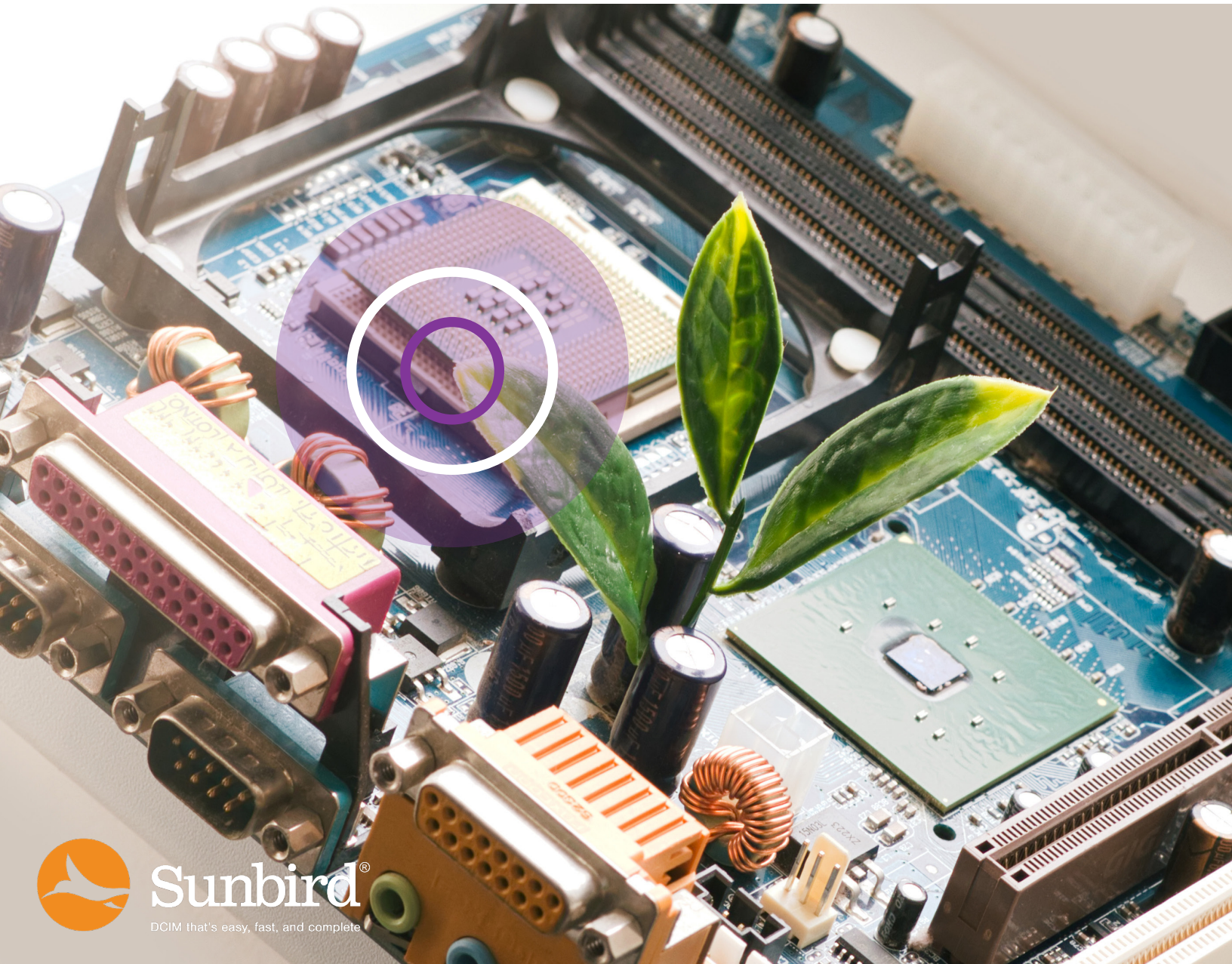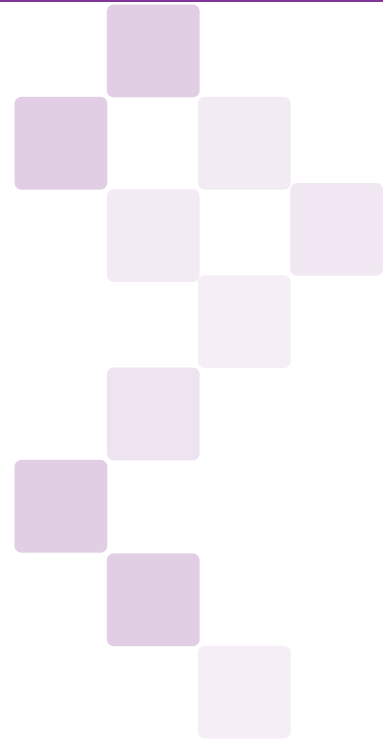# Tips for Developing a Data Center Sustainability Plan

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Introduction

As the world becomes increasingly conscious of sustainability, data centers are under scrutiny due to their significant energy requirements and environmental footprint.

Around the globe, governments, industry regulators, and customers are demanding that data center operators adopt practices and technologies that minimize their climate impact.

But most organizations are behind on complying with their sustainability objectives and need help creating a plan.

The purpose of this eBook is to provide you with practical guidance on forming a comprehensive sustainability plan tailored to your unique needs. It covers various aspects of sustainable data center management including insights into setting sustainability goals, overcoming obstacles, implementing instrumentation for monitoring and reporting, and developing strategies for sustainable data center design and operations.

By adopting the principles outlined in this guide, you can start to take proactive steps towards reducing your data center's environmental impact, optimizing resource utilization, and contributing to a more sustainable future.

Table of Contents
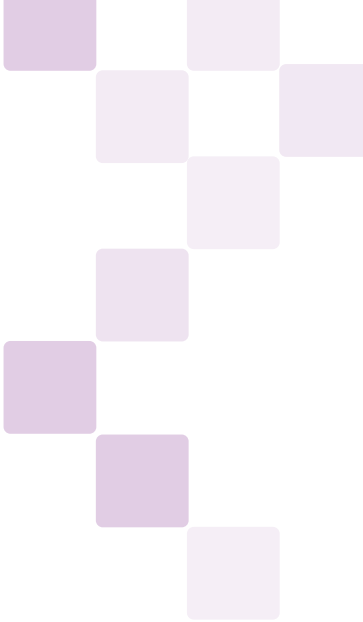
Understanding Data Center Sustainability

Sustainability lies at the core of modern data center management.

Data center sustainability refers to the adoption of practices and technologies that minimize resource consumption, reduce carbon emissions, and mitigate environmental impact throughout the lifecycle of data center operations. It incorporates a holistic approach that considers energy efficiency, carbon footprint, water conservation, waste management, and overall environmental stewardship.

A sustainable data center achieves a balance between meeting the ever-increasing demand for computing resources and minimizing the ecological footprint associated with data center operations.

Key Environmental Risks Posed by Data Centers

Data center sustainability is primarily driven by the environmental challenges posed by the intensive energy consumption, carbon emissions, and water usage caused by data center construction and operations.

- **Energy consumption.** Data centers are voracious consumers of energy, accounting for about 2% of global electricity usage. The continuous operation of servers, networking equipment, and cooling systems requires substantial power, contributing to high energy bills and carbon emissions.
- **Carbon emissions.** The reliance on fossil fuels for electricity generation in many regions results in data centers contributing about 2.5%-3.7% of global greenhouse gas emissions. This is more than the aviation industry. These emissions contribute to climate change and environmental degradation, underscoring the need for decarbonization strategies within the data center industry. A data center's carbon footprint is determined by its utility energy source (i.e., coal, natural gas, renewables) and the efficiency of its equipment and cooling systems.
- **Water usage.** Cooling systems, essential for maintaining optimal operating temperatures within data centers, often require massive amounts of water. A mid-sized data center uses about 300,000 gallons of water a day which is equivalent to the water consumption of 100,000 homes. This can strain local water resources and exacerbate water scarcity in regions already facing water stress.

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Understanding Data Center Sustainability (continued)

Scope 1, 2, and 3 Emissions for Data Centers

There are three primary ways that data centers contribute to greenhouse gas emissions. Tracking and managing these three "scopes" allows you to comprehensively assess our sustainability, identify opportunities to reduce emissions, and implement strategies to improve sustainability across your operations and supply chain.

- **Scope 1 emissions.** These are direct emissions from sources that are owned or controlled by the data center, such as backup diesel generators. They indicate the direct environmental impact of data center operations.
- **Scope 2 emissions.** These are indirect emissions associated with purchased electricity consumed by the data center. They measure the environmental impact of total energy usage and help identify opportunities to reduce carbon footprint through renewable energy procurement and efficiency initiatives.
- **Scope 3 emissions.** These are indirect emissions that occur upstream or downstream of the data center's operations, including emissions associated with the production and transportation of purchased equipment and services, employee commuting, and end-of-life disposal of equipment. While scope 3 emissions are not directly caused by the data center, they represent a significant portion of the overall carbon footprint and require collaboration with supply chain partners to address effectively.

Benefits of Implementing Sustainable Practices

Embracing data center sustainability offers numerous environmental and economic benefits.

- **Reduced environmental footprint.** By optimizing energy efficiency, reducing carbon emissions, and minimizing water usage, sustainable data center practices help mitigate environmental impact and contribute to global efforts to combat climate change.
- **Cost savings.** Energy-efficient technologies and practices not only reduce electricity bills, but also lower operational costs associated with cooling and maintenance, offering long-term savings for data center operators.
- **Enhanced reputation.** Demonstrating a commitment to sustainability can enhance brand reputation, attract environmentally conscious customers, and differentiate data center operators in a competitive market.
- **Regulatory compliance.** Adhering to sustainability standards and regulations ensures compliance with environmental laws and regulations, mitigating regulatory risks and potential fines.

Setting Sustainability Goals and Overcoming Obstacles

Setting clear and measurable sustainability goals is essential for driving meaningful progress. However, it's important to anticipate and overcome several common challenges.

Common Data Center Sustainability Goals

Organizations often set sustainability goals aligned with reducing environmental impact and improving resource efficiency. The most common goals include:

- **Offsetting 100% of energy consumption with renewables.** Transitioning to renewable energy sources such as solar, wind, or hydroelectric power can offset the entire energy consumption of the data center.
- **Reducing reliance on diesel generators.** Minimizing or eliminating the use of diesel generators for backup power reduces carbon emissions.
- **Achieving a Power Usage Effectiveness (PUE) of 1.2 or lower.** While not perfect, this popular metric is a good indicator of the overall energy efficiency of a data center.
- **Consuming little or no water.** Implementing water-efficient cooling systems and practices can minimize water consumption in data centers.

Common Data Center Sustainability Obstacles

Despite the importance of setting sustainability goals, you may encounter various obstacles that impede progress. The most common obstacles include:

- **Technical barriers.** Implementing sustainable practices may require significant technical expertise and investment in new technologies.
- **Existing long-term contracts.** Contracts with utility providers or colocation facilities may limit your ability to quickly transition to renewable energy sources or make other sustainable changes.
- **Uncertainty on critical metrics to monitor.** Determining which sustainability metrics to track and how to measure them effectively can be challenging, leading to uncertainty and indecision.
- **Too low a priority.** In some cases, sustainability may not be a top priority for organizations, leading to a lack of resources, investment, or focus on implementing sustainable practices.
- **Absence of a meaningful plan.** Without a clear roadmap in place, you may struggle to make progress towards your sustainability goals.
- **Lack of budget.** Improving sustainability may require upfront investment in new technologies, equipment upgrades, or infrastructure improvements, which may not be feasible without adequate budget.

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Setting Sustainability Goals and Overcoming Obstacles (continued)

Strategies for Overcoming Obstacles

To overcome these obstacles and effectively set sustainability goals, consider the following strategies.

- **Establish clear and measurable objectives.** Define specific, measurable, achievable, relevant, and time-bound (SMART) sustainability goals that align with the overall business strategy and environmental objectives.
- **Prioritize areas for improvement.** Identify areas where sustainable practices can have the most significant impact and prioritize efforts accordingly based on their feasibility and potential environmental benefits.
- **Develop a timeline for achieving targets.** Create a realistic timeline for implementing sustainability initiatives, taking into account factors such as resource availability, budget constraints, and technical feasibility.
- **Collaborate with stakeholders.** Engage with internal stakeholders to garner support for sustainability initiatives and secure buy-in for necessary changes.
- **Seek external support and expertise.** Leverage external resources, such as sustainability consultants, industry associations, or government incentives, to gain insights, access funding, and overcome technical or regulatory hurdles.
- **Monitor progress and adjust strategies.** Regularly monitor progress towards sustainability goals, track key performance indicators (KPIs), and adjust strategies as needed to address emerging challenges or capitalize on new opportunities.

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Establishing Your Data Center Sustainability KPIs

Establishing KPIs is essential for tracking progress towards sustainability goals and benchmarking performance over time. Selecting the right KPIs with aggressive yet attainable targets helps define your sustainability plan and next steps.

Common sustainability metrics to consider include:

Efficiency Metrics

- **Power Usage Effectiveness (PUE).** Measures overall data center energy efficiency by indicating how much energy is consumed by IT equipment compared to supporting infrastructure.
- **Carbon Usage Effectiveness (CUE).** Evaluates a data center's carbon footprint by comparing carbon emissions to energy consumed by IT equipment.
- **Water Usage Effectiveness (WUE).** Tracks the efficiency of a data center's water usage by comparing water consumption to energy consumed by IT equipment.
- **Cabinets compliant with ASHRAE guidelines.** Measures how much progress is being made towards optimal environmental conditions that minimize energy waste from overcooling.

(continued)

Establishing Your Data Center Sustainability KPIs (continued)

Resource Utilization

- **Virtualization ratio.** Tracks how many VMs are in the environment for every one host to determine the extent to which virtualization technologies are implemented.
- **Facility utilization.** Measures how much data center space capacity is used.
- **Stranded power.** Quantifies the amount of unused power capacity at the site or rack level, highlighting opportunities to utilize existing resources.
- **Server utilization.** Tracks CPU, memory, and disk utilization rates to provide insights into the efficiency of computing resources.

Environmental Impact

- **Carbon emissions.** Tracks the amount of CO2 emitted due to data center operations to support efforts to mitigate climate change.
- **Water consumption.** Measures the amount of water used by the data center to cool equipment to promote conservation efforts.
- **Electronic waste.** Monitors the amount of electronic waste generated within the data center and its responsible disposal or recycling.

Renewable Energy Usage

- **Renewable energy percentage.** Indicates the proportion of energy consumed by the data center that comes from renewable resources.
- **Renewable energy capacity.** Measures the installed capacity of renewable energy systems.
- **Carbon emission savings.** Quantifies the reduction in carbon emissions achieved through the use of renewable energy sources.

Instrumenting the Data Center

Collecting real-time data is the key to understanding and improving data center sustainability. Instrumenting your data center with power meters, environmental sensors, and monitoring software is vital to track parameters like energy consumption, temperature, humidity, and airflow.

Data center instrumentation supports sustainability planning by enabling:

- **Real-time monitoring.** Instrumentation provides real-time visibility into power and environmental conditions, allowing you to identify inefficiencies and optimize resource usage.
- **Data-driven decision-making.** By collecting and analyzing data on energy consumption, cooling efficiency, and other parameters, you can make informed decisions to minimize energy waste and improve sustainability.
- **Resource optimization.** Instrumentation enables you to optimize the utilization of space, power, and cooling capacity to maximize use of existing resources and maximize energy efficiency.
- **Compliance and reporting.** Accurate data collection and monitoring facilitates compliance with environmental regulations and reporting requirements, enabling you to demonstrate adherence to sustainability standards.

Measurement Points for Data Center Sustainability Planning

While it is possible to meter at salient points in a data center power circuit, there are three critical measurement points.

- **Building feeds.** Metering power at the point where electricity enters the building provides a broad overview of total facility energy consumption. This data is valuable for understanding overall energy usage trends and analyzing the overall impact of energy-saving initiatives.
- **Branch circuits.** Monitoring power at the branch circuit level provides more detailed insights into the energy consumption of specific areas within the facility to help compare efficiencies and implement targeted energy-saving measures.
- **Rack PDUs.** Intelligent rack PDUs with outlet-level metering enable you to track power consumption at both the rack and device level. This makes it easy to identify power hogs and find underutilized servers to consolidate workloads and optimize capacity utilization. Plus, because they are already on the network, they can easily be instrumented with additional environmental sensors.

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Instrumenting the Data Center (continued)

Why kWh Matters

Energy consumption in data centers should be measured in kilowatt-hours (kWh). kWh is a standard unit of energy measurement that quantifies the actual amount of electricity consumed over a given period. Using other power readings like kW or kVA are point in time readings, not accumulated energy, and could provide inaccurate sustainability reports. Using the right measurement is fundamental to understanding and improving sustainability for several reasons.

- **Quantitative measurement.** By measuring energy consumption in kWh, you can obtain precise, quantitative data on the amount of electricity used by the facility, individual racks, equipment, or even applications. This data serves as a baseline for evaluating energy efficiency, setting goals, and tracking progress.
- **Cost analysis.** Energy consumption directly impacts operational costs as it is billed by kWh. Measuring consumption in kWh enables you to accurately assess the financial implications of energy usage, identify opportunities for cost savings, and prioritize investments in energy-efficient technologies.
- **Environmental impact.** Understanding the carbon mix for the energy coming into the facility in kg CO2/kWh and multiplying that by data center energy consumption in kWh provides you with a figure for the carbon emissions caused by your data center operations.
- **Benchmarking and comparison.** Using kWh facilitates comparison of data center energy efficiency to industry standards and peers.
- **Regulatory compliance and reporting.** Your jurisdiction may have regulations and standards that require you to report on energy consumption in kWh. Accurate kWh measurements support transparency and accountability in sustainability efforts.

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Technology Vendors for Data Center Instrumentation

Selecting the right technology vendors is crucial for implementing effective instrumentation in data centers to support sustainability goals.

The following are some major players to help begin your vendor research.

Outlet-Metered Rack PDU Technology Providers

- Raritan
- Server Technology
- CPI
- APC
- CyberPower

- Eaton
- Enlogic
- nVent
- Vertiv Geist

Branch Circuit Metering Solutions

- Raritan
- ABB
- Eaton
- Janitza

- Leviton
- Packet Power
- Schneider Electric
- Veris

Building Metering Solutions

- ABB
- Eaton
- Honeywell

- Schneider Electric
- Siemens
- Verdigris

Source: Raritan

Enabling Energy Monitoring and Reporting

Once you have the metering infrastructure in place, you need enterprise-class data center monitoring software to collect, store, and report on all the data that it generates. Effective monitoring and reporting are essential components of a data center sustainability plan, enabling you to track performance, identify areas for improvement, and communicate progress to stakeholders.

Implement DCIM Software

Deploying Data Center Infrastructure Management (DCIM) software for power and environmental monitoring is crucial for gaining real-time visibility into data center sustainability and utilization metrics. Modern DCIM software offers:

- **Centralized data collection and documentation.** Collect billions of data points per day from the meters and sensors installed throughout the facility and store that data for long periods of time for reporting purposes.
- **Automatic alerts.** Configure thresholds on power and environmental sensor readings and get notified immediately when thresholds are violated (e.g., when cabinets are overcooled or you risk tripping a breaker).
- **Energy dashboard charts and reports.** With out-of-the-box charts and reports, get actionable insights into energy consumption and efficiency that enable better energy management decisions. For example, automatically calculate and trend PUE for any site or view your racks on an ASHRAE psychrometric cooling chart.
- **Collaboration and reporting.** Energy KPIs can be downloaded, printed, and shared via automatically created and scheduled email reports, your corporate portal, or secure links that respect role-based access control.

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Enabling Energy Monitoring and Reporting (continued)

Feed Data into ESG Software

Feed accurate data center energy consumption information from DCIM software into Environmental, Social, and Governance (ESG) software to simplify:

- **Data integration.** Integrate data from DCIM software and other sources with ESG software to streamline data collection, analysis, and reporting processes across all building types.
- **Performance benchmarking.** Benchmark data center sustainability performance against industry peers to identify areas for improvement and demonstrate leadership in sustainability.
- **Regulatory compliance.** Ensure compliance with environmental regulations and reporting requirements by leveraging ESG software tools to track and report on sustainability metrics accurately.

Report Progress to Stakeholders and Regulators

Regular reporting of sustainability performance is essential for transparency, accountability, and stakeholder engagement. You may need to communicate progress towards sustainability goals through comprehensive sustainability reports, stakeholder presentations, and regulatory filings. Factors to consider include:

- **Frequency and format.** Determine the frequency and format of sustainability reporting, considering stakeholder preferences, regulatory requirements, and industry standards.
- **Transparency and disclosure.** Provide transparent and comprehensive reporting on sustainability performance, including quantitative data, qualitative analysis, and future goals and initiatives.
- **Stakeholder engagement.** Engage with stakeholders, including investors, customers, employees, and regulators, to solicit feedback, address concerns, and demonstrate commitment to sustainability.
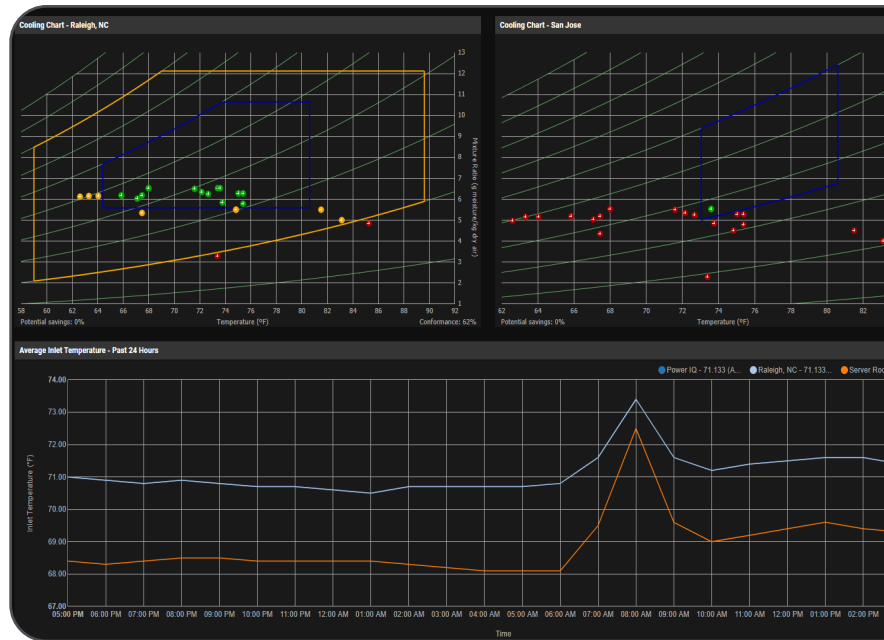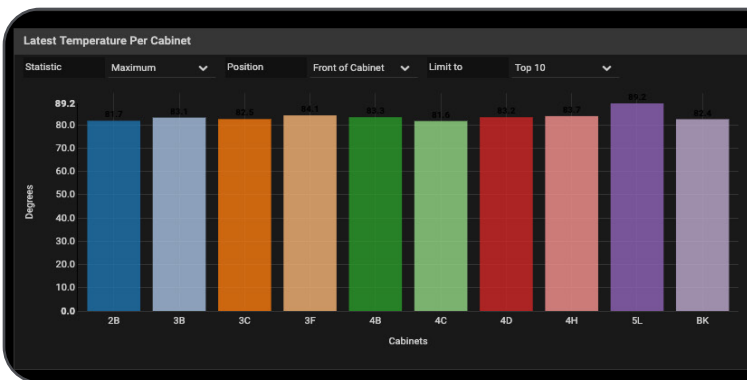
Strategies for Sustainable Data Center Design

A sustainable data center design minimizes environmental impact, optimizes resource utilization, and helps ensure long-term operational efficiency.

Facility Location, Layout, and Equipment for Energy Efficiency

The location and infrastructure of a data center facility play a significant role in its energy efficiency and environmental impact. Consider the following strategies for optimizing facility location and layout.

- **Proximity to renewable energy sources.** 62% of new renewable energy sources are already cheaper than new fossil fuel sources. Select locations with access to these renewable energy sources such as solar, wind, or hydroelectric power to minimize reliance on fossil fuels and reduce carbon emissions.
- **Climate considerations.** If local conditions allow, utilize free cooling techniques such as air-side economization or water-side economization to leverage ambient outdoor temperatures for cooling, reducing the need for mechanical cooling and lowering energy costs by up to 70%.
- **High-efficiency servers.** Deploy energy-efficient servers and IT equipment that meet ENERGY STAR or other efficiency standards to minimize power consumption by up to 30% compared to conventional models.
- **Liquid cooling.** Consider liquid cooling systems which can save up to 30% of cooling energy costs when compared to mechanical air cooling.
- **Efficient layout.** Leverage hot/cold aisle containment to prevent the mixing of hot and cold air and increase cooling system efficiency by up to 40%.


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Strategies for Sustainable Data Center Design (continued)

Green Building Practices and Renewable Energy Sources

Incorporating green building practices and renewable energy sources into data center design can significantly improve sustainability.

- **LEED certification.** Pursuing Leadership in Energy and Environmental Design (LEED) certification ensures that data center facilities meet stringent environmental standards for energy efficiency and water conservation. On average, LEED buildings use 25% less energy than non-certified buildings.
- **On-site renewable energy generation.** Installing solar panels, wind turbines, or other renewable energy systems on-site to generate clean, renewable energy to power data center operations and reduce reliance on fossil fuels.
- **Power Purchase Agreements (PPAs).** Entering into PPAs with renewable energy providers allows data centers to procure renewable energy at competitive rates, supporting the development of new renewable energy projects, and reducing carbon emissions.
- **Renewable Energy Credits (RECs).** Purchasing RECs enables data centers to offset carbon emissions associated with electricity consumption by supporting renewable energy projects elsewhere, contributing
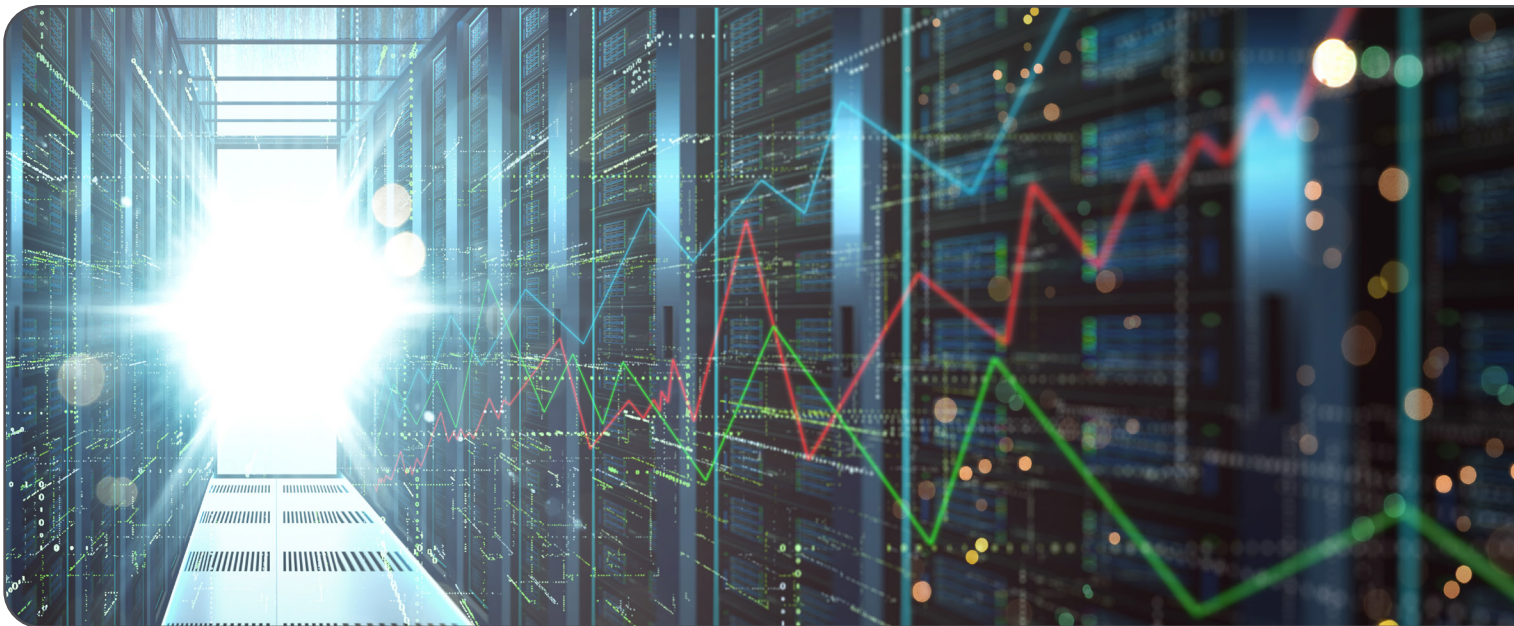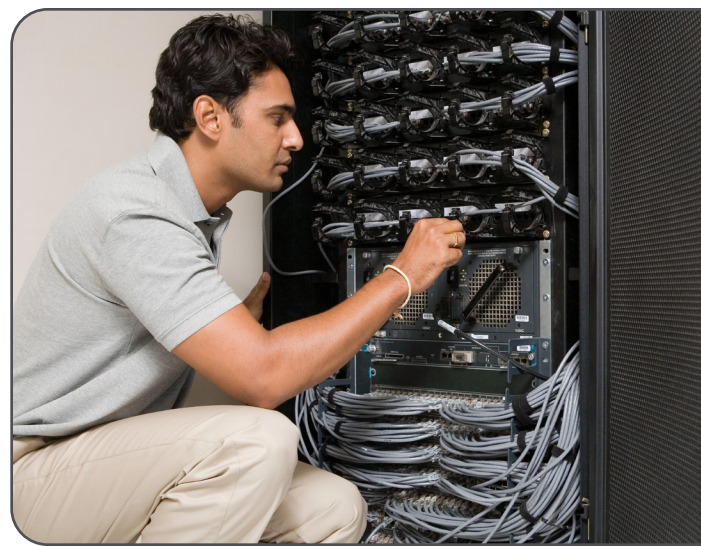
Driving Efficient Data Center Operations

A comprehensive data center sustainability plan requires tools that enable operators to intelligently reduce energy consumption while also increasing the utilization of existing facilities to defer energy-intensive data center constructions. Integrating intelligent outlet-metered rack PDUs and environmental sensors with DCIM software provides the insights needed to dramatically increase sustainability.

Reducing Energy Consumption

Modern hardware and software tools provide the granular insights you need to intelligently increase the energy efficiency of your data center without introducing risk.

- **Raise temperatures.** You can potentially save 4%-5% in energy costs for every 1°F increase in server inlet temperature. With precise temperature monitoring and easy-to-understand cooling charts, you can identify which cabinets are outside of industry- or manufacturer-recommended guidelines and correctly adjust set points reduce the cooling load and improve energy efficiency without compromising equipment reliability or performance. Learn how Vodafone used this approach to drive sustainability.
- **Virtualize and consolidate.** Consolidating workloads onto virtualized servers can reduce energy costs by up to 50% while improving resource utilization and reducing your hardware footprint. Integrating VMware with DCIM software lets you map your VMs to their physical hosts. With this information, you can move VMs to your most efficient servers to maximize efficiency gains.
- **Shut down ghost servers.** About 15%-30% of the equipment running in your data center may not be doing any computing. Find your potential ghost servers with a built-in report that lists them based on their power load. Decommissioning them eliminates unnecessary energy consumption and removing them frees up space which can be used for other equipment or to improve airflow.
- **Use billback reports.** Energy cost reports by data center, customer, or application allow you to accurately charge business units based on actual usage, incentivizing energy conservation and accountability while identifying power hogs and areas where efficiency can be improved.

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Driving Efficient Data Center Operations (continued)

Enabling More Efficient Facilities

Building new data centers has a real environmental impact. Use intelligent rack PDUs and DCIM software to maximize the utilization of existing facilities to defer—potentially indefinitely—constructing your next data center.

- **Automate device power budgeting.** "Auto Power Budget" is a machine learning algorithm that enables you to confidently deploy more servers in your existing cabinet resources. With live data from outlet-metered intelligent rack PDUs, it automatically calculates and updates a highly accurate power budget number for each server instance based on its actual load in your environment. Learn how Comcast was able to get 40% more utilization out of their existing resources with this feature.

- **Leverage what-if analysis.** Simulate one or more projects to determine the impact that adding new equipment or changing existing configurations will have on your rack and space power capacity. This predictive modeling lets you know if you can leverage existing resources for your next project instead of purchasing more.

- **Understand capacity better.** Pre-configured capacity dashboards with real-time gauge charts by resource type let you know your available capacity at a glance. Plus, you can get a holistic 2D or 3D digital twin view of rack capacity across multiple parameters like space, power, and cooling to visualize where resources are underutilized or unevenly distributed.

- **Intelligently find capacity.** In seconds, find the optimal cabinet to deploy new equipment in. Simply search for the model you're deploying and get a list of all the cabinets with the available space, power, and connectivity capacity for it. Then, you can easily reserve all those resource at once.
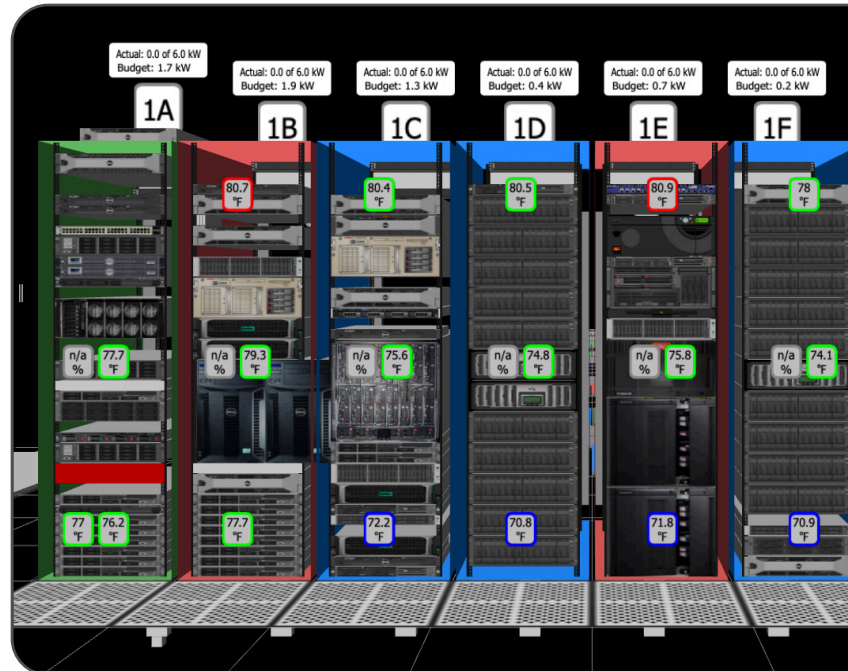
Other Key Considerations

A comprehensive data center sustainability plan goes beyond energy consumption and resource utilization. It also requires careful consideration of water usage, electronic waste, and constant effort to keep employees engaged and contributing to an adaptable plan.

Water Conservation and Waste Management

While energy efficiency is typically the main focus of sustainability initiative, water conservation and waste management are other essential aspects of data center sustainability, contributing to environmental stewardship.

- **Water-efficient cooling systems.** Implementing water-efficient cooling technologies, such as closed-loop cooling systems, minimizes water usage in data center operations while maintaining optimal thermal management.
- **Minimizing water usage.** Adopting water-efficient practices in equipment maintenance and cleaning processes helps minimize water usage and environmental impact, contributing to overall sustainability efforts.
- **Recycling programs.** Establishing recycling programs for electronic waste, including decommissioned equipment and obsolete hardware, promotes responsible disposal and recycling practices, reducing environmental impact, and conserving resources.

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Other Key Considerations (continued)

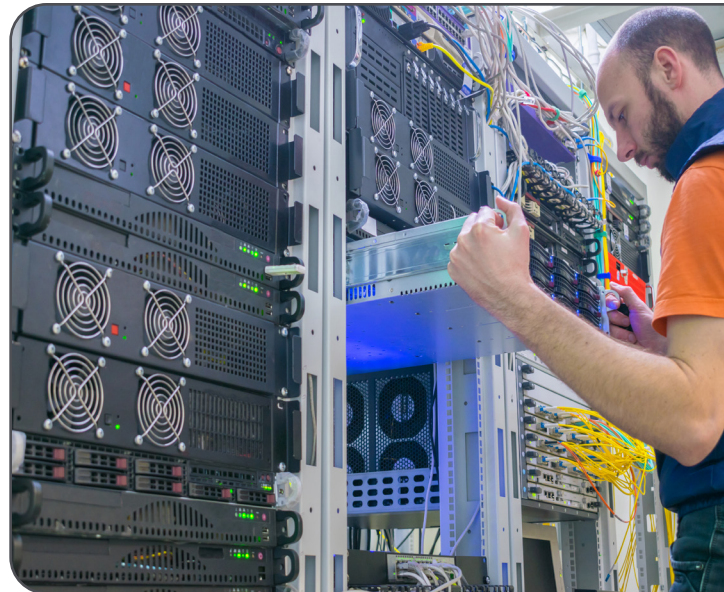## Employee Engagement and Training

Engaging employees and providing training on sustainability best practices are crucial for fostering a culture of environmental responsibility and driving sustainability initiatives.

- **Raising awareness.** Educating data center staff about sustainability goals, initiatives, and the importance of resource conservation raises awareness and promotes a sense of ownership and accountability for sustainability outcomes.
- **Training programs.** Providing training programs on energy efficiency, waste reduction, and environmental stewardship equips employees with the knowledge and skills to implement sustainable practices in their daily operations.
- **Incentive programs.** Implementing incentive programs, such as rewards or recognition for sustainability achievements and contributions, motivates employees to actively participate in sustainability initiatives and drive continuous improvement.

Continuous Improvement and Adaptation

Continuous improvement and adaptation are fundamental principles of data center sustainability, enabling operators to identify opportunities for enhancement and respond to evolving environmental challenges.

- **Regular reviews and assessments.** Conducting regular reviews and assessments of data center operations, performance metrics, and sustainability initiatives helps identify areas for improvement and optimization.
- **Staying updated on emerging technologies.** Keeping abreast of emerging technologies and industry best practices in data center sustainability enables operators to leverage innovative solutions and stay ahead of evolving environmental standards and regulations.
- **Adapting to changing conditions.** Flexibility and adaptability are essential for data center operators to respond effectively to changing environmental conditions, regulatory requirements, and stakeholder expectations, ensuring ongoing alignment with sustainability goals.

Conclusion

Creating a sustainable data center requires a multifaceted approach that encompasses energy efficiency, renewable energy integration, water conservation, waste management, employee engagement, and continuous improvement.

By implementing the strategies outlined in this eBook, you can significantly reduce your data center's environmental impact, optimize resource usage, and enhance operational sustainability.

Together, we can create a more sustainable future for the data center industry and contribute to a healthier planet for all.

Other Resources You Might Be Interested In:

- The State of Data Center Sustainability
- Top 30 Data Center Sustainability Metrics
- World's Leading Data Center and Cloud Operators with Zero Carbon Goals
- Green Data Centers Around the World
- How to Safely Avoid Overcooling Your Data Center and Save Money Today
- How to Measure Data Center Sustainability
- 10 Best Practices to Reduce Your Carbon Footprint
- 5 Ways DCIM Software Improves Data Center Sustainability
- 8 Ways to Ensure a Green Data Center
- How DCIM Software Improves Data Center Energy Efficiency
- 6 Best Practices to Increase Data Center Energy Efficiency
- 3 Ways Modern Data Centers Are Driving Energy Efficiency
- 5 Ways DCIM Software Supports EU Green Deal Compliance
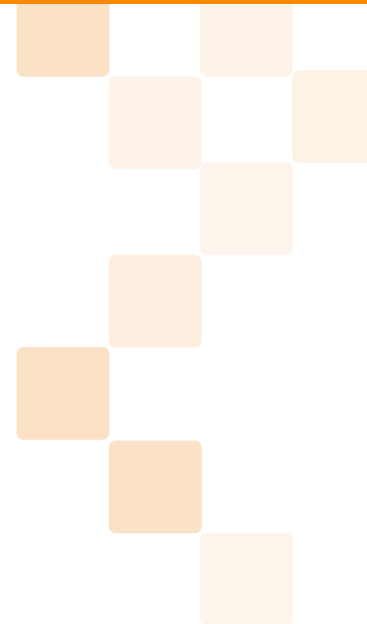
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Schedule a Personalized Demo
Get a one-on-one live tour of our modern data center management software with a DCIM specialist.

Schedule a Demo Now

DCIM Operations Online Demo
Remote 3D visualizations of all you racks, assets, power, and network connections. View 250+ dashboard charts and reports. Know the capacity of all infrastructure items.

Try it Free

DCIM Monitoring Online Demo
Remotely monitor rack PDUs, UPSs, branch circuit meters, RPPs, floor PDUs, busways, cameras, door locks, and temperature, humidity, and other sensors. Remote central power control of all servers. See trends, and get alerts.

Try it Free

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