to continue improving its service to clients — now and in the future. Visit `www.hitachivantara.com/en-us/company/customer-stories/gijima-case-study.html#challenge` for more information.

Reducing application carbon footprint

In some cases, the reduction in footprint, electricity, and emissions can be dramatic. For one data center, an evaluation of their power for one lab showed that it was costing them $2.5 million a year. After a measurable gains assessment, an optimization solution revealed that the power costs could be reduced to $1.1 million, resulting in an estimated annual savings of $1.4 million. This savings came from modernization in storage, compute, licensing, SAN, and LAN.

Carrying out data center optimization

The original consolidation in the enterprise occurred with the arrival of virtualization and its ability to help organizations start utilizing idle compute power and excess storage capacity in data centers that were sprawling out of control thanks to the application-per-server approach. The next generation of optimization addresses power consumption and carbon emissions impact across the entire life cycle of the systems — from procurement of materials to production, transport, use, disposal, and recycling.

In addition, all-flash storage arrays enable data centers to consolidate legacy disk systems, freeing up floor space, dramatically lowering power consumption and costs, and reducing carbon dioxide (CO_2) emissions. Finally, adopting a recycling-oriented mindset enables the data center to shift from the conventional linear economy to a circular economy.

Deploying a Systematic Approach to Decarbonizing Data Centers

Developing and implementing a comprehensive strategy for reducing your data center carbon footprint is a critical but challenging endeavor. It requires a data-driven, holistic approach designed to measure the total data center carbon footprint through a detailed understanding of the emission sources, provide a complete view of data center components, and deliver effective data center decarbonization solutions.

Data is increasing exponentially. Data centers now comprise about 3 percent of the global electricity supply and account for about 2 percent of total greenhouse gas emissions. In addition, energy costs are rising, and data center managers are looking to incorporate renewable energy sources.

Increasing public pressure and regulations are driving companies to prioritize data center environmental sustainability while balancing these commitments with cost and data center performance objectives.

Assessing and planning

You can build a strategic, aligned roadmap by understanding carbon reduction targets, today's realities, and data-related challenges. Then you can use the roadmap to drive greenhouse gas reductions and operational mandates through prototype dashboards, key performance indicators (KPIs), baseline metrics, and consolidated data.

REMEMBER

An effective data center decarbonization plan must involve the following management:

- **IT management:** IT managers focus on IT infrastructure sustainability, application efficiency, and operational change management.
- **Facilities management:** Facility managers focus on building and mechanical, power supply, and power equipment sustainability efforts.

- **Sustainability and data center management:** Sustainability and data center leaders work to ensure that sustainability solutions address all cross-functional elements and span the entire carbon footprint.

The result is an integrated platform that supports the organization's collective decarbonization efforts and allows groups to collectively set measurable targets, monitor progress to goals, engage in scenario planning, and report results to internal and external stakeholders.

Using data and asset insights

Disparate data sources, data format and quality issues, and the timeliness of data make even basic reporting a challenge. When reports are available, they're often too high-level and hide opportunities for carbon reduction impact.

An end-to-end suite of data center carbon reduction solutions addresses numerous challenges associated with your data center facility and your related hardware, software, and operational components. A combined portfolio of green data center solutions can help you progress in your sustainability goals, regardless of where you are in your data center decarbonization journey.

A carbon insights platform provides increased visibility and understanding of data center carbon sources to enable data center sustainability leaders to effectively analyze, plan strategies, and audit results. It enables measurement and verification, data consolidation, dashboard reporting, scenario planning, and program management. A digital platform increases transparency for all stakeholders, provides real proof of carbon reductions, and integrates with existing asset platforms such as environmental monitoring systems (EMS), building management systems (BMS), and data center infrastructure management (DCIM).

Establishing the application carbon footprint helps companies understand the carbon footprint for an application based on consumed IT infrastructure (storage, servers, network), consumed data center power, and shared data center overhead. Data center managers empowered with this knowledge can develop strategies to reduce carbon impacts.

Optimizing assets

When you leverage deeper, asset-oriented assessments and analytics, you can identify opportunities for carbon reduction and greater operational efficiencies. You can then implement asset replacement and improvement strategies, shown in Table 5-1, to reduce your carbon footprint and confirm expected impacts, utilizing advanced modeling and recommendation engine capabilities.

TABLE 5-1 Optimization Strategies

Strategy	Description
MV Microgrid	Medium voltage (MV) microgrids utilizing solid state transformers and converters to materially reduce power efficiency loss and enable a path to diesel generator replacement
Battery Energy Storage Systems	Integrated battery storage systems for power quality management, backup power, and harvesting onsite generation to lessen carbon impact
HVAC Artificial Intelligence	Virtual sub-metering, monitoring, and management platform to optimize HVAC-related technologies and minimize carbon footprint Results: 5 to 20 percent gas/electric reduction
Immersive Cooling	Immersive cooling site analysis, design, and implementation to understand financial, operational, and carbon impacts Results: Up to 50 percent energy reduction; up to 40 percent more CPU performance
Virtual Store Arrays	Modern storage hardware built for performance, scalability, resiliency, efficiency, and carbon footprint optimization
Application Modernization	Review of data center-consuming applications for efficiency, scaling, flexibility, data center infrastructure, and footprint reduction

IN THIS CHAPTER

- Going green
- Optimizing storage capacity
- Auditing energy consumption
- Assessing the quality of your applications
- Following the value chain to the source
- Partnering with experts
- Focusing on efficiency

Chapter 6
Ten Things to Think about When Decarbonizing Your Data Center

An eco-friendly data center is designed to maximize energy efficiency and to minimize the environmental impact from cradle to grave. There are several factors to consider, the most important of which is your carbon footprint, which is the amount of carbon dioxide (CO_2) emissions for which your plant is responsible. Decarbonizing your data center can accelerate your digitalization goals, reduce energy costs, and increase the value of your data. In this chapter, I give you some things to consider when you want to decarb your data center.

Using Green Power

The element that has the biggest impact on your carbon footprint is your energy source, such as fossil fuels versus renewable energy. These fall under Scope 2 emissions in the Environmental Protection Agency (EPA) framework.

Each country has a mixture of brown and green power in their grid. A country with a greener power grid emits less CO_2 than a country with a brown power grid. Look for systems manufactured in greener countries. See Chapter 1 for more details.

Maximizing Energy Efficiency

The second biggest element that impacts your carbon footprint is your energy consumption. This falls under Scope 1 emissions in the EPA framework. Naturally, your IT infrastructure comes to mind — compute, network, and storage. But it also includes uninterruptible power supply systems, cooling, lights, bathrooms, and the like.

Regarding your IT infrastructure, your energy consumption depends on the technology implemented in your storage systems, such as the type of storage you have (enterprise, mid-level, or both), the number of storage arrays, and the age of the equipment.

REMEMBER

Age is a critical factor when evaluating the amount of CO_2 emissions produced by legacy and modern technology data centers.

Energy consumption is also impacted by the total capacity of your systems in terabytes and the percentage of storage using solid-state drives (SSD) versus spinning disks, and non-volatile memory express (NVMe) versus serial attached small computer system interface (SAS) and Near-Line SAS. This split is important because, when it comes to energy consumption, storage arrangements aren't all created equal.

Solid state memory will obviously consume less energy than a system that relies on a motor to spin a disk. And in an SSD environment, NVMe can consume up to 50 percent more power than SAS SSDs.

Cooling is also essential in a data center, especially identifying and rectifying hot spots through automatic temperature monitoring and periodic manual spot checks. If you need to estimate your CO_2 emissions, visit `apps.hitachivantara.com/co2-estimator-tool`.

See Chapter 3 for more information.

Evaluating Data Management

When it comes to data management, it's all about strategically using your storage space. When you improve on how efficiently you use storage capacity, you reduce the number of storage systems required, which has a beneficial impact not only on your budget but also on your carbon footprint.

You can optimize your storage capacity in several ways:

- Data deduplication eliminates duplicate copies of data in a system.
- Data compression reduces the space data consumes by identifying patterns and replacing them with a code that's shorter than the pattern.
- Data tiering identifies underutilized data on expensive, high-performance, low-latency storage and moves it to cheaper levels of storage.
- Archiving moves rarely-accessed data offline to be accessed as needed.

Setting Goals and Tracking Performance

Conducting an energy audit is an essential first step for understanding the existing level of energy consumption, as well as identifying priorities for improvement and defining a roadmap

for implementation. The outcome benefits of the audit can then be used to calculate return on investment (ROI) and prioritize initiatives. To conduct your audit, follow these steps:

1. **Define the problem and goals for improvement.**

   Achieve energy optimization while keeping organizational goals in mind.

2. **Measure process performance.**

   Determine current baselines for energy consumption.

3. **Analyze the process.**

   Identify root causes and collect and analyze data pertaining to energy waste.

4. **Improve the process.**

   Implement solutions for improvement by using quality control techniques such as design of experiments or poka-yoke, a Japanese practice of mistake-proofing a process.

5. **Control the improved process.**

   Continuously monitor new processes, making corrections and adjustments when necessary, and then implement statistical process controls (SPC) when the cycle is complete.

See Chapter 5 for more details.

Modernizing and Streamlining Processes and Applications

Assess the quality of your current applications, including legacy applications. Consider what's working well and what will bring you better business outcomes in the future.

You can modernize and streamline your processes and applications by following these four Es:

- **Envision:** Invest time in value-based assessment and mapping your portfolio to your business, keeping your people and processes in mind. Think about the outcomes you want to achieve.

- **Evaluate:** Identify your gaps and your level of maturity in terms of DevOps, agile, and modern engineering principles. Build a road map and identify the applications that will benefit more from a container-based architecture — or a more modern architecture, such as microservices and serverless functions. Be strategic in your choices.
- **Execute:** As you begin to execute, make sure to measure. Measure the pace at which you work, and scale your modernization for a pace that works for you. With each iteration, you'll start to mature and begin to execute your application modernization journey at scale.
- **Evolve:** As you work your way through the envision, evaluate, and execute processes, you'll find you can continuously adapt to change and deliver results faster. You're setting the digital foundation that allows you to speed your evolution toward data-driven innovation and growth.

Flip back to Chapter 2 for more information.

Using the Latest Technology to Increase Efficiency and Reduce Emissions

To promote sustainability, your organization can do a few things:

- Set a reduction rate of CO_2 emissions per business unit compared to the previous fiscal year based on efficiency enhancements in your facility. Calculate reductions in CO_2 emissions annually.
- Calculate avoided emissions as reductions in CO_2 emissions due to implementing new systems and solutions that emit less CO_2 while providing an equivalent value to existing products, services, and solutions.
- Calculate the avoided emissions as reductions in CO_2 emissions due to the introduction of renewable and other non-fossil energy sources as compared to the existing grid-supplied electricity.

Optimizing Your Budget, Performance, and Security

Traditional data centers use on-premises storage area network (SAN) infrastructure for high-speed access to data and to connect applications to structured data. Unstructured data is available through file service and object storage. It's an architecture that's proven across two decades of best practices. However, it's not sustainable when storage budgets are flat, yet data growth in the next three years is expected to match that of the last 30 years.

The last decade focused on the public cloud data center, which scales capacity to your production environment for a small monthly fee per gigabyte. You don't have to commit to a large upfront investment that ties up capital in infrastructure that could be used for innovation, new software, starting new projects, or transformation of monolith apps into modern apps. This approach has been more flexible, allowing you to flex up and flex down resources and the corresponding costs according to need.

However, the public cloud raises issues regarding security. Compliance officers get concerned when data is stored on a different continent. In addition, the price of a gigabyte in the public cloud has been frozen since 2015, whereas, for the last 50 years, traditional data centers have taken advantage of Moore's Law, which observes that approximately every two years the cost of capacity drops by half. But the public cloud isn't passing that economy on to the clients.

Private cloud delivers infrastructure similar to on-premises, a black box located in your data center or a nearby co-location facility and delivered by a vendor or a service provider. The difference is that the black box delivers virtual storage as a service similar to the public cloud, where costs are scaled to usage, eliminating the large upfront costs for a buildout. This includes infrastructure-as-a-service, where additional hardware capacity is installed, but your costs are based on usage, not hardware installed, and is backed up by a service-level agreement to guarantee performance.

Consolidating and Upgrading Infrastructure and Equipment

TIP

The advantage of adopting an eco-friendly solution is that it can replace legacy infrastructure and move critical operations to a hyperconverged setup. This migration provides greater visibility into the network and the performance of each component, allowing you to optimize performance and cut back infrastructure requirements. In many cases, operations run smoothly without the full complement of resources recommended by the vendors, allowing IT to retire hardware, shift resources, and increase operational reliability and performance.

You can realize cost savings from avoided capital expenditures (CapEx), facilities costs and maintenance, and consulting support. The reduced hardware footprint reduces the CapEx charge to upgrade or build on the equipment, and you need fewer colocation facilities for power and cooling to hold servers. Also, you can reallocate employee resources who were maintaining legacy technology to higher-value tasks.

Looking at the Value Chain when Investing in New Products and Services

While you're addressing in-house emissions (Scope 1) and energy-provider emissions (Scope 2), you can also evaluate the carbon footprint of your suppliers (Scope 3). Depending on your infrastructure, Scope 3 sources can represent most of your carbon emissions, which means they may offer your best opportunity to reduce your carbon footprint. Add sustainability requirements to requests for proposals to new vendors and when renewing contracts with existing vendors.

Hitachi Vantara is in a unique position because its Virtual Storage Platform products have been developed and certified by the Carbon Footprint of Products certification, from raw materials and transportation to the use of its products to meet customer

sustainability goals. In addition, Hitachi Vantara offers value chain implementations, including asset monitoring, analytics for power consumption, and fleet management analytics.

Check out Chapter 1 for more details.

Working with Partners and Suppliers with Expertise in Eco-Data Centers

Sustainability is a moving target, and it's unlikely that any given data center will have in-house expertise on all the varied challenges that will arise during implementation and day-to-day operations. In fact, two issues are lack of resources and lack of personnel with the required skill set.

That's where partners come in. Not only do they have expertise and experience with the technology, but also they have a tight relationship with the provider, working together to align product roadmaps to provide a joint, cost-effective solution. These engagements are outcome-driven, as-a-service offerings with no upfront commitment that can scale up or down as requirements change.

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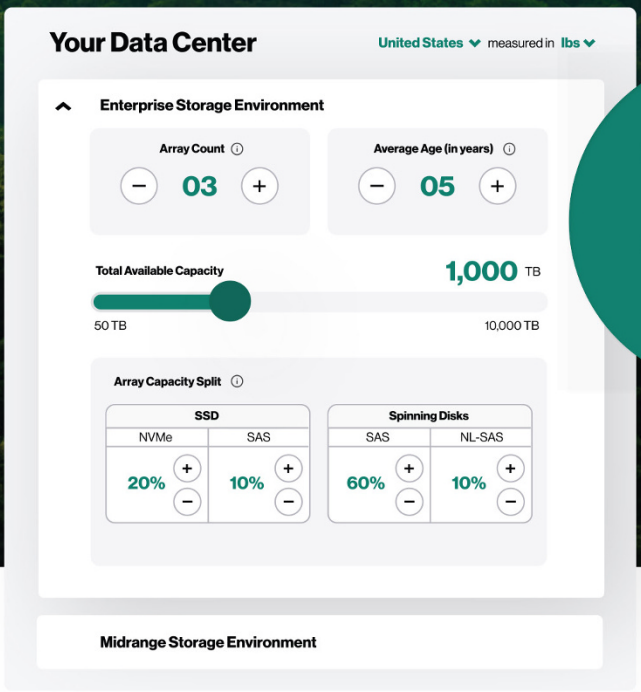
Decarbonize Your Data Center

Do you know how much CO2 is produced by your storage infrastructure? Learn how you can decrease it by up to 96%.



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Decarbonize your data center

In this book, you discover how to grow company value and business opportunities while meeting compliance and customer expectations — and doing good for the environment. You learn how to design data centers that are energy-efficient and environmentally sustainable, set and track decarbonization goals, and implement energy-saving data management techniques. This book also highlights the value of working with expert partners and suppliers for eco-friendly data center solutions.

Inside…

- Designing an eco-friendly data center
- Managing sustainability regulations
- Meeting customer expectations
- Cost-saving through sustainability
- Optimizing IT equipment and facilities

Hitachi Vantara

Brad Whittington is a technology author with a diverse background in IT, telecommunications, education, and whimsy. He has authored more than a dozen books.

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