EBOOK How to Increase Data Center Sustainability:

10 Best Practices to Reduce Your Carbon Footprint

Sunbird®

DCIM that's easy, fast, and complete.

Introduction

The demand for computing power and digital services is exploding. In the last decade, global internet traffic increased ten-fold and data center storage capacity increased by a factor of 25.

With transformative yet energy-hungry innovations such as 5G mobile networks, big data, and artificial intelligence still just taking off, data center demand is only going to continue to grow.

As data centers get bigger and require more energy to keep up with the demand of modern consumers and businesses, so too does the spotlight as customers, governments, and industry regulators increasingly push for increased sustainability and social responsibility.

While many hyperscalers have set goals to reduce their carbon footprint to zero by 2030, increasing energy efficiency is an objective every data center manager should have. Beyond reducing the data center's impact on climate change, driving efficiency reduces operating costs, maximizes the value of existing capacity, and helps compliance with regulations and initiatives.

In this eBook, we've compiled the top 10 best practices any data center manager can implement to dramatically reduce energy consumption and drive sustainability.

10 Best Practices to Reduce Your Carbon Footprint

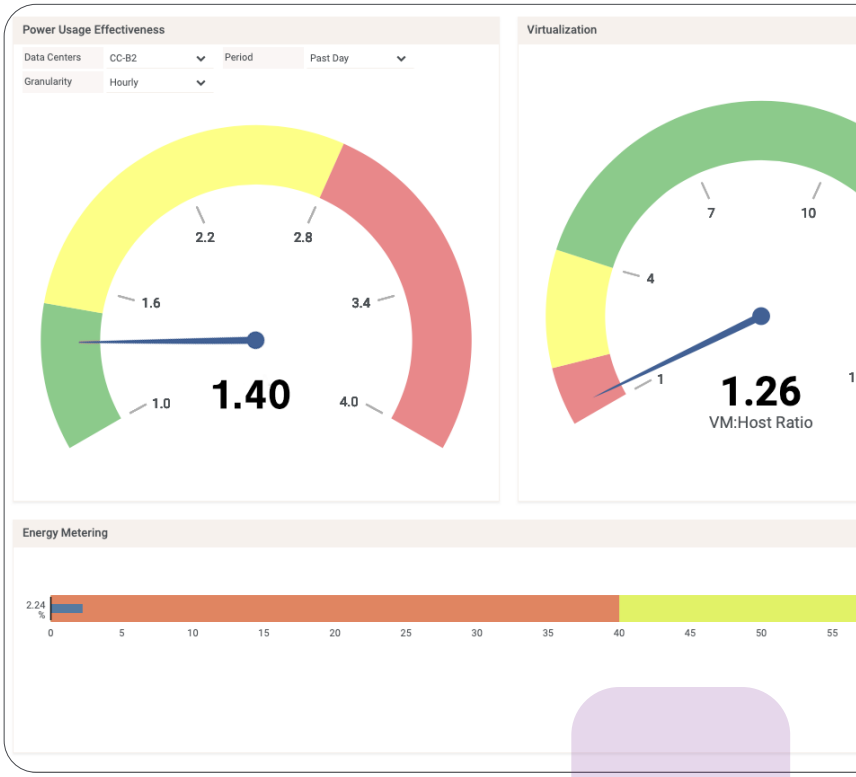
Collect data on your energy consumption.

BEST PRACTICE
#1

The first step to increasing your data center's sustainability is to collect data on how much power you are using. This data is critical for better decision-making and to see the impact of efficiency initiatives in your data center.

Intelligent rack PDUs are a must-have for determining power usage and available capacity at the rack. Outlet metered PDUs provide data at the device level so you can identify ghost servers that are wasting space and energy, see power hogs that can be replaced or virtualized, allocate costs to customers, and compare IT efficiencies. Switched PDUs with outlet control allow you to remotely power on and power off individual outlets when equipment is not in use to save energy, just like turning your lights off when you leave your house.

Metering and monitoring every connection point in your power circuits enables you to improve capacity planning, optimize management of existing resources, and report on efficiency metrics like PUE. Other power meter options include bus drops and busway end feeds, remote power panels, floor PDUs, UPSs, and building meters.



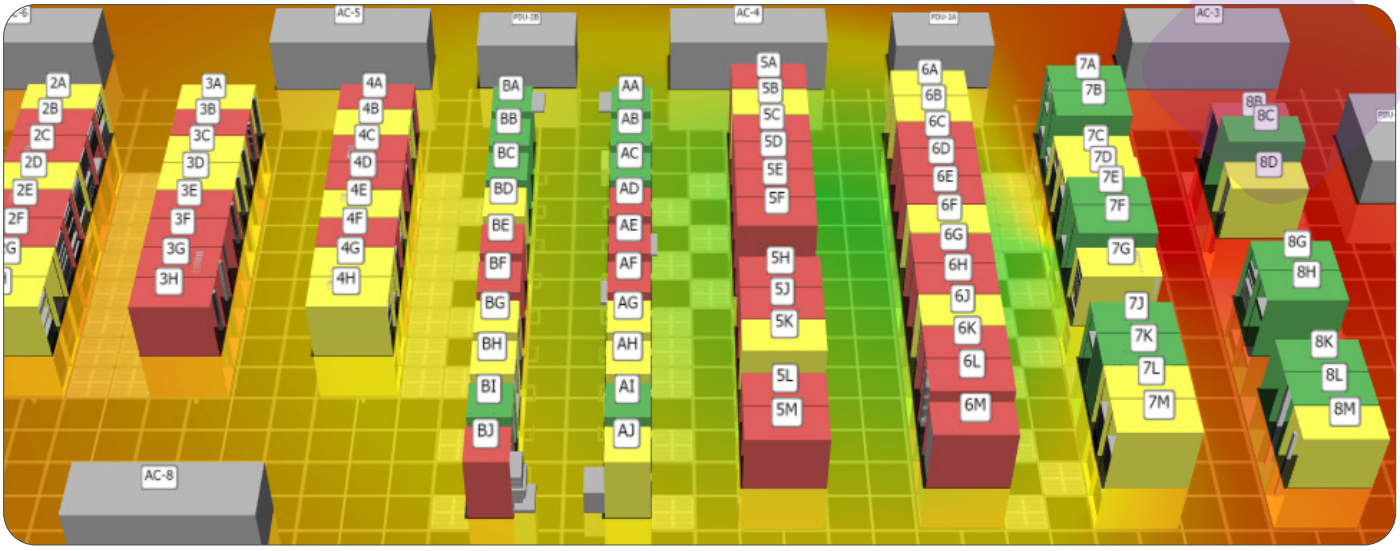
BEST PRACTICE
#2

Collect data on your environmental conditions.

Next, you need to deploy environment sensors. This will allow you to remotely monitor the conditions of your data center, know where opportunities to improve energy efficiency are, and ensure that your efficiency initiatives are not putting your equipment outside of recommended ranges and increasing the risk of downtime. Plus, sensors are easy to install and cost-effective.

Environment sensors that will help you increase efficiency include:

- **Temperature.** Temperature sensors placed at each rack give you data on if you are overcooling, and if so, by how much. With this data, you will know how much you can raise temperature set points by to save energy. Temperature sensors also help you ensure you don't raise temperatures above manufacturer or ASHRAE® recommendations which can damage equipment and cause downtime.
- **Humidity.** Humidity sensors placed at about every five racks will let you know if you are wasting energy by allowing your CRAC units to excessively humidify or de-humidify your environment.
- **Airflow.** Airflow sensors placed at each cold air supply and hot air return allow you to ensure the cooling system is functioning properly and that airflow is at the right level so that all your equipment is receiving cooling air as efficiently as possible.
- **Air pressure.** If you have a hot/cold aisle containment system in place, air pressure differences between the aisles could lead to partition leaks that lead to inefficient cooling and hot spots. Air pressure sensors placed under the raised floor can provide data to CRACs, CRAHs, or the building management system to vary fan speeds to efficiently cool the data center.



BEST PRACTICE
#3

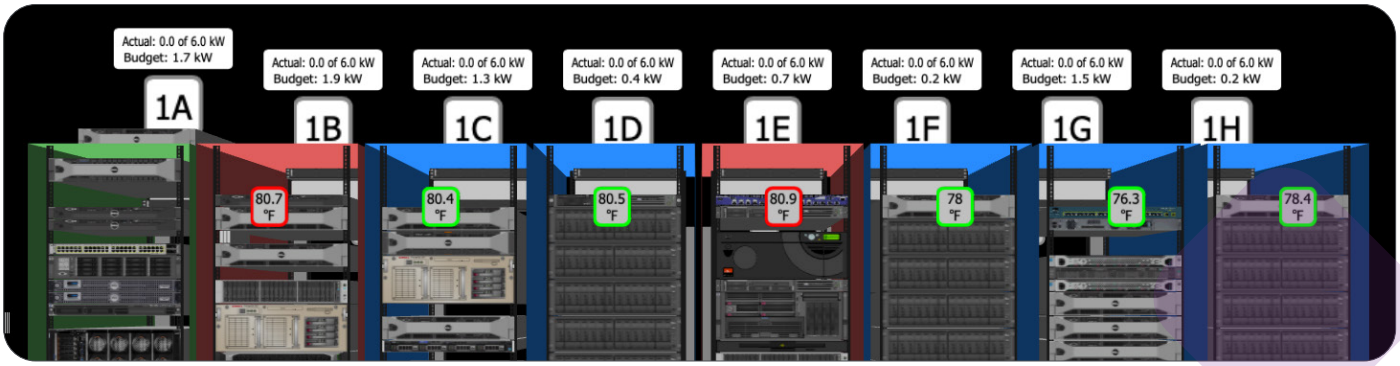
Deploy a complete data center management solution.

Data Center Infrastructure Management (DCIM) software—when combined with metered power infrastructure and environment sensors—forms the complete solution to operate highly efficient data centers.

DCIM software provides an enterprise-class polling engine that collects live measured readings from your meters and sensors, stores that data over long periods of time, and transforms it into actionable insights that make increasing efficiency easy in the form of zero-configuration business intelligence dashboard charts, reports, and visual analytics on your floor map in 3D. You can also set warning and critical thresholds on your collected data to be the first to know of potential issues such as overcooling or overtemperature conditions.

Reasons to deploy DCIM software at the start of your green data center initiative include:

- **Instant Accuracy.** Have a complete picture of your energy usage and environmental conditions from day one and start trending that data so you can clearly see the state of your data center before and after you've increased efficiencies.
- **Data-driven decision-making.** Turn your meter and sensor data into actionable information. Easily assess, plan, and review your strategy to make the most informed decisions during your sustainability initiatives.
- **Perfect Timing.** Having an objective to increase your sustainability provides a fresh start to move away from manual, inaccurate, and antiquated tools and towards a modern solution. DCIM software will make up only a small part of the project scope, so it's a great time to get funds for a cutting-edge data center management platform.
- **Immediate return-on-investment.** Gain all the benefits of having a DCIM solution right away. Maintain uptime, improve capacity utilization, boost productivity, and reduce costs from the onset.



BEST PRACTICE
#4

Track data center sustainability metrics.

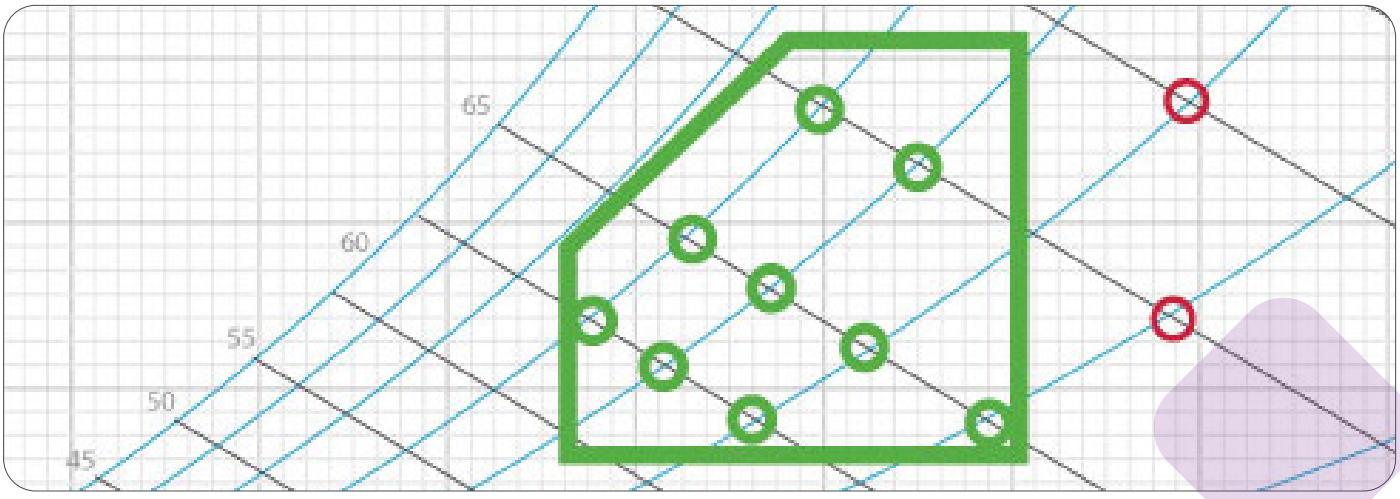
Most data center professionals are familiar with Power Usage Effectiveness (PUE), which is the ratio of total facility energy to total IT equipment energy. The closer to 1.0 your PUE is, the more efficient your data center is.

PUE is certainly one of the most important KPIs to gauge your efficiency efforts, but there are many other KPIs you should measure for the most complete picture of how sustainable your data center is.

Some of the data center sustainability metrics you should track are:

- **Percentage of Cabinets Compliant with ASHRAE Standards –** Measures how much progress has been made towards ideal environmental conditions.
- **Carbon Usage Effectiveness (CUE) –** Measures the overall sustainability of your data center from a carbon footprint perspective.
- **Cooling Capacity Factor (CCF) –** Measures the overall efficiency of your data center's cooling system.
- **Data Center Space Efficiency (DCSE) –** Measures how efficiently your data center space is used.
- **Delta-T Per Cabinet –** Measures how effectively cold air is cooling the IT equipment in each cabinet.
- **Green Energy Coefficient (GEC) –** Measures how much renewable energy is generated onsite.
- **Stranded Power Capacity Per Rack –** Measures how much additional equipment can be deployed in existing cabinet resources.
- **Technology Carbon Efficiency (TCE) –** Measures how clean the energy consumed by your data center is.
- **Water Usage Effectiveness (WUE) –** Measures how efficiently water is being used in the data center.

For a complete list of sustainability KPIs all data center managers should measure, read the **Top 30 Data Center Sustainability Metrics infographic**.



Safely raise temperatures.

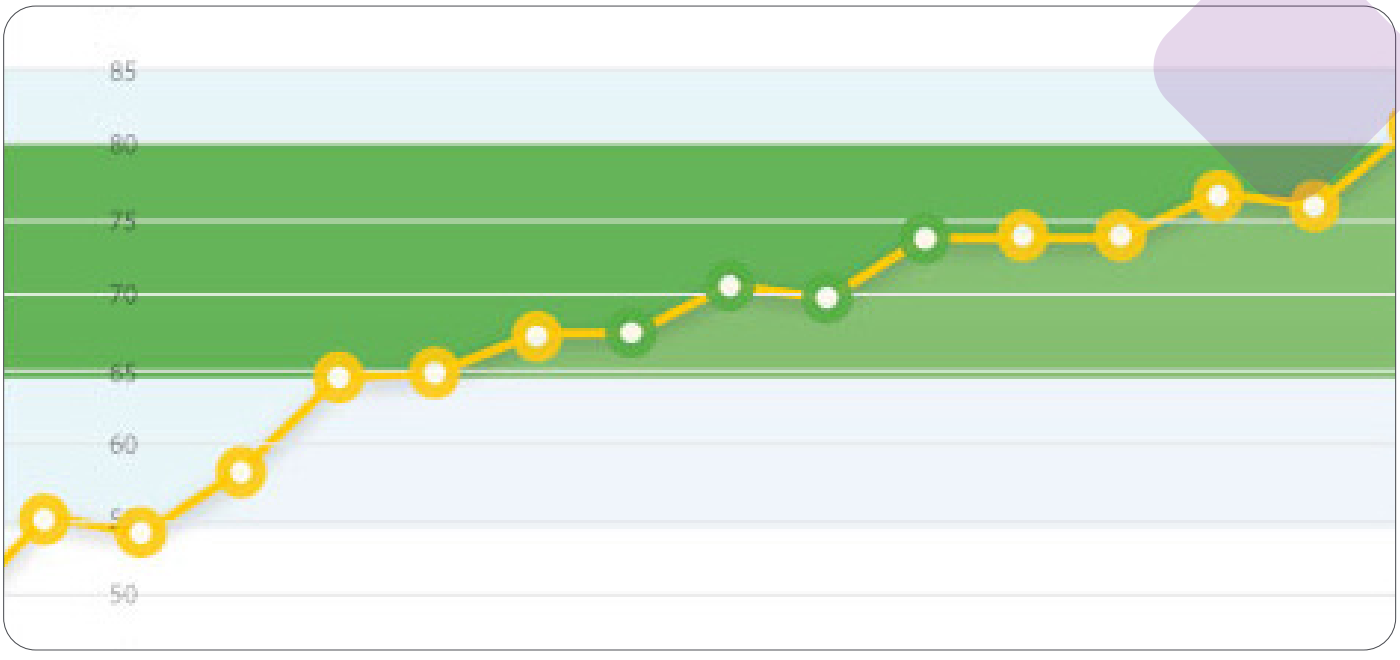
BEST PRACTICE
#5

According to Energy Star, data centers can save 4-5% in energy costs for every 1°F increase in server inlet temperature. Fortunately, obtaining these impressive energy savings without introducing risk can be very simple.

ASHRAE's recommended temperature range is between 65-80°F at the server intake, yet some data center managers play it safe and keep their equipment in temperatures as low as 55°F. This only wastes energy and money. With temperature sensors and DCIM software, it's easy to safely increase temperatures to instantly improve efficiency while ensuring that the equipment is safely within guidelines.

To achieve this, follow these simple steps:

1. Make sure your temperature sensors are placed properly. ASHRAE's thermal guidelines recommend placing no fewer than six sensors in each rack, mounted at the top, middle, and bottom of both the front and back of the rack.
2. With your DCIM software, set appropriate rack inlet thresholds to be instantly and automatically alerted of overtemperature conditions.
3. Check your DCIM tool's built-in ASHRAE cooling charts so you can easily determine if your cabinets are compliant with recommended ranges and assess how much you can raise the temperature.
4. Slowly raise your CRAH/CRAC set points and check your cooling charts again to ensure your equipment remains within ASHRAE guidelines. In some cases, you can even turn off CRAH/CRACs completely.
5. Periodically, review your temperature trends and thermal time-lapse videos in your DCIM software and make any necessary adjustments.



Implement hot/cold aisle containment.

BEST PRACTICE
#6

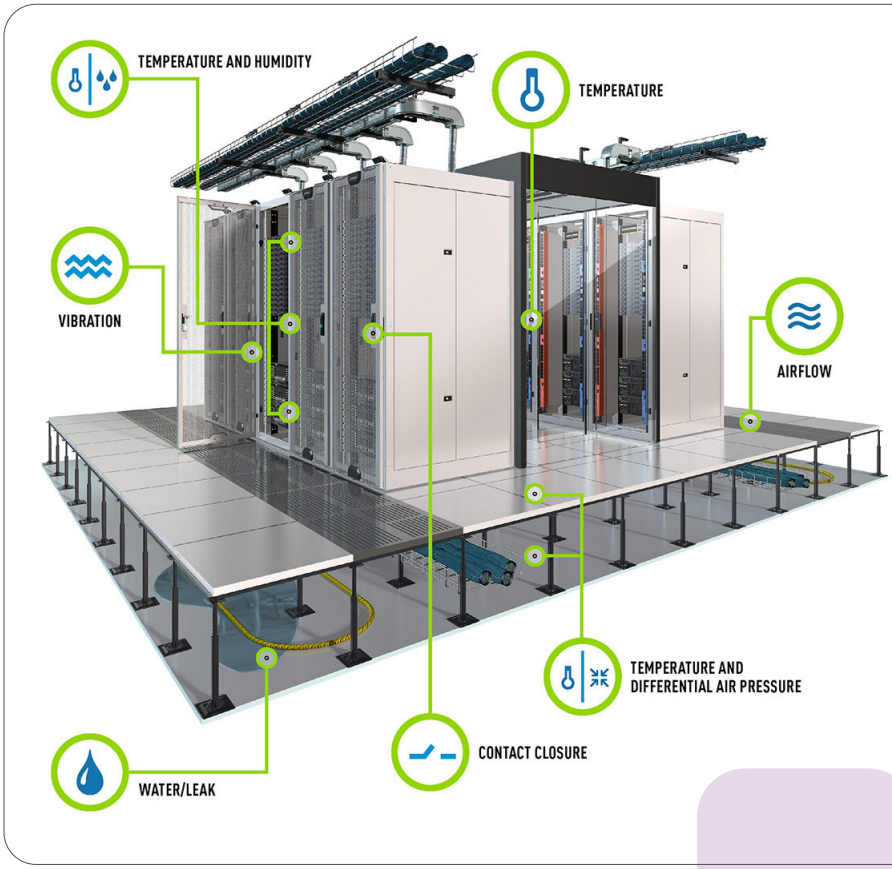
Ceiling panels and doors enclose the hot aisle between rows of cabinets so that warm exhaust air can be separated and returned to the cooling system.

Implement a data center containment strategy where cold supply air from cooling units is separated from the hot exhaust air from IT equipment. This will enable a uniform, stable supply air temperature and warmer, drier return air. The result is that your CRAH/CRACs will only cool the hot air in the data center so they can operate at maximum efficiency.

There are a variety of containment options, including:

- **Hot aisle containment.** Measures how much progress has been made towards ideal environmental conditions.
- **Cold aisle containment.** Ceiling panels and doors enclose the cold aisle between two rows of cabinets, allowing the rest of the data center to become a hot-air return plenum.
- **Chimney systems.** The warm exhaust air is pushed up through chimneys above each rack to the ceiling return air plenum.
- **Curtain systems.** Racks are faced in alternating rows of front-to-front and back-to-back and curtains separate the cold supply air and warm exhaust air.

To learn about other innovations in data center sustainability, read the **Green Data Centers Around the World** infographic.



Minimize bypass airflow.

BEST PRACTICE
#7

Cooling accounts for about half a data center's energy consumption, so improving the efficiency of your cooling infrastructure is critical for improving overall efficiency. One often-overlooked way to achieve this is by optimizing airflow.

Bypass airflow is air that does not pass through and cool IT equipment before returning to a cooling unit, and it should be kept to the absolute minimum. On average, about 60% of cold supply air does not reach the intake of IT equipment.

Some of the best ways to reduce bypass airflow include:

- **Blanking panels.** Blanking panels are a low-cost solution that improves airflow, decreases server inlet temperatures, and increases return air temperatures. Panels alone can reduce energy costs by 1-2%. Don't forget to plug up holes such as open U spaces, spaces between rails and edges of cabinets, and under cabinets.
- **Raised floor.** Perforated tiles should be placed on the raised floor in front of IT equipment that requires cooling. Use grommets in the raised floor to seal cable penetrations and allow for maximum pressure to be maintained under the floor.
- **High-flow cabinet doors.** Perforated cabinet doors improve airflow compared to doors made of glass or similar materials.
- **Efficiency hoods.** Efficiency hoods for your CRAC units allow them to receive warmer air by extending your unit up to the return plenum. Pulling the hottest air possible out of the data center causes the temperature to get cooler and to cool quicker. Hoods can increase the capacity of cooling units by up to 25% and allow CRACs to cycle off more frequently, extending their lifespan.

BEST PRACTICE
#8

Identify and decommission ghost servers and power hogs.

Up to 30% of servers may be "ghost servers" or "zombies"—idle servers that are physically running and consuming energy but are not performing any useful functions.

The most common reasons for this are because new hardware is deployed at such a high rate that decommissioning older servers is a lower priority, some organizations build out additional capacity just in case it is needed, and some data center managers lack data on which servers are not in use.

Ghost servers waste space, energy, and money as they sit idle in your cabinets. Identifying and decommissioning them will improve the overall efficiency of your data center. By deploying outlet metered intelligent rack PDUs and DCIM software, you can easily spot which servers are idle with one simple report.

Just as easily, you can identify which servers are power hogs drawing significantly more power than the rest of your devices. With this information at your fingertips, you can then replace the power hogs with more efficient hardware or virtualize them.

Ghost Servers

Date Range: 2019/11/01 – 2020/10/31

Device	Max kW
Test Power Connection	0.00
SERVER-CAB6F-8	0.05
SERVER-CAB6F-36	0.05
SERVER-CAB6F-2	0.05
SERVER-CAB6E-32	0.05
SERVER-CAB6E-24	0.05
SERVER-CAB6E-18	0.05
SERVER-CAB6E-15	0.05
PDU1	0.00
NEXUS-CAB6F-39	0.05
NEXUS-CAB6E-41	0.05
KX-CAB6F-22	0.05

Consider data center consolidation and virtualization.

BEST PRACTICE
#9

If your data center infrastructure is outdated or your data center's utilization of space, power, and cooling resources is inefficient, you stand to benefit greatly from consolidation and virtualization efforts that will decrease the number of physical assets you have and the associated resources they consume.

Consolidating equipment, racks, or even entire sites enables you to increase efficiency by migrating workloads to fewer physical locations or the cloud. With less equipment and sites to power and cool, energy consumption is greatly reduced.

Inefficient use of space and power can often be attributed to the shortcomings of manual capacity planning and device power budgeting. While the traditional approach to power budgeting is to derate the server nameplate value to around 60-70%, this process is based upon estimations and is largely inaccurate. It often results in wasted space and stranded power which negatively impact your sustainability.

Instead, it is best practice to automate rack power capacity planning to get the most out of your existing resources. Leverage outlet metered PDUs and a modern DCIM solution with an "Auto Power Budget" feature that automatically calculates an accurate power budget number for each make and model instance of a device based upon the actual load of that device in your environment running your applications. Auto Power Budget provides you with many opportunities to safely deploy more devices in fewer racks, enabling highly efficient data center operations.

DCIM users like Comcast and eBay report improvements in rack power utilization by as high as 40%. For more details, read the **Comcast case study**.

Bill back customers for the energy they use.

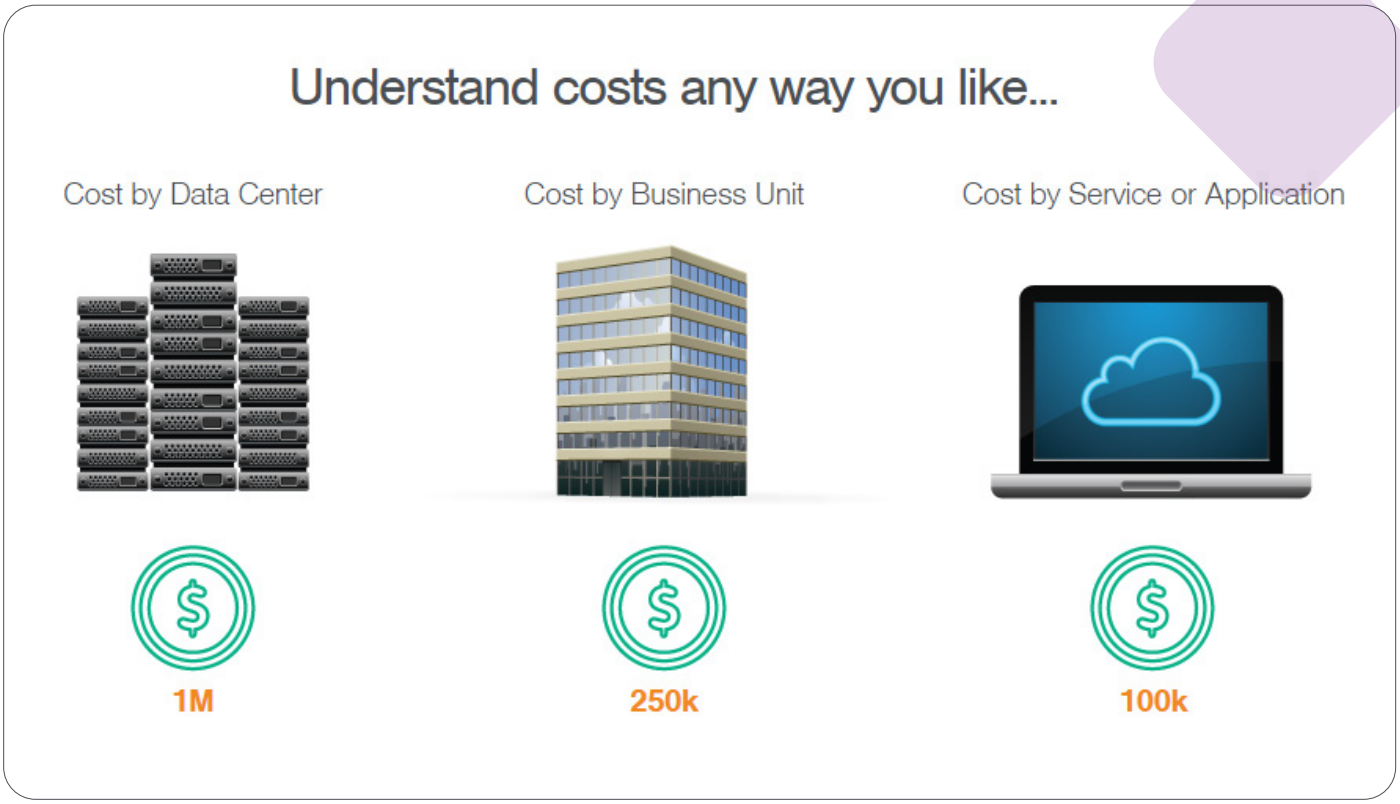
BEST PRACTICE
#10

Today, it's becoming more common for organizations to have green data center initiatives to drive energy-efficient behaviors both from internal and external customers.

However, most data center managers can agree that ensuring compliance with those initiatives is often difficult, reducing the impact of those initiatives on overall efficiency.

A simple way to encourage your customers to follow best practices for energy efficiency and to drive a culture of environmental awareness and accountability is to charge them for the energy their equipment consumes. When they see their inefficient practices affect them directly in the form of higher costs, they are much more likely to be more efficient.

Use your DCIM software to collect and display energy and cost data in bill back reports which can be delivered by customer, data center, or even by rack. Understanding and allocating costs by customer, business unit, or application makes it easy for you to identify power hogs and eliminates human error so your charges are always accurate.



Conclusion

From 2000 to 2005, data center energy consumption grew by 90%. This was noticed by many who raised concern over the sustainability of data centers and their impact on the environment if this growth was to continue.

In response, data centers around the world pioneered many innovations in efficiency and began to align on best practices. The data center industry was able to slow energy consumption to just a 6% increase from 2010 to 2018 while the number of physical servers increased by 30% and virtual machines grew by 550%.

Now, we are starting to see similar headlines as we did then, and data center professionals are being tasked to do more with less to meet efficiency objectives. Fortunately, there are simple steps any data center manager can take to ensure efficient operations.

Data center managers must leverage state-of-the-art infrastructure and software and follow best practices to dramatically increase energy efficiency and reduce their carbon footprint. They did it once before, and now with even more modern tools available to them, they will do it again.

Other Resources to Help You Increase 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
- 8 Best Practices to Simplify Your Data Center Consolidation
- Remote Data Center Management: Metering, Monitoring, and Management in the New Normal

Take the Next Step with Sunbird

Schedule a Personalized Demo

Get a one-on-one live tour of our remote data center management software with a DCIM specialist.

Request Demo Now

DCIM Operations Online Demo

Remote 3D visualization of all your racks, assets, power, and network connections. View 100+ 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. Set thresholds, see trends, and get alerts.

Try it Free

Sources

https://datacenterfrontier.com/the-bitcoin-energy-debate-lessons-from-the-data-center-industry/

https://www.sunbirddcim.com/blog/top-30-data-center-sustainability-metrics

https://www.energystar.gov/products/low_carbon_it_campaign/12_ways_save_energy_data_center/server_inlet_temperature_humidity_adjustments

https://www.datacenterknowledge.com/archives/2012/11/15/benefits-of-data-center-containment

https://journal.uptimeinstitute.com/implementing-data-center-cooling-best-practices/

https://www.42u.com/solutions/airflow-management/blanking-panels

https://regy.com.sg/index.php/products/cooling-optimization/cooling-efficency-accessories/crac-hoods

https://www.chatsworth.com/en-us/news-events/blogs/october-2020/ghost-servers-creeping-you-out-of-efficiencies-and

https://www.sciencedirect.com/science/article/pii/S0306261921003019#:~:text=%5B1%5D%20conclude%20that%20despite%20a,data%20centers%20increased%20only%206%25