cisco Meraki

WHITEPAPER

Six Ways for IT Leaders to Reduce Their Carbon Footprint

Executive summary

Addressing the climate crisis is a critical initiative for governments, businesses, and constituents alike. As the world becomes more connected, technologies like cloud, artificial intelligence (AI), energy-efficient networks, hardware, and the Internet of Things (IoT) create new opportunities to champion a sustainable future. Cisco Meraki has a culture of pushing boundaries and innovating to make IT more intuitive, faster, and smarter for our customers.

We believe applying these same principles to the climate crisis can enable our customers to leverage digital innovations that are good for business and for the environment.

As more organizations set aggressive and actionable goals to reach net zero greenhouse gas (GHG) emissions and move toward using 100% renewable energy in the coming decades, increased emphasis has been placed on improving energy efficiency in data centers. This whitepaper covers a variety of best practices that organizations can adopt to increase data center energy efficiency while reducing their energy usage and carbon footprint. Practices discussed include free cooling, hot aisle containment, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) guidelines, environmental sensors, psychrometric charts, and power usage effectiveness (PUE) monitoring.

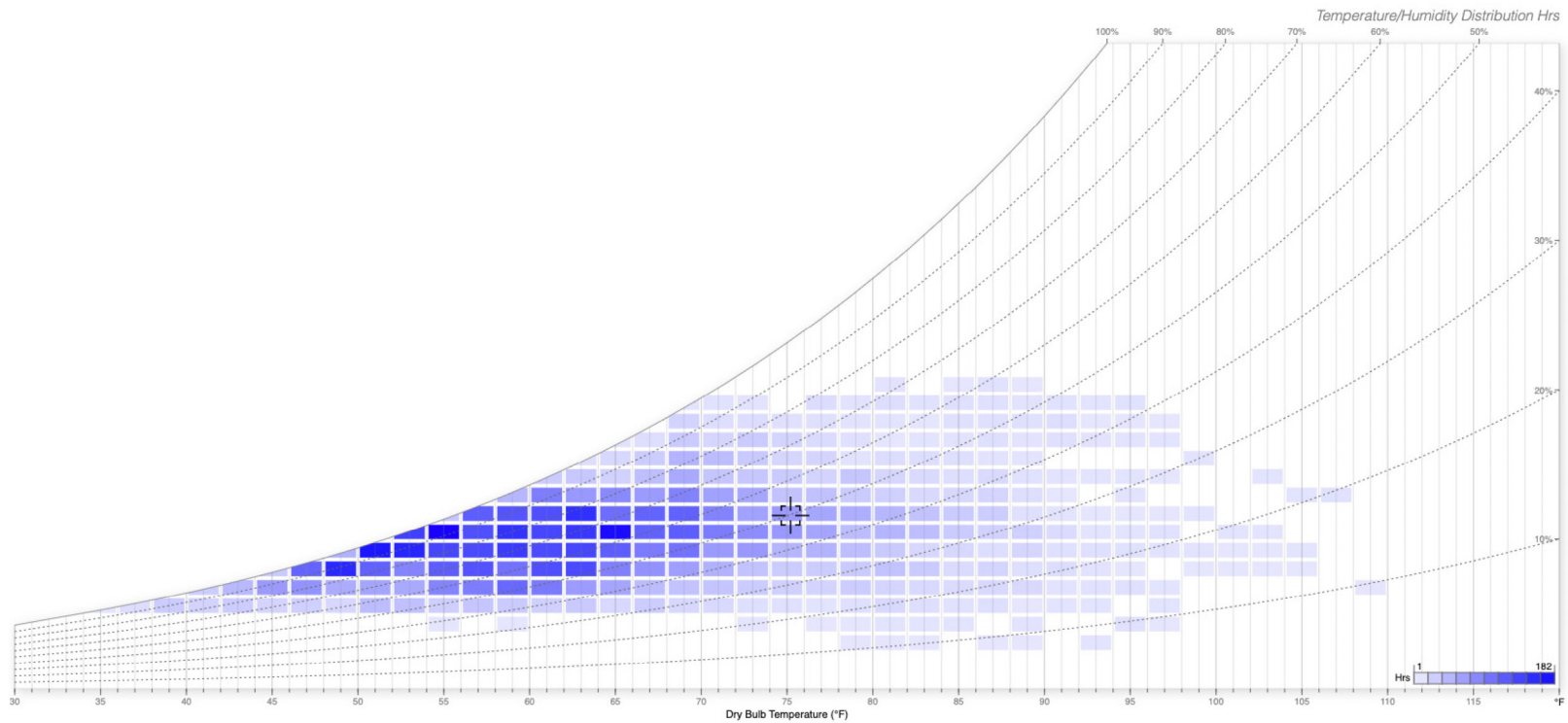
Implementing these tactics can help organizations decrease their energy consumption and associated carbon emissions by 20-50%.

Keeping things cool for free

Data centers and server rooms require a substantial amount of energy to reliably operate business-critical IT equipment. However, in some cases, less than half of the total energy consumed is actually used to power IT hardware. The rest is frequently used by the HVAC system to regulate airflow and protect IT equipment from extreme temperature and humidity. Using traditional mechanical refrigeration from an HVAC system is an energy-intensive process. Significant energy savings and carbon reductions are possible when the data center is cooled and proper humidity is maintained through alternative means.

Fortunately, cool outdoor ambient air and water can serve as a natural alternative to mechanical refrigeration through a process known as “free cooling.” Free cooling uses a machine called an economizer to source naturally cool air or water from the outside to control interior environment levels.

The number of days per year that free cooling can be leveraged will vary depending on the latitude, elevation, local climate, etc. of the location. Research has shown that incorporating an economizer and free cooling can reduce cooling costs by up to 60%. Weather data from specific geographic locations can be plotted on a psychrometric chart to help estimate the number of hours per year that free cooling can be leveraged.



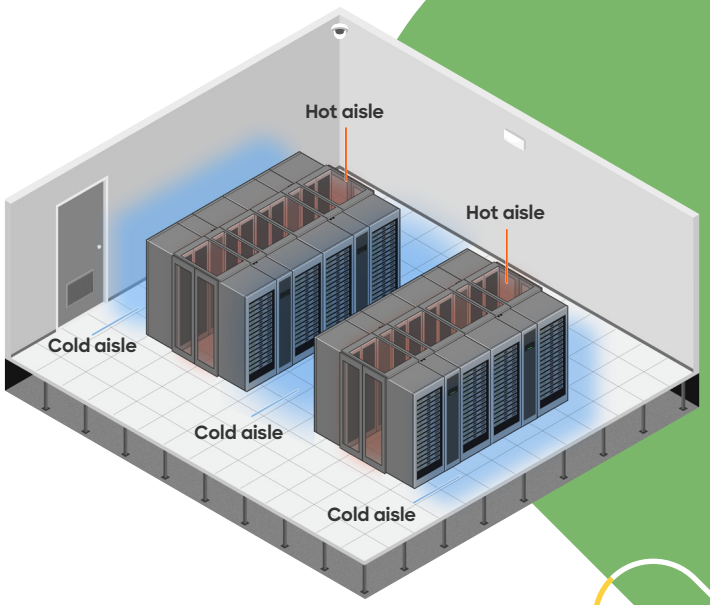
A psychrometric chart showing the frequency of ambient temperature and humidity values per year for a given location.

A common best practice is to place temperature and humidity sensors inside the data center and outside the building to help automate the building management system and determine when the economizer can leverage free cooling or if mechanical refrigeration is required.

A global advertising company and Meraki customer reduced their annual energy cost at one of their campuses from $183,600 to $134,000—a savings of 27%—after implementing Meraki MT sensors and a free cooling economizer. Read the Total Economic Impact™ study of Cisco Meraki MT sensors, conducted by Forrester Consulting, to learn more.

Contain the hot air

Inside data centers, cold supply air is typically drawn over top of IT equipment while hot air is typically exhausted out the back. A significant problem can occur if hot exhaust air from one rack mixes with the cold supply air of another rack. When this happens, the room must be over-cooled to prevent the IT equipment from overheating, ultimately leading to wasted energy. Hot aisle/cold aisle containment is a strategy used in data centers to improve energy efficiency and cooling effectiveness and prevent the hot and cold air from mixing.



To achieve containment, physical barriers or partitions are installed to separate the hot and cold aisles, preventing air mixing. The containment can be achieved through various methods, such as using doors, curtains, or panels on the ends of the aisles, as well as using roof or ceiling systems to enclose the aisles. By preventing the hot exhaust air from mixing with cold supply air, data centers can increase cooling efficiency and energy savings and enable predictable temperatures for IT equipment. Based on estimates run by Siemens and included on the U.S. government's ENERGY STAR program website, implementing hot aisle/cold aisle containment could potentially reduce cooling costs by 10-35%. Organizations can make the decision on how to build out containment systems with Meraki sensors being utilized to monitor temperature and humidity throughout both hot and cold data center aisles, helping to identify hot spots and ultimately supporting the containment system chosen within a particular location.

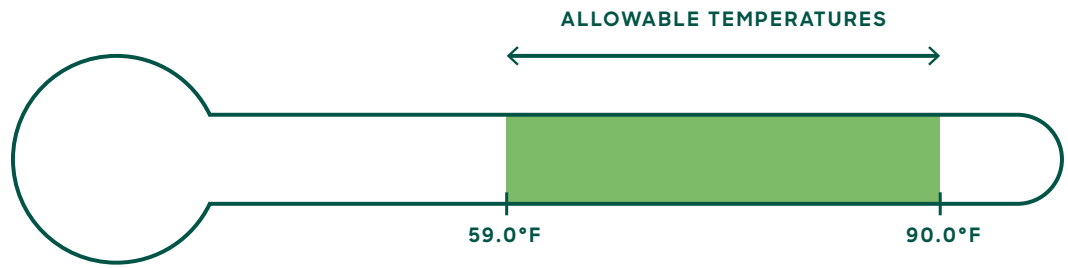
Accurately manage temperature within approved guidelines

It is important for organizations to monitor and manage their data center temperatures based on the equipment they have and the recommended ASHRAE temperature guidance. According to the association's "2021 Equipment Thermal Guidelines for Data Processing Environments," the recommended range should be kept between 18 °C to 27 °C (64.4 °F to 80.6 °F). By monitoring the precise temperature, organizations can ensure that they do not overcool their data centers, which can result in significant energy savings. Research has shown that every 1 °F increase in temperature can save 4% to 5% in energy costs.

As a best practice, Meraki temperature and humidity sensors can be placed throughout a data center to precisely identify hot spots and manage the need for overall cooling. By placing monitoring equipment at inlet and exhaust areas, temperature levels can be monitored and issues with air flow restrictions or the mixing of hot and cold air can be addressed acutely, thus ensuring temperatures fall within ASHRAE guidelines but aren't overcooled in a blunt manner.

By following the ASHRAE guidelines and accurately monitoring data center temperature, organizations can optimize their cooling systems to maintain the ideal temperature range for their equipment, ensuring that it operates at peak efficiency while minimizing energy consumption. This not only helps to reduce costs, but can contribute to a more sustainable and environmentally friendly operation.

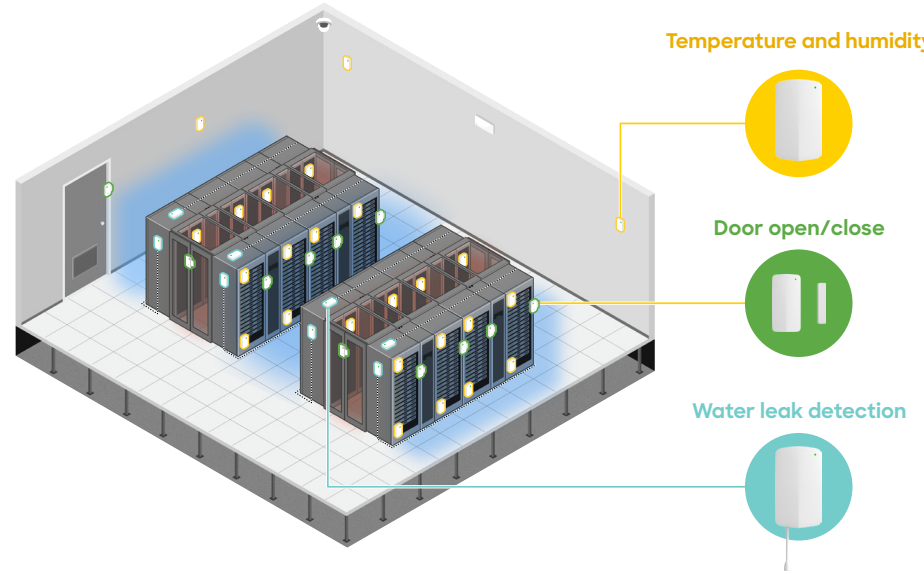
RECOMMENDED SERVER INLET TEMPERATURES



SOURCE: ENERGY STAR

Monitor and automate energy savings with environmental sensors

Organizations can benefit from monitoring and automating the data center environment so that processes are optimized for energy efficiency and equipment reliability. Meraki temperature, humidity, water leakage, and door sensors provide rich contextual environmental data to help technicians proactively identify problems or automate cooling based on IT loads.



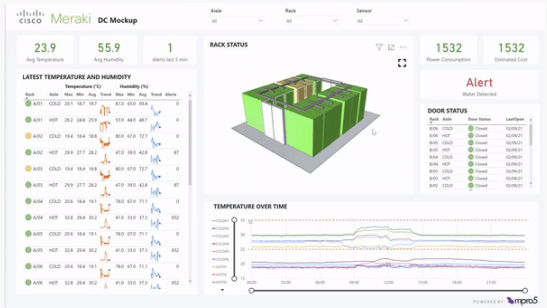
Meraki MT sensors are easy to install and integrate. By placing the sensors strategically, IT teams can reduce the complexity associated with monitoring temperature and humidity while ensuring they stay within the recommended ASHRAE temperature guidelines. Alerts can be sent to key stakeholders when sensor data deviates from the guidelines so issues are quickly remediated.

MERAKI MT SENSORS

Temperature and humidity sensor data can be plotted on Meraki energy savings charts to identify if the temperature can be increased to achieve additional energy savings, while remaining compliant with ASHRAE guidelines. Sensor data can also be consumed by the building management system to determine when free cooling can be used to save energy or if mechanical cooling is necessary for equipment reliability. Greater energy savings and reduced carbon emissions are possible any time sensor data indicates that free cooling can be used.

In addition to temperature and humidity sensors, door sensors can be placed on each rack to make sure the cabinet remains closed. This is extremely important for systems with in-row cooling. Water leak detection sensors can also help prevent catastrophic damage to IT equipment by making sure there are no leaks coming from the HVAC system.

PARTNER SOLUTION



Meraki ecosystem partners can help integrate sensor data with other systems to deliver custom business outcomes.

Learn more at apps.meraki.io

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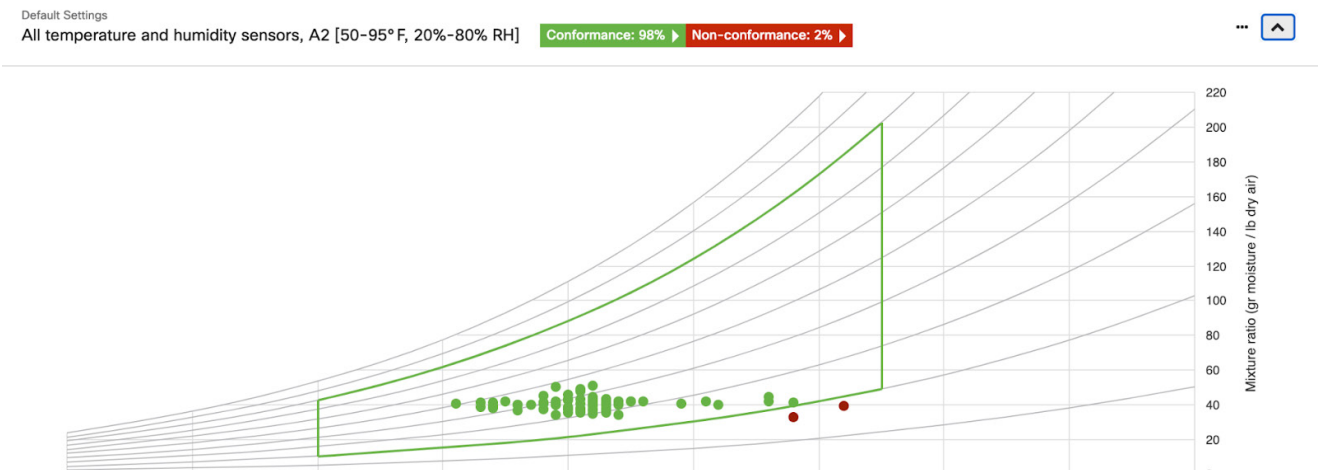
Visible energy savings: meet the psychrometric chart



Individual environmental sensor readings do not provide enough information for organizations to assess real-time operating conditions or make informed decisions on improving data center energy efficiency. Meraki energy savings charts can help address this issue by combining a psychrometric chart with ASHRAE guidelines to help determine the environmental efficiency of a data center or server room.

The psychrometric chart plots temperature against humidity to assess the thermodynamic properties of air. Psychrometric charts are a great tool to help estimate the number of hours per year that free cooling can be leveraged by plotting weather data from a specific geographic location on the chart.

The Meraki energy savings chart overlays an envelope defined by ASHRAE guidelines on top of a psychrometric chart to show the recommended ideal environmental conditions inside a data center or server room.

Technicians can safely increase the temperature of the data center and decrease their overall energy costs as long as the sensor data conforms to ASHRAE guidelines. Conversely, sensor readings can reveal hot spots, identify issues with air flow, or indicate that the temperature or humidity levels in the room need to be adjusted. Data analysis from energy savings charts can also help influence the building management system logic to optimize use of the free cooling economizer to save additional energy and carbon emissions.

You've done the work, now lower the PUE

PUE is a ratio of the total data center facility energy consumption divided by the amount of energy delivered to IT equipment. Energy data is typically acquired from power monitors connected to servers, storage, switches, and other IT equipment, in addition to air handlers, chillers, pumps, humidifiers, and other cooling infrastructure. Data centers become more efficient as the PUE ratio approaches 1.0 or 100% efficiency, however the average data center has a PUE ratio of 1.57.

PUE is an excellent metric to determine how efficiently a data center is operating and can be directly correlated to energy costs and associated carbon emissions.

Decreasing the amount of energy required by the cooling infrastructure is one of the best ways to decrease PUE. Organizations should monitor PUE over time as they implement some of the energy-saving tactics defined in this whitepaper to understand how improvements affect energy consumption.

$$\text{PUE} = \frac{\text{Total Facility Energy}}{\text{IT Equipment Energy}}$$

As an example, BNY Mellon, a global financial services company, decreased their PUE from 2 to 1.52 after installing a hot aisle containment system and increasing the temperature and humidity levels inside one of their data centers, according to ASHRAE guidelines. The net result was 24 million kWh, or $1.7 million, saved over the course of the project, from 2006-2012.

An energy-efficient future

As more organizations voluntarily make climate action pledges and move toward sustainable practices, they can look to their IT infrastructure and data centers to help them meet their carbon neutrality goals. The best practices outlined in this whitepaper offer simple and readily available ways to actively implement sustainability in powering, building, and cooling data centers.

Whether the motivation is out of concern for the climate or a company's bottom line, there is an opportunity for technology to help lead the way. With intuitive technologies like IoT-enabled sensors, Meraki can help you optimize your IT experiences and approach sustainability from a business perspective.

Meraki

To learn more, visit Meraki.com

Ready to take the next step toward sustainability?
Email our IoT sales team to discuss further:
merakiiot@cisco.com