5

Trends Shaping The Future of Data Center Facility Management

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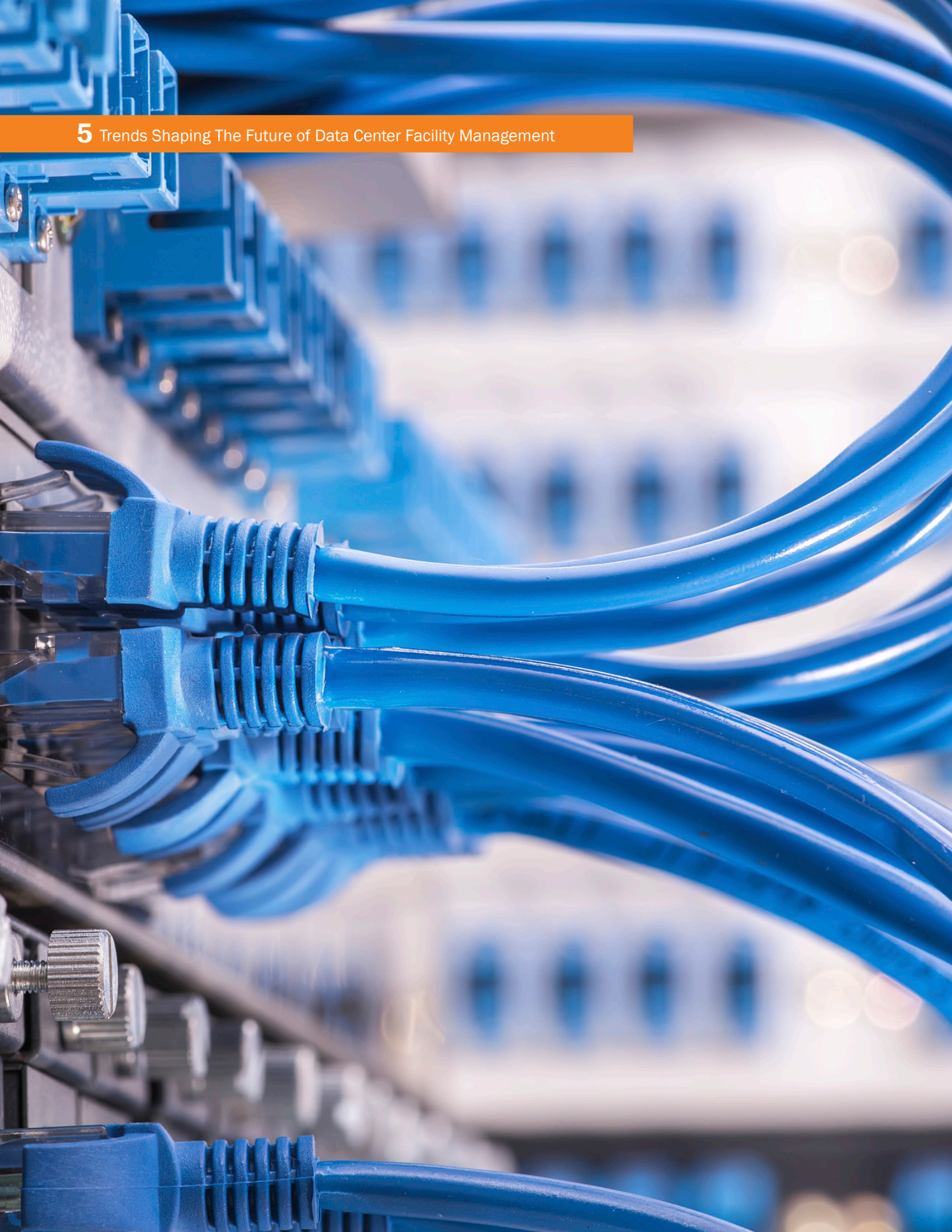

Executive Summary

According to Internet World Stats, an international website that features up-to-date world internet usage, there are currently over 3.6 billion internet users or slightly over 49 percent of the world population (June 2016). Not surprising, the Data Center industry is experiencing phenomenal growth. As a result of this growth, the industry has also become one of the fastest-growing sectors for energy consumption. In 2014, US data centers consumed about 70 billion kilowatt-hours (kwh) of electricity, up 4 percent from 2010, or about 1.8 percent of the country's total energy consumption. Researchers predict another 4 percent increase, or approximately 73 billion kwh by 2020 (US Department of Energy, June 2016).

Although information technology equipment (ITE) operation accounts for a large portion of the total energy usage, maintaining adequate environmental conditions within the data center consumes large quantities of additional energy. A study conducted by market research company, MarketsandMarkets, found that more than 40 percent of the total power consumption within an average data center is spent solely on data room cooling (July 2015). Transferring or converting heat produced by ITE reduces the risk of overheating servers that can impact efficiency and/or damage sensitive circuitry. Data center facility managers, tasked to reduce energy usage and maintain indoor environments, also face rapidly changing standards, higher equipment densities, new performance metrics, the push for greener solutions, and rising customer demands.

In an increasingly competitive market, facility managers can't afford to make costly mistakes. For this reason, staying ahead of the curve requires a focus on the latest technologies available. This is the key to developing and maintaining efficient and cost effective solutions that meet the needs of the growing data center industry.

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Evolution of the Industry

From the time the first modern electrical air conditioning unit was invented by Willis Carrier in 1902, the heating, ventilation and air conditioning (HVAC) market has experienced steady growth. Advancements in technology have led to a greater understanding of air flow, while evolving building designs have prompted the need for greater HVAC performance. A prime example is the trend for airtight construction, first popularized in the 1970s, and persists today.

Today, internet reliance in every facet of life is prompting the need for more robust servers housed in dedicated facilities. Regulating these indoor environments is critical when inconsistent temperature and humidity levels can lead to equipment failure, unplanned downtime and loss of revenue. Additionally, energy and money spent maintaining the indoor environment for ITE reduces profitability of the facility. With ever evolving data center performance metrics and higher goals for energy savings, the push for greater energy efficiency and greener options is creating a need for higher performing HVAC options.

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5 Trends in Data Center Facility Management

Changing rules and guidelines reflect an evolving data center industry. One example is the ASHRAE 90.4 standard that establishes the minimum energy efficiency requirements of data centers for design, construction, and a plan for operation and maintenance. Recently introduced, this new standard includes the Mechanical Load Component and Electrical Load Component metrics, which require new ways for increasing facility efficiency prior to construction. ASHRAE 90.4 additionally references standards that feature wider acceptable ranges for temperatures and air humidity levels that reflect recent improvements in server hardware environmental tolerances as well as regional conditions. On the plus side, the new ranges allow data centers to take advantage of free cooling (air side economizers) and evaporative cooling to reduce mechanical cooling loads. Then again, by widening the window, this standard could potentially open the door for designers or data center owners to risk running their facilities at higher temperatures and lower humidity levels than the equipment was designed to tolerate. Equally concerning, equipment warranties may be invalid at the higher end temperatures.

With the recent push for more sustainable, environmentally friendly buildings, data centers are also challenged to embrace greener practices. The Power Usage Effectiveness (PUE) metric, developed by the nonprofit consortium GreenGrid represents a long standing performance metric for greener industry facilities. As the ratio of total facilities energy to IT equipment energy, ideally the PUE would be 1, where all the energy is used for computing.

For data center facility managers and business owners, achieving energy saving goals while also reducing risk is challenging. Addressing future issues today is essential. Here are five industry trends that are shaping internal environments in the data center industry.

1

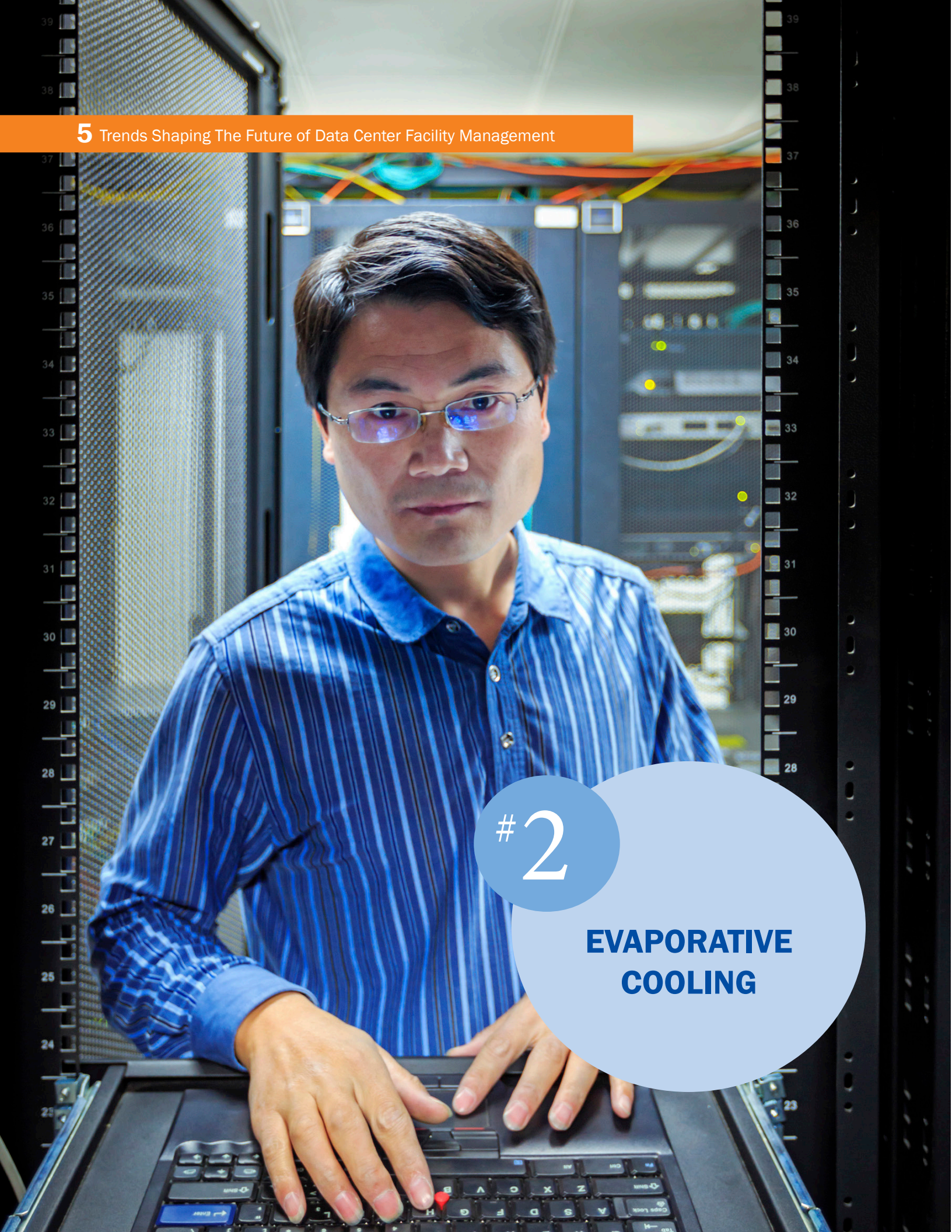
LOCATION

#1 Location

> “Selecting the correction unit for your climate is essential for unit performace and maximizing cost”

A relatively new cost-reducing trend employed by large businesses is locating data centers in areas with colder climates. In 2013, Facebook opened its first mega data center, or server farm, outside the U.S. in Lulea, Sweden. Less than 70 miles south of the Arctic Circle, Lulea’s average yearly temperature is 2 degrees Celsius or 36 degrees Fahrenheit. Large fans pull in the frigid outside air, cooling thousands of servers in a building the length of six football fields. According to the social media giant, this cooling system is 10 percent more efficient and uses almost 40 percent less power compared to traditional data centers. Scandinavian data center locations are also in the works for Apple, Google and Amazon.

Providing free cooling, northern locations offer exceptional value. However, because cold air holds less moisture than warm air, low RH becomes an issue. When adding moisture to the air the amount of energy required to drive the phase change from liquid water to vapor is the same with a cold water or a steam system. However, whereas a steam system uses electricity or natural gas as the energy source, cold water humidification systems, such as high pressure spray or evaporative systems use the energy that is already in the air stream generated from equipment. Because maintaining a consistent RH is essential to fully receive the benefits of a cold climate location, investing in a high performing, low cost humidification system is key.



#2

EVAPORATIVE COOLING

#2 Evaporative Cooling

> "In climates with warm and humid outdoor conditions indirect evaporative cooling can be employed"

Evaporative cooling is a process that introduces liquid water directly into the air without the need for adding thermal energy (heat) to the water. As the water evaporates, it draws heat from the air to drive the phase change from liquid to vapor. Evaporative or adiabatic systems used directly in a ventilation airstream result in both increased humidity and cooling of the air. Reducing mechanical cooling requirements offers significant energy savings.

In climates where direct evaporative cooling in the ventilation air stream is not practical due to warm and humid outdoor conditions, a different approach called indirect evaporative cooling can be employed. Indirect evaporative cooling involves placing an evaporative cooler into the exhaust airstream. This air is then cooled as much as possible and directed through an air-air heat exchanger where it pre-cools incoming supply air. The moist air is then exhausted from the building. The result is a reduction in mechanical cooling requirements without adding moisture to the building.

Unfortunately, facility managers and building owners make the mistake of associating evaporative cooling with dampness, biological issues and odors. As a result, they miss out on the energy reducing opportunities of this process. Modern evaporative cooling systems address many of these issues with intelligent controls, drying and washing cycles, and sterilization systems. Control accuracy has improved greatly over the years as well, which facilitates better tracking of set points and part load operation in the shoulder seasons.

3

INTERNET OF THINGS (IoT)

#3 Internet of Things (IoT)

> "By allowing individual components of the same system to "talk" to each other, the efficiency of the system as a whole can be increased."

The Cisco Internet Business Solutions Group (IBSG) defines the IoT as the point in time when more "things or objects" are connected to the internet than people. Gartner, Inc., the world's leading information technology research and advisory company, forecasts 25 billion connected things by 2020, up 30 percent from 2014.

Why is this important to data center facility managers? Today, many HVAC technologies are reaching their "peak" physical limits of performance and efficiency. This state creates several opportunities for improving performance in the future. Intelligent maintenance and diagnostics along with better interactivity between the individual products that make up a system will have a positive impact on internal environments.

The IoT opens up new opportunities to achieve both of these goals. By allowing individual components of the same system to "talk" to each other, the efficiency of the system as a whole can be increased by enabling individual components to operate longer at their peak level. Utilizing IoT technology increases the ability to operate and run buildings more effectively by ensuring less conflict between devices, such as simultaneous heating and cooling or operating humidification when the cooling system is drawing moisture out of the air. Further, the IoT goes hand-in-hand with building automation, permitting facility managers to oversee multiple automated buildings simultaneously.

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Internet of Things (IoT) - *continued*

IoT enabled devices provide facility managers and building owners with the ability to interact on a higher level with equipment and systems and troubleshoot more effectively. Their increased internal intelligence allows the devices to signal maintenance schedules, indicate issues, and suggest fixes. This can contribute to an increase in overall system reliability and the ability to remediate small problems before they become major failures.

With the integration complexity of the IoT, the skills and IT training required are typically beyond that of the traditional controls contractor. The result is that new smart device connectivity blurs the lines between building controls and IT. That's why ensuring a mix of the right skills is essential to a smooth integration of IoT enabled devices.

Security can also be an issue that needs to be addressed with competent IT staff during the planning stage. For instance, a hacker shutting down the heating or cooling system of a data center could render the facility unusable until the system is restored, halting all data transfer from personal emails to critical business transactions.

#4

LONG-TERM SUSTAINABILITY

#4 Long-term Sustainability

> "The global green building sector continues to double every three years, with survey respondents from 70 countries reporting 60 percent of their projects will be green by 2018."

Maintaining a cost efficient building requires a commitment to follow facility management best practices. Yet, this can be challenging, particularly when it comes to water conservation. Copious amounts of water are required to operate commercial HVAC systems. In addition to the heating boilers, cooling towers, and chilled water systems that are common in many buildings, humidity control systems add to increased water usage. In particular, humidifiers contribute to the overall building water usage. Heating the air causes a significant decrease in RH even though the actual mass of moisture in the air has not changed. This means that ventilating with outside air cooler than the building set point tends to dry the building, an effect that is especially pronounced in cold climates.

Overall, stabilizing the humidity requires adding water to the air, which increases overall water usage.

At the same time, all natural water contains minerals. While these minerals are beneficial in drinking water, they contribute to scale formation within HVAC and plumbing systems. Regardless of the process, whether utilizing evaporated or filtered water, keeping an HVAC system clean and running efficiently requires flushing out minerals. Depending upon the amount of minerals present, the waste water used in the process can be considerable.

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Long-term Sustainability - *continued*

Because energy management also plays a significant role in maintaining a sustainable building, understanding how individual components interact is essential. For instance, updating ventilation equipment to provide increased air flow falls short if existing sheet metal duct work cannot accommodate the increased pressure. Similarly, replacing something as simple as air filters will do more harm than good by releasing particles and contaminants throughout the building if existing ductwork is not cleaned beforehand.

The key to getting the most out of any HVAC system is consistent follow through. According to a report by the Institute for Building Efficiency (IBE), regular maintenance of HVAC systems can reduce energy 10 to 20 percent, regardless of the climate zone (September 2011). Overall, effective energy management requires checks and balances, the right people overseeing the system, and monitoring energy savings to make sure expected goals are met.

#5

HUMIDIFICATION / DEHUMIDIFICATION

#5 Humidification / Dehumidification

> “Humidity control is a key factor in preventing electrostatic discharge (ESD)”

Humidity is defined as the amount of water vapor in air. Whereas absolute humidity is a measurement of the actual water vapor in a given volume of air, relative humidity (RH) is the amount of water vapor in a given volume of air compared to the amount of water vapor the same volume of air will hold at saturation (100% RH) at a given temperature. ASHRAE recommends a humidity level of 41.9°F (5.5°C) dew point to 60 percent RH and an allowable range of between 20-80 percent RH.

For data center facility managers and owners, RH is an important consideration. This is because humidity control is a key factor in preventing electrostatic discharge (ESD), which can damage electronic equipment. Although adding moisture to the air typically requires additional energy, low energy techniques, such as incorporating intelligent water management systems reduces water usage, while minimizing maintenance. At the same time, by incorporating low energy cooling techniques, a company can significantly reduce or even eliminate the need for mechanical cooling, which results in a significant drop in PUE. Further, by tracking moisture levels in the building over the course of the season, facility managers can identify dryness issues and maintain appropriate RH levels. Evaluating the state of humidification equipment, ensuring it is correctly installed and commissioned, and conducting regular inspections all contribute to efficient and trouble free operation when moisture is required.

High levels of humidity in data centers are equally problematic. Too much moisture can cause dust adherence inside IT equipment, reducing heat transfer efficiency and perfor-

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Humidification / Dehumidification - *continued*

mance, and leading to increased failures. Results from a recent study indicate a strong link between humidity control and hard disk failure levels, particularly when humidity levels were elevated ("Environmental Conditions and Disk Reliability in Free-Cooled Data centers" Manousakis et al. 2016). For this reason, it's important for data centers located in areas with high humidity to utilize dehumidifiers and dryers to ensure processes remain safe and stable. Dehumidifiers can protect pipework, installations, operating materials and technical appliances from moisture damage, which can lead to rust, corrosion, mold and rot. This helps to ensure that equipment is always ready for use, reduces the need for expensive renovations and lowers the risk of production downtime.

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Challenges and Solutions

The internet is forever changing the way people interact, share information and conduct business. Assuming this trend continues, by 2020, over 5 billion active internet users will be demanding even faster, more reliable data transfer. For the data center industry, achieving this goal will be challenging. Investing in a reliable, cost effective HVAC system is key. Equally important is maintaining an ideal indoor environment that minimizes risk and allows servers to reach their full potential.

5 Trends Shaping The Future of Data Center Facility Management

Eight Environmental Tips for Data Center Facility Managers

The following tips can help facility managers stay on top of the rapid changes in the industry and produce better internal environments:

The following tips can help facility managers stay on top of the rapid changes in the industry and produce better internal environments:

1. Utilize effective, efficient, cutting edge HVAC equipment. Seek out advances in hygiene, energy and sustainability that are changing the marketplace.

2. Monitor building conditions consistently. Have a systematic process for review and maintenance. Be willing to adapt to changing conditions.

3. Set the bar high. Look for opportunities to use ambient outdoor conditions, and economizer strategies to reduce mechanical cooling loads.

4. Invest in evaporative cooling systems. The cooling effect of evaporating water reduces mechanical cooling requirements and maintains proper moisture levels.

5. Work closely with IT equipment managers to balance loads across the data center and maximize free cooling potential.

6. Invest in reliable controls and sensors for temperature and moisture. Having the correct data allows for fine tuning of systems. Operating HVAC equipment at optimum efficiency points reduces energy consumption and saves money.

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Eight Environmental Tips for Data Center Facility Managers - *continued*

7. Consider outsourcing equipment management to companies that employ experts who are knowledgeable, skilled and certified on a given manufacturer's equipment. This ensures the equipment is maintained to a high standard and keeps the facility functioning at top levels.

8. Stay current on evolving trends. Continuously look to industry leaders for products, procedures and technologies that can improve facility efficiency. Review new data center standards for strategies to help further drive efficiency. Maintain close communication with IT hardware teams; newer generation equipment can tolerate wider environmental conditions, allowing set points to be relaxed.

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Conclusion

For today's data center facility managers and owners who face an expanding global market, a growing dependency on online communication, and increased pressures to reduce energy costs, the challenges are many. For this reason, choosing a HVAC system that meets the needs of the specific facility is essential.

Overall, an increasingly competitive market demands cutting edge technology, progressive thinking, and the ability to embrace changes coming down the pipeline. Facility managers and building owners who see the bigger picture, demonstrate leadership by challenging the status quo, and seek new technologies and solutions, are confidently moving their companies forward today and into the future.

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About Condair

Condair is the leading manufacturer and provider of complete solutions in the areas of humidification and evaporative cooling, with a comprehensive portfolio including products, services, experience and know-how. This enables us to create the ideal indoor climate while keeping energy consumption low and reducing impact on the environment. The company also offers humidifier design, manufacturing, supply, installation, and maintenance, as well as solutions for bacteria control, bacteria testing and energy efficiencies to significantly improve facilities and production. Today, with approximately 600 employees, Condair operates production sites in Europe, North America and China, are represented in 15 counties by its own sales and service organizations and is supported by distribution partners in more than 50 locations worldwide.

For more information or to contact your local Condair representative visit www.humidity.com or call 1.866.667.8321.