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Optimizing Uptime and Availability with Proactive Data Center Mechanical Services

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Chapter 1

Data center expectations, challenges, and needs

Data centers no longer are viewed solely as the background operations and support for the vast quantities of processing and data that businesses generate. Consumerism, digitalization and the Internet of Things (IoT) all challenge the pace data centers have to maintain to meet industry demands, regulations and technology developments.

Uncovering hidden or overlooked opportunities in the data center can help companies minimize risks and downtime, and maximize energy and operating costs. One of such opportunities is with data center mechanical services.

All types of facilities and businesses are reliant on different data centers, from the mid-sized corporate data centers to hyperscale, colocation and enterprise data centers. A downtime event single-handedly impacts profitability and productivity, and in worst-case scenarios, an organization's very survival.

- In the healthcare space, lack of access to patient Electronic Health Records (EHRs) because of data center downtime—at times caused by inadequate mechanical system maintenance—can result in dangerous scenarios in the ER or OR.
- In retail, if a data center is at capacity, this could have a negative domino effect. For example, a retailer's go-to-market product or app launch can be significantly delayed, resulting in negative consumer feedback and repercussions on the company's brand. Specifically for online retailers, a data center that reached its capacity could result in not having a functioning retail website to secure online sales. In both cases, the results could cost their business millions in a short amount of time (such as with annual holidays where brick-and-mortar and online shopping is at an all-time high).
- K-12 school districts and higher education campuses are incorporating technology-rich environments that elevate the educational experience for students, provide better access to technology, and allow teachers to implement more innovative teaching methods. Budget shortfalls leave institutions reliant on shared heating, ventilation and air conditioning (HVAC) systems and aged infrastructures that must now run precariously at capacity. A downtime event can disrupt classes, community events, security access, and even safety.

While each scenario presents different issues that impact uptime and availability, both IT and facilities maintenance directors of data centers are tasked with staying on top of growing demands, changing needs due to next-gen technology, and efficient equipment—all while working 24/7 to prevent downtime.

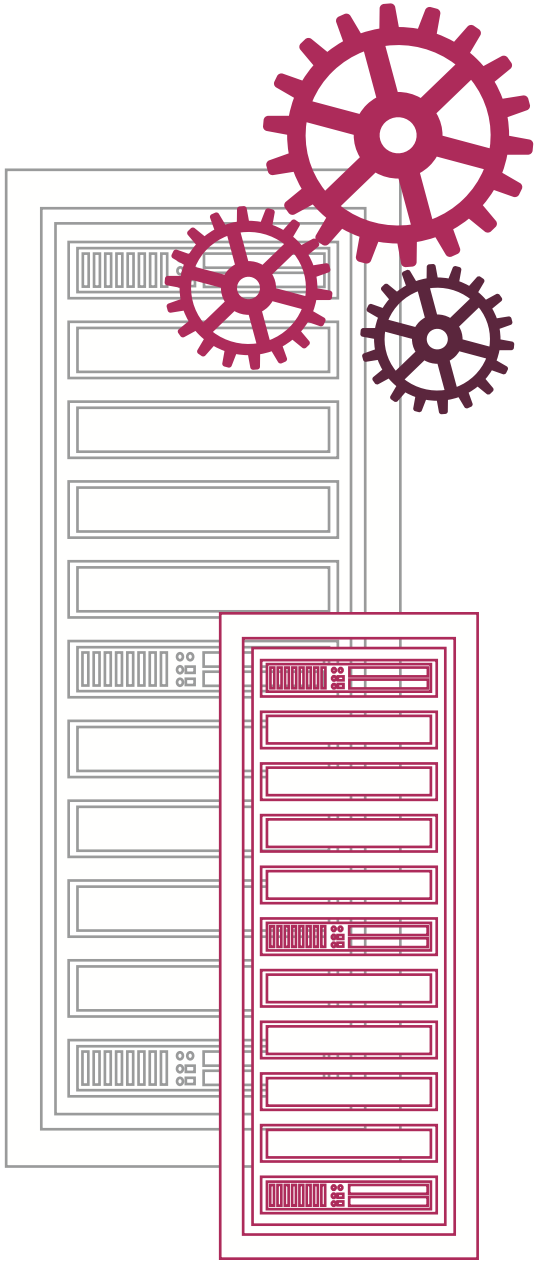
Some companies address this by adding an extra facility, or building in redundancy, as their backup plan. But keep in mind—data center redundancy is NOT a maintenance plan. Another way is through a proactive data center mechanical services approach. This method provides a safety net that ensures IT equipment is being cooled appropriately and efficiently, and without taxing any of the other systems to the point of failure. This approach can also help address high energy bills, compliance issues, and how infrastructure can best support the latest IT technology.

Best results are achieved when a critical systems analysis is conducted to determine risks that—if not addressed—can lead to downtime and also negatively affect equipment longevity. Key performance indicators (KPIs) measure the success of the work that was performed and help an organization realize their operational goals. Improvements that are implemented using this holistic approach can increase availability while reducing total owning and operating costs.

Chapter 1

This eBook will address the key market drivers and trends that are influencing how a data center is designed and maintained today. It will illustrate the data center ecosystem and the role its mechanical system plays in securing uptime and reliability. The eBook will also explore the impacts a mechanical system may have on other data center or facility systems such as electrical, fire suppression, building automation, and security.

It will examine both effective and ineffective types of mechanical maintenance services. Finally, it will explain how key performance indicators (KPIs) should align with company goals to measure and manage the success of maintenance programs and provide a roadmap for continual improvements.



7 Questions this eBook will answer:

1. How are IT systems and other critical systems in a data center interrelated?
2. What are the differences between reactive, preventive and predictive mechanical services?
3. What is a critical systems analysis?
4. Why is collecting, correlating and analyzing data from various systems critical for identifying trends, uncovering root causes and implementing strategies for improvement?
5. How can data center managers align key facility goals through the use of robust predictive services?
6. Does one type of maintenance approach provide the greatest value, both initially and year-over-year?
7. Why is it important for your business to understand the inner workings of your entire data center systems?

Chapter 2

Examining the role mechanical services play within the data center ecosystem

Since the days of mainframe glass rooms, the primary purpose of an HVAC system in a data center has been to cool IT equipment. Fast, exponential growth and short-lived IT technology left little time to focus on if the right mechanical system was in place, until an issue arose that caused downtime. Redundant infrastructure systems were built for additional peace of mind.

In 2007, the U.S. Congress, alarmed by the amount of energy data centers required, directed the U.S. Environmental Protection Agency (EPA) to identify strategies that would push the market towards greater efficiency.[1] Fast forward to today and governing and federal organizations continue to target those data centers which continue to consume too much power.

The increased government scrutiny of a data center's natural resource consumption and carbon emissions generated more awareness among the general public and company stakeholders. This contributed to making data center operators much more cognizant of the power and energy being consumed by their facility. Other market drivers also forced IT and facility maintenance managers to look at the efficiency of their infrastructure and cooling methodologies in place.

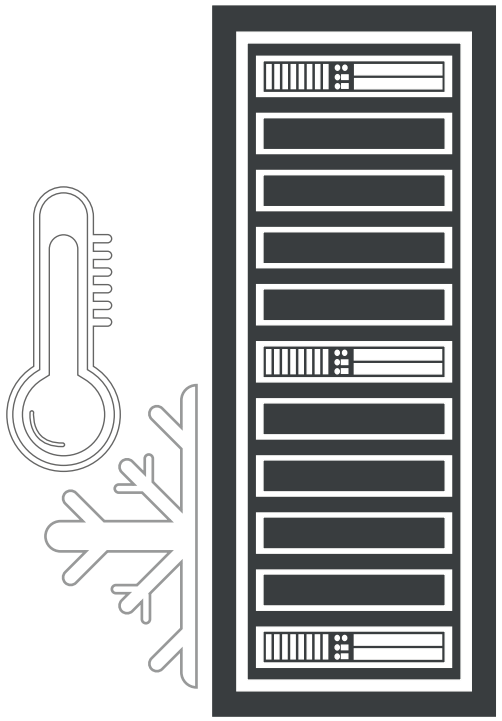
Good news is that proper maintenance of mechanical systems plays a large role in reducing power consumption. As some industry leaders construct new, sustainably designed data centers, the role that mechanical systems contribute is brought front and center. A proactive data center mechanical services approach can help create a facility that is more energy efficient, reliable and environmentally friendly.

Some in the industry achieve energy efficiency and savings by upgrading controls and implementing consistent system maintenance to extend equipment life. Data centers of all kinds are adapting ASHRAE 90.4 air management strategies, evaporative cooling technologies, hot-aisle or cold-aisle containment, and economization of favorable ambient air temperatures to gain greater energy efficiency.

In many data centers, decades-old mechanical equipment reached or surpassed its ASHRAE-estimated 15-year life expectancy. That life expectancy decreases by three-to-five years when the system hasn't been used or maintained properly. The facility managers who have consistently maintained systems through mechanical services have been able to extend equipment life; others use predictive analytics to determine the best time and scenario for system upgrades.

Increasing data center capacity and advancing server technology heightened the need for the right type of cooling strategy with the right mix of airflow, humidity and ventilation. It's estimated that cooling systems consume over 30% of the electricity used by a data center. As such, having the right analysis of the system, room and equipment requirements and components is essential to controlling costs and reducing wasted energy.

Focusing on these elements through implementation of a proactive mechanical services approach can lead to better uptime, reduced operating costs and greater environmental stewardship.



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Chapter 2

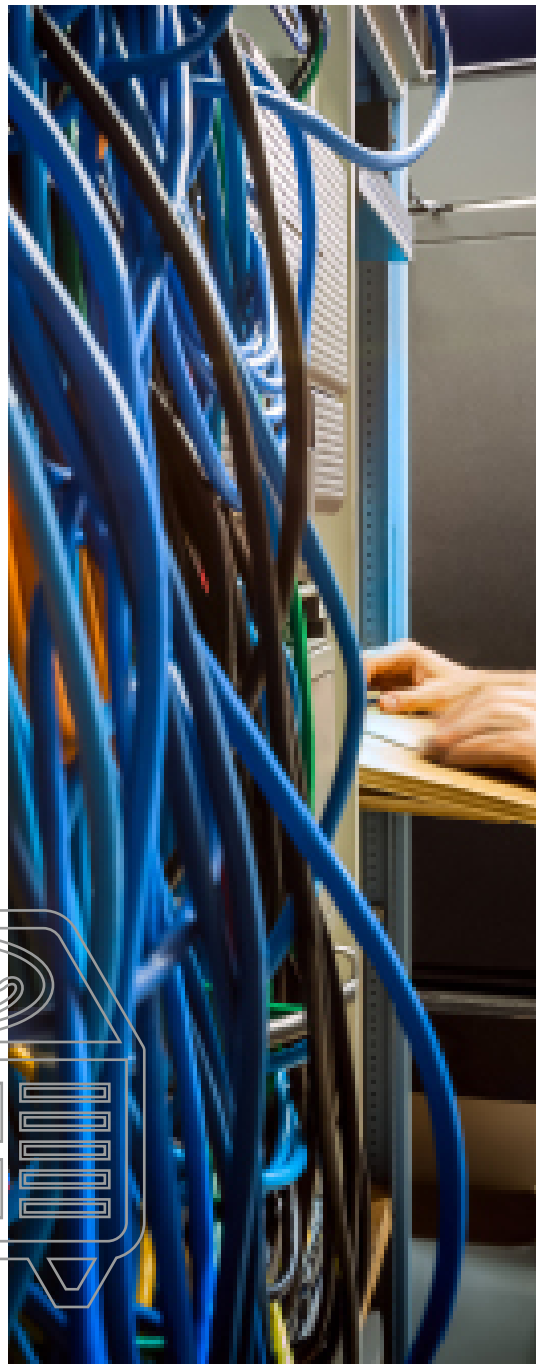
How do a mechanical system's components impact the data center's overall cost of operations?

Proper maintenance of a mechanical system helps control the cost of ownership by reducing costs associated with emergency repair or replacement (e.g., after-hour service charges or rush charges for replacement parts and equipment). Proper mechanical system maintenance can also identify the problem and "fix" a misdiagnosed machine. Hot spots, blocked airflows, and failed or poorly designed cooling systems all put performance at risk. Which is why it is essential to maintain critical system performance and availability.

Approximately 30% to 40% of data center outages are due to infrastructure hardware failures that were avoidable through proper preventive maintenance. While several studies calculate the average cost of downtime in the range of $8,000 to $9,000 per minute, one data center industry veteran estimates the full cycle cost of an outage actually closer to $10,000 or more per minute.[2]

Maintaining the mechanical system and components in a data center is key to controlling energy consumption and improving efficiency, capacity, redundancy, and performance. Such components may include:

- Chiller plant and cooling towers
- Computer Room Air Conditioning (CRAC) units, with side and front access to internal components (in addition to traditional rear access)
- Computer Room Air Handling (CRAH) units
- Air Handler Units (AHUs)
- Fans
- Economizers
- Dampers
- Variable Frequency Drives (VFDs), in cooling devices to control speed of internal cooling fans (eliminating the need to service moving belts)



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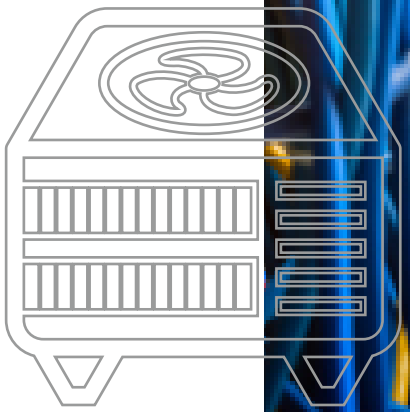

30% to 40%
of outages

Chapter 2

What role does the mechanical system play in the larger data center ecosystem?

From the mechanical to the electrical to the IT systems of a data center—if not addressed properly, a problem in any one of these systems can cause a negative domino effect on the entire data center ecosystem. For example, heavy power loads or a defective piece of equipment can quickly lead to a short circuit or overheating with major repercussions. Because data centers are complex environments with numerous different air patterns, complete integration of critical systems in a data center can ensure complete visibility and efficiency for maximum performance and uptime. This can include such systems as power and cooling trains, fire suppression systems, security and building automation.

Resource demands at one data center resulted in a densely packed server room that reached capacity because its ineffective cooling approach was constantly overheating the servers and other IT devices. Exhaust from one device was sucked into the air intake of another. The AC unit was running at full throttle to push 45-degree Fahrenheit air out of the floor vents into the room. In addition to expensive air-conditioning bills, two to three drives were failing each week. Temperatures behind the racks soared to 100-degrees Fahrenheit. The situation with the elevated room temperatures and high number of servers became so concerning to the point of the Occupational Safety and Health Administration (OSHA) becoming informed.

When a new server room with in-row cooling was built, the internal staff adjusted the set point to 68 degrees Fahrenheit, at the lowest ASHRAE recommended operating range for IT equipment.

In a different case, understanding the delicate balance of systems at his facility prompted one data center operator to consult with a maintenance professional to help implement hot aisle containment. Since the professional was knowledgeable in all of the systems in the facility, they were able to update the cooling units, change constant volume air handlers to variable air volume control, and adjust the speed on server fans to reduce power consumption. In addition, they also understood how the reconfigured room required the correct number of installed fire heads for safety and NFPA compliance.

The complex issues within a data center require an in-depth understanding of all of the facility's critical systems. A professional who understands these systems can advise on and prioritize how the goals and challenges of the facility will be met and measured.

Conducting a critical systems analysis allows data to be integrated into a maintenance and management approach that protects the delicate balance of a data center's ecosystem. When this type of integrated approach is followed, there are fewer surprises and better managed expectations through prioritized goals and measured results.

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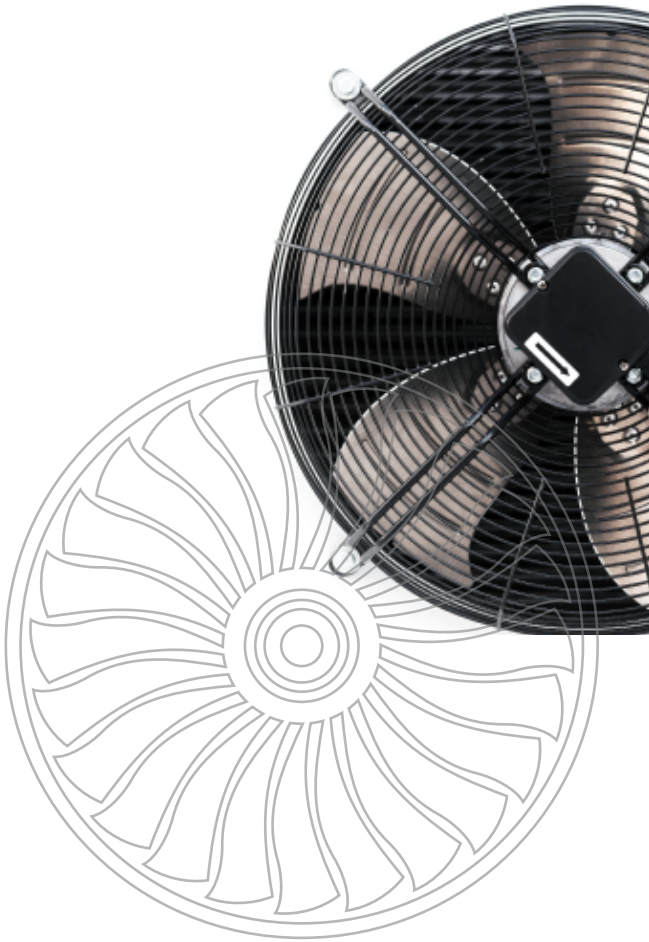

How does mechanical affect IT?

A proactive mechanical services approach helps with capacity recommendations and system optimization by suggesting some simple implementation changes such as:

- Using extra perforated tiles to help cool hotspots
- Moving cable trays overhead to allow better distribution under the floor
- Filling unused positions in the racks with blanking panels to keep cool air from leaking through empty spaces before it reaches IT equipment
- Using variable air volume systems instead of constant air volume systems to redirect or shut off airflow as needed

At one data center, a critical systems analysis uncovered an opportunity to retrofit CRAHs with VFD kits, which enabled fan speed ramp based on underfloor pressure. Doing so allowed the system to maintain the same temperature, yet it operated at approximately 75% less kW per CRAH unit. Repair costs were also reduced as the VFDs decreased the wear-and-tear on fans and belts.[3]

Thermography, also known as infrared or thermal imaging, was used at another data center to look for hotspots to determine if a CRAC unit was distributing cool air to the right places. Scanning top-of-rack temperatures helped determine if the cold air was going back into the CRAC units. Finding these hotspots addressed some of the high risk areas for overheating and enabled fast resolution, which prevented downtime.

Common challenges to maintaining mechanical systems

When well-maintained, a data center's equipment performs reliably, but that is based on the assumption that the right processes, procedures, training, staff, and a knowledgeable expert are utilized.

- Level of expertise and the domino effect: Mitigating human error continues to be one of the biggest challenges for data center operators and various contractors. Varying levels of expertise are necessary to perform maintenance on one piece of equipment without affecting another critical system within the data center. When an under-qualified person performs the maintenance, the risk of a negative outcome escalates.

- Differing environments: Maintaining mechanical systems in complex data centers is challenging and risky. Inconsistent mechanical service maintenance approaches can equally help and hinder data center or facility performance. For example, many hyperscale data centers are able to build new facilities in the cool, dry environments of the U.S. Pacific Northwest, where outside air can be used for free cooling. But what if your data center is part of a hospital, university or federal facility in the U.S. Midwest or Southeast, where hot and humid conditions are the weekly norm throughout the summer? One who is experienced in cross-pollination business strategies and versed in all critical systems can bring new design and equipment strategies into context to achieve efficiency and reliability.

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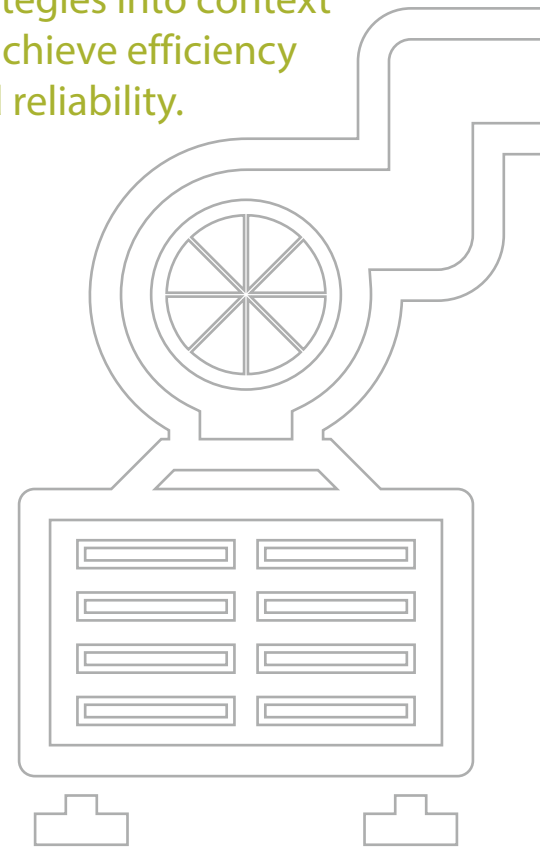
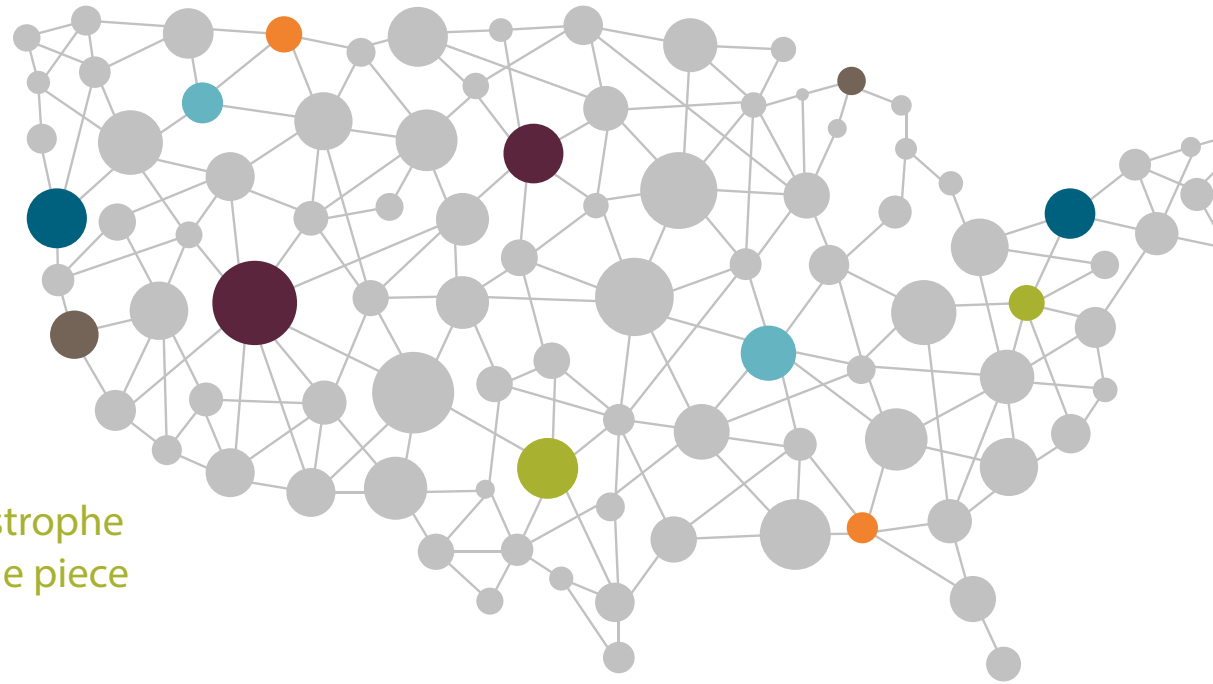


- Siloed IT and facility management departments: With disparate systems, failures are often managed individually. There may not be a single view into the overall problem. Furthermore, the facility manager may be managing multiple contractors or service partners with specialized areas of expertise—in addition to daily responsibilities and managing an internal team. They may also need to address numerous questions on top of all of this, e.g., are they being charged fees for 24/7 support? Is a person accessible locally for troubleshooting each and every system? Are service partners involved in planning sessions for improvements? Do they holistically advise on equipment, systems and new technology? There are efficiencies to be gained by single-sourcing contracts with one main point of contact and centralized control.
- Inability to pinpoint issue and determine root cause: Rarely does one catastrophe start and end with one piece of equipment. Was the problem a faulty breaker, an AHU, a smoke detector, or the chiller? When there's a problem, a root cause analysis is needed and should include thorough documentation and risk mitigation.

Properly maintaining and servicing a data center's mechanical systems requires a critical systems analysis which is essential to an integrated data center management approach. Using a critical systems analysis approach that measures success as related to a company's KPIs ensures results.



Rarely does one catastrophe start and end with one piece of equipment.

Chapter 2

Different data center maintenance approaches

Data center IT and facility managers know that mechanical and electrical equipment and components are like an automobile. Some parts will eventually break. Others require the inspection of normal and abnormal bearing wear and the periodic replacement of oils and lubricants. Whatever the case, the approach IT and facility managers take for mechanical system maintenance does differ.

The reactive or deferred maintenance approach: Few data center operators solely use a reactive (or deferred) mechanical services approach today because of higher repair costs and longer length of downtime.

Additionally, data center operators may rely on their redundant systems. Redundant cooling or power designs allow for concurrent maintenance, ensuring the critical IT load is protected while maintenance on a component is being performed. The challenge is that adding redundancy stop gaps without strong service agreements can be perceived as reactive when an entire system backup does not function properly or the extra facility fails. And using redundant systems can still put data centers at risk. If the backup equipment is never utilized, tested or maintained, the risk of a redundant system being able to perform at load when needed is uncertain.

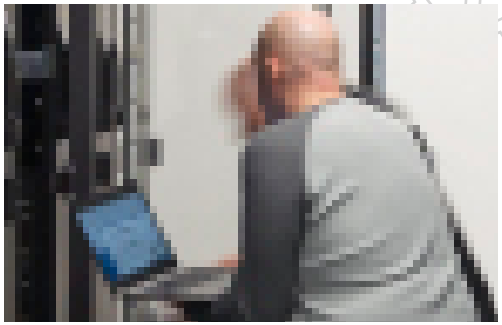
The preventive maintenance approach: A preventive maintenance agreement extends, protects and maintains a data center's mechanical equipment and components. Ongoing preventive maintenance keeps safety and efficiency at the highest levels. It also limits the risk of downtime and, according to ASHRAE, can extend equipment useful life by approximately five-to-seven years.

Preventive maintenance is a time-based approach that is performed seasonally or based on run-time hours. Services may include: the replacement of parts; the thermal scanning of breaker panels; component and system adjustments; cleaning of air or water filters; lubrication; or physical infrastructure firmware updates.

The predictive maintenance approach: Predictive maintenance diagnoses and prescribes; it enables proactive maintenance that leads to improved uptime, PUE and utility savings. Techniques are designed to help determine the condition of in-service equipment to predict when maintenance should be performed. Some examples are vibration analysis, infrared imaging, ultrasonic testing, eddy current testing, oil analysis, and performance trending. A predictive maintenance approach leads to cost savings because tasks are performed only when warranted, rather than because a date marked on the calendar signifies replacement. Adhering to predictive maintenance failure practices avoids unnecessary execution of invasive procedures, which has greater risk of human error, potentially leading to downtime.

The main benefits of predictive maintenance include:

- Convenient scheduling of corrective maintenance
- Uses technology to detect and predict imminent equipment failure
- Allows visual inspection and/or scheduled measurements of vibration, temperature, and oil and water quality
- Enables measurements to compare to a "healthy" baseline and historical software-based statistics
- Helps data center operators schedule equipment repair that is near-failure



Predictive maintenance diagnoses and prescribes; it enables proactive maintenance that leads to improved uptime, PUE and utility savings.

Implementing a critical systems analysis to maximize a data center mechanical services approach

Taking a comprehensive approach to data center maintenance programs begins with an analysis of all of the critical systems in the facility. A critical systems analysis is at the cornerstone of a customizable solution. Mastering the availability of critical assets drives operational business value. Service should be prioritized to the most critical equipment as determined by the data center facility or IT manager. Risk analysis should include looking at the data center as a whole to see what other systems would be impacted by services.

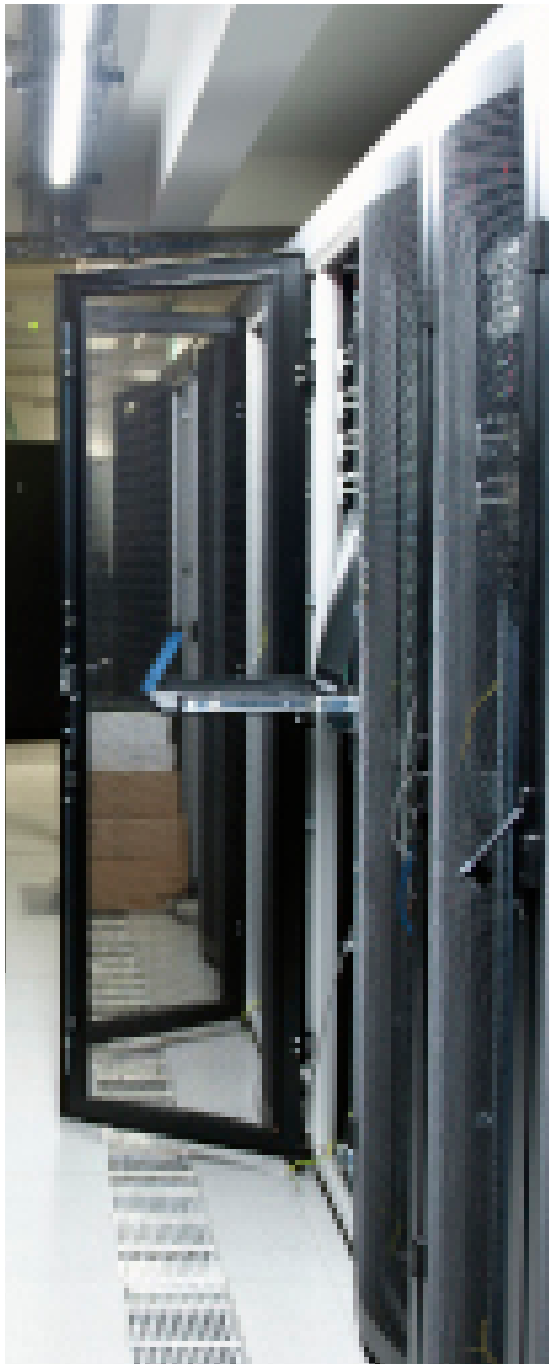
Key considerations include:

- Area(s) served
- If mechanical systems fail, what is impacted?
- Age of mechanical system equipment
- Backup availability
- Downtime cost and damages
- Cost/time to repair
- History of failures

This process first identifies where your operating costs are being generated and where specific services can make an impact.

Efficiently maintaining data center cooling can be achieved through use of performance reporting, aligned services and a custom assessment of your goals and KPIs. This type of integrated approach will help limit the risk of downtime, extend equipment life, address regulatory compliance, increase safety, and reduce owning and operating and costs.

A service program should be discussed and implemented to deliver proven, measurable results that are matched to your unique business needs. Every data center manager has different data center needs. A maintenance program should be tailored to meet the needs of the data center as the criticality of each piece of equipment can vary depending upon the tier level of the facility.



Taking a comprehensive approach to data center maintenance programs begins with an analysis of all of the critical systems in the facility.

Chapter 3

Implementing the proactive maintenance approach

A proactive data center mechanical services approach is a custom-built maintenance plan that involves predictive and preventive maintenance. Preventive maintenance provides for routine inspection of equipment and records, while predictive maintenance identifies potential problems using historic baselines and industry guidelines to prevent business disruptions.

This proactive approach helps data center or IT managers maintain safety, cooling and continuity through comprehensive protection of their data center infrastructure. Flexible services and solutions can be tailored to meet data center requirements and budget while delivering reduced downtime, increased lifecycle, reduced repair and replacement costs, and risk deflection.

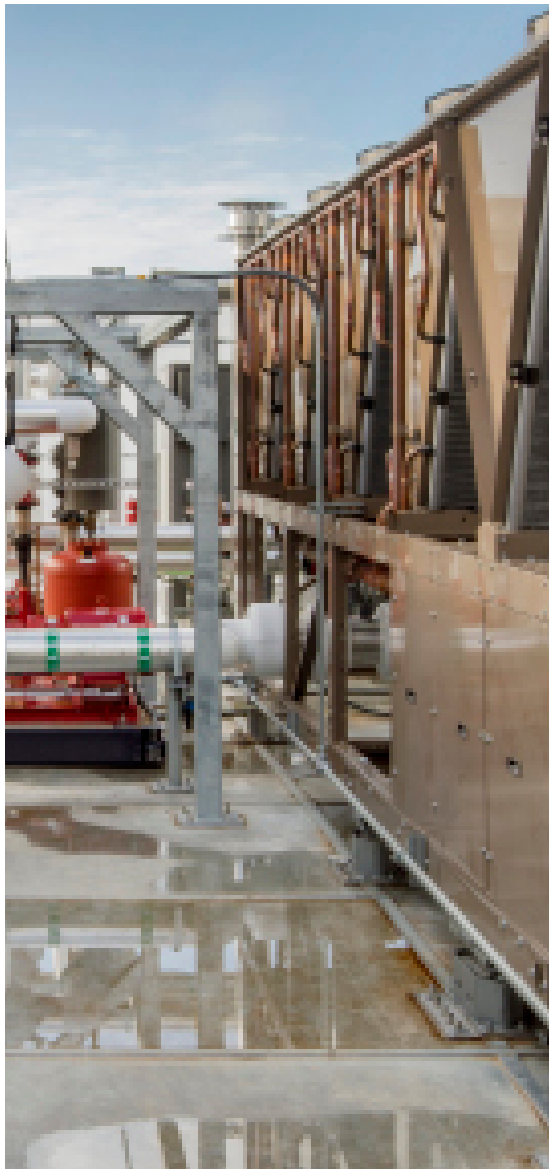
Other areas included in a proactive data center mechanical services approach also include:

- Emergency service: gets systems back online, quickly and efficiently
- System retrofit: repairs or replaces OEM equipment and components with technologically advanced and energy efficient devices
- Performance improvement services: deliver performance reporting to assure peak efficiency
- Training and education: improves staff productivity and knowledge

When a university was preparing to develop a new building to accommodate their growing data and technology needs, their first thought was to build a new air-cooled plant, rather than utilize the existing chilled water central plant that serviced the rest of the campus. A critical systems analysis revealed that the existing plant was not fully optimized and in need of new pumps, VFDs and switches. Variable control technology and building management software were also integrated into the building automation system. The new building was connected to the central plant with chilled water piping, avoiding the construction cost of building a separate chiller plant. These improvements reduced the energy consumption of the central plant by approximately 24%.

In a different case, a data center was proactively managing their facility with a comprehensive program that enabled them to experience huge savings and no unscheduled downtime in nearly three years. During predictive maintenance, trending of a large compressor revealed badly worn bearings. When the bearings were replaced, a design flaw was discovered. This predictive maintenance led to $34,000 in cost savings on parts and labor and $204,000 savings in production.

In yet another case, a once reactive, then preventive data center eventually transitioned to a predictive maintenance approach. In doing so, their unplanned failures dropped to almost zero and the annual maintenance budget on 600 of their critical motor and pumps was reduced by half over a 10-year period.



Predictive maintenance led to $34,000 in cost savings on parts and labor and $204,000 savings in production.

What KPIs can be used to achieve facility goals?

There is no "one size fits all" approach when it comes to maintaining or lowering operating costs. A recommended approach is to first identify where your operating costs are generated and where specific services can make an impact. To assist in measuring service impact, Key Performance Indicators (KPIs) are the metrics used to measure your goals and are a proven way to drive business value. After all, you can't manage what you don't measure. Once the goal is set, it is measured with the KPI. Keep in mind: your list of KPIs is dependent upon your key goals as an organization.

KPIs typically fall into three overarching categories:
- Managing system operations and compliance;
- Optimizing performance and productivity; and
- Protecting lifecycle investment.

Some common examples of KPIs are:
- Energy savings
- Unscheduled downtime
- Maintenance & replacement cost reduction
- Uptime
- Baseline equipment comparison
- Reduced PUE
- Regulation and standards compliance
- Repair cost reduction
- Training
- LEED status

"You can't manage what you don't measure."

Implementing KPIs in your data center

How can data center managers align key facility goals through the use of robust predictive services?

- Develop a systems approach that evaluates critical assets
- Work with a maintenance service partner who utilizes predictive technologies to help guide preventive maintenance programs
- Utilize cost of operating models to align programs with your goals, budgets, and KPIs

A maintenance services partner can help you identify, measure and manage your goals and KPIs. Their services should be tailored around this process and based on a critical systems analysis, and a discussion about what's important to your data center.

Do you want to save energy? Instead of basing maintenance simply on manufacturer recommendations, part of the analysis process should include looking at the efficiency of equipment and understanding what's needed to keep machines operating smoothly. Intelligent decisions can be made based on the tools, philosophies, experience, and resources an outside expert uses to provide you with the results you need. Everything from what's important to your operations as a whole, to how the individual piece of equipment impacts other systems, should be taken into account and used to provide a list of solutions.

Implementation of the goal setting and KPI measurement process begins with a critical systems analysis and then follows specific phases.

The planning and evaluation phase: During this phase, the service program and KPIs are defined. An evaluation should include a cost of operations evaluation, site walkthrough, and an understanding of current maintenance practices and equipment conditions.

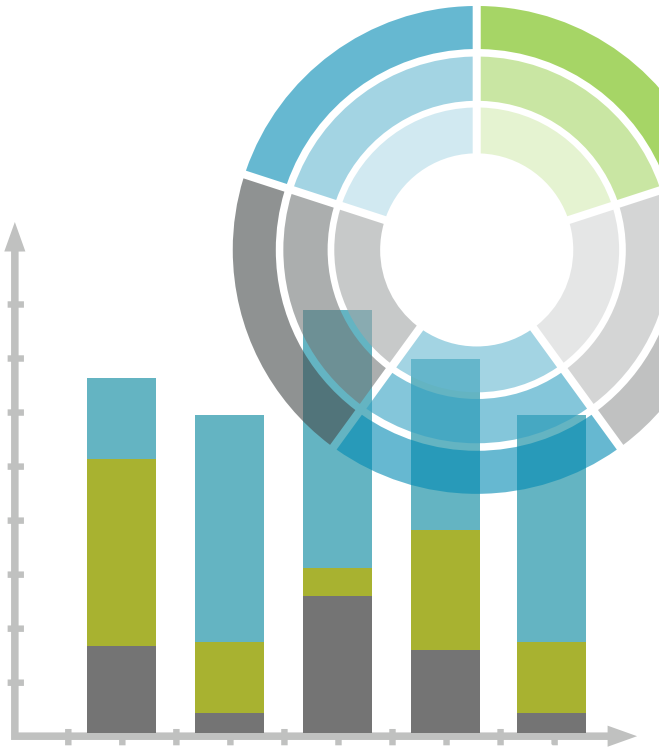
The implementation and service phase: This is when KPI driven services are defined and scheduled. This phase includes program set-up, predictive analysis, establishing baselines, some one-time services, modernizations, and ASHRAE-standard evaluations. Predictive and preventive services are included in this phase.

The measurement phase: This involves demonstrating results through performance and execution reporting, regulations and standards verification, and quality assurance meetings.

Consultation services should be ongoing and—depending on a data center or IT managers needs—scheduled quarterly, semi-annually or annually. During these meetings, outcomes and KPIs should be reviewed, along with cost savings gained from reduced owning and operating expenses. Regulations and standards should also be evaluated.

Data analysis is also continuous. As goals are achieved and measured through KPIs, new goals, emerging technologies, and interests are re-evaluated and correlated KPIs are assigned. This enables year-over-year growth and an ongoing reduction in owning and operating costs.

Continuous data analysis enables year-over-year growth and an ongoing reduction in owning and operating costs.



Achieving results through a proactive approach

The industry is rapidly changing as data growth and hybrid data center models continue to cause added focus on data center and facility lifecycle management.

Several approaches to maintaining a data center mechanical system are evident including a reactive, preventive and predictive approach. Some data center operators today do implement a proactive data center mechanical services approach to maintaining their mechanical systems. Yet, many do not fully reap all the rewards. Proper maintenance of a data center's mechanical system—and how each critical system in the data center affects the other—is not fully understood.

Using proactive data center mechanical services to manage critical systems holistically offers a data center the best value. As part of an integrated data center management approach, a critical systems analysis reveals cost-saving opportunities that proper maintenance can address to help minimize risks and downtime, and maximize compliance, energy and operating costs. In this way, the critical infrastructure layer is connected with the IT stack and key facility goals are aligned through the use of comprehensive services that include metrics, analysis, and follow-up for realignment and continuous improvements.

8

KEY TAKEAWAYS

There are eight key takeaways your data center can leverage to prevent downtime, improve infrastructure which increases availability, and reduce total owning and operating costs.

1. Predictive maintenance diagnoses and prescribes; preventive maintenance protects, extends and maintains.
2. Predictive technologies should be utilized to help guide preventive maintenance programs.
3. A mechanical service agreement that looks at all of the data center's critical systems holistically reduces the potential for downtime and saves money on the annual budget.
4. It is difficult to collect, correlate and analyze data from various systems, which is critical to identify trends, uncover root causes and implement strategies for improvement. As a result, a partner with expertise in many areas and industries as well as the tools, technology and resources can help you address your challenges today and provide you the information you need to prepare for the future.
5. Consider developing a critical systems analysis to achieve lower owning and operating costs.
6. Utilizing cost of operating models can help you align programs with your goals, budgets and KPIs.
7. KPIs align with an organization's goals and quantify the meeting of these goals. As goals are achieved and new goals are developed, KPIs are updated to remain in alignment.
8. As we move towards digitalization, having data about your building will enable the use of powerful analytics and action steps that can lower operating expenses, reduce energy, or prevent emergency costs.

Chapter 5

Next Steps

As equipment ages, and technology and trends evolve, you will need someone who understands such impacts on a data center's delicate ecosystem. Other factors to consider also include the costs of value engineering versus new construction, scalability and sustainability.

Although many companies may service data center mechanical systems, not all use a proactive data center mechanical services approach to match the capabilities and resources that a global manufacturer and industry leader can provide.

Consider the value of the following services when evaluating your next data center mechanical systems services provider:

- Local experts backed by global resources
- Dedicated service resources that ensure service quality and building performance
- Responsive 24/7 onsite and online support
- More than 2,000 service experts at 100+ local office nationwide
- A comprehensive portfolio of mechanical services
- Service program flexibility that adjusts to your needs and requirements
- Single source for long-term system reliability

Additional Resources

> Download the webinar, "6 IT Considerations to Prevent Costly Data Center Mechanical System Failure" now on demand.

> Learn more by downloading our "Proven Outcomes for Data Center Mechanical Services" datasheet.

> For more information, please visit usa.siemens.com/datacenters

References

1. Sasser, John. "A Look at Data Center Cooling Technologies." Uptime Institute. Uptime Institute, LLC. May 2014.
2. Gates, Robert. "Minute by minute, data center outage costs stack up." SearchDataCenter.com. TechTarget. 29 Jan. 2016.
3. Gleason, Matt. (2015). The Value Proposition for Data Center Optimization: https://betterbuildingssolutioncenter.energy.gov/sites/default/filesWednesday%20-%20The%20Value%20Proposition%20for%20Data%20Center%20Optimization.pdf

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