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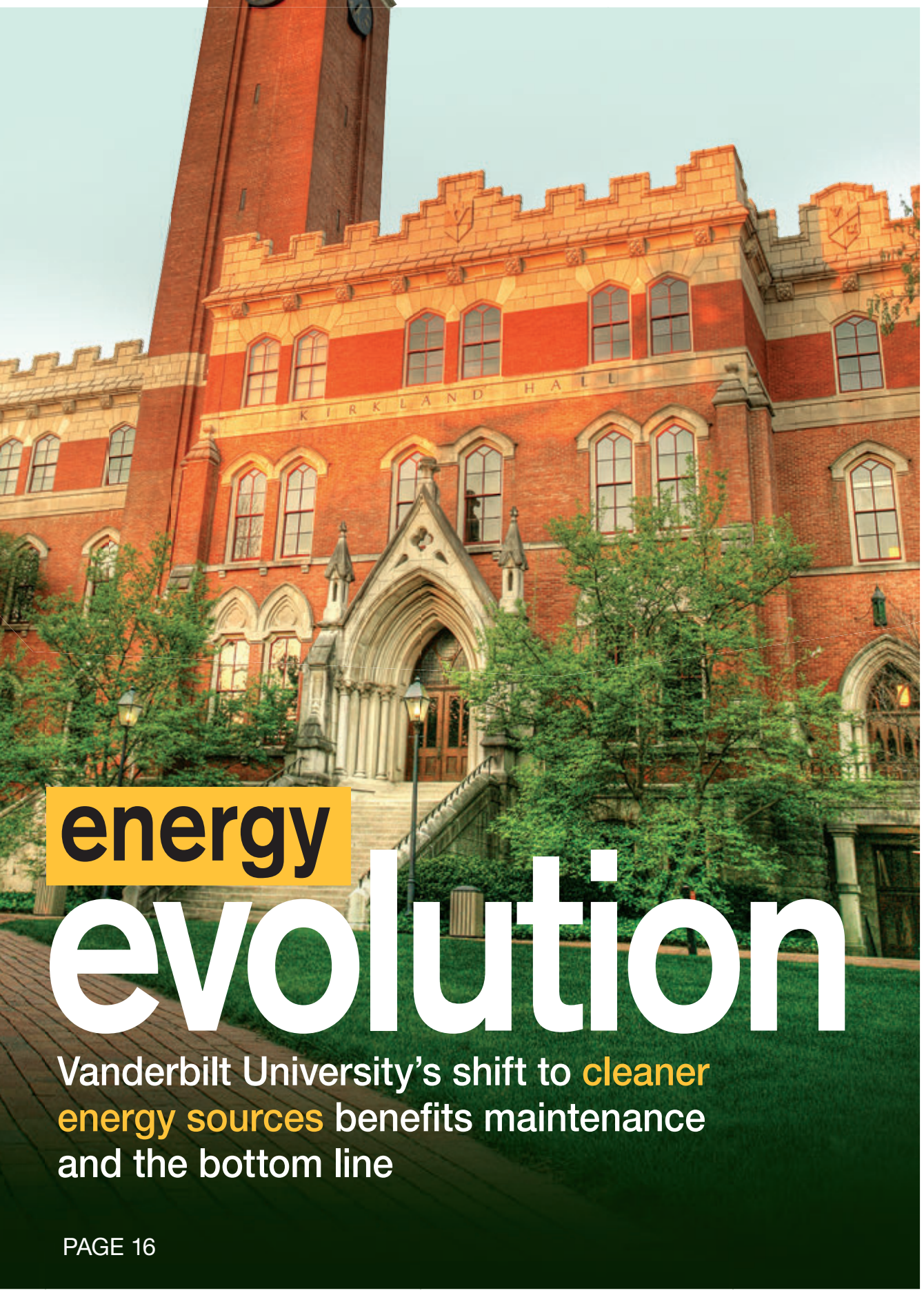

energy evolution

Vanderbilt University's shift to cleaner energy sources benefits maintenance and the bottom line

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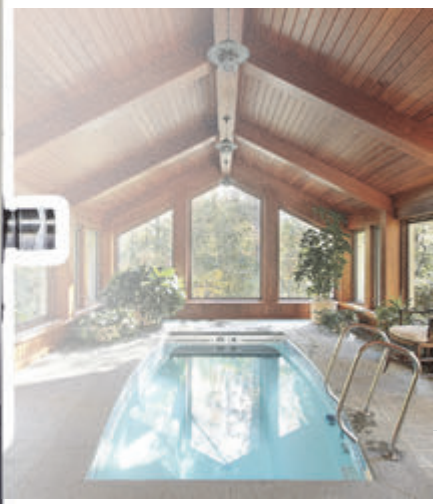

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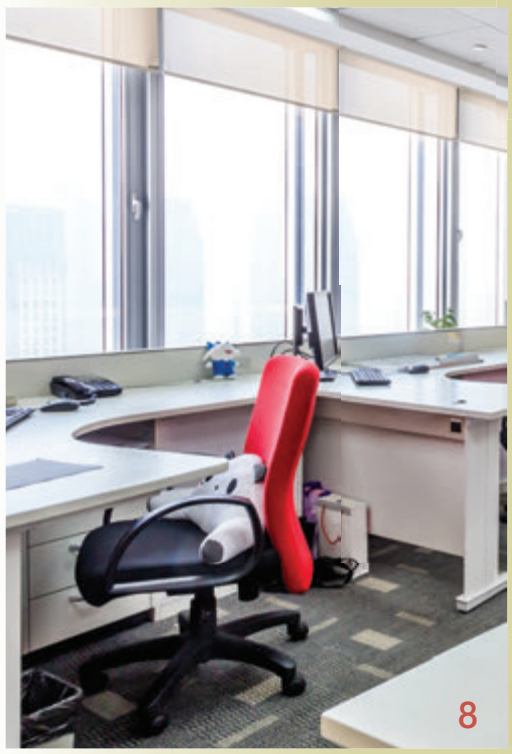

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Ask the Drain Brains—Water Jets vs. Cable Machines. What's the difference?

By Marty Silverman – General Pipe Cleaners

Q. We use cable drain cleaners at our facility. But my young guys keep telling me I should switch to high pressure Water Jets to do the same job. Are they right?

A. Well, yes and no. Traditional cable drain cleaners do a great job cutting up tree roots and retrieving objects. But when it comes to grease clogs, cables have a difficult time.

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Electric jets typically offer a maximum of 1500 psi at about 2 gpm. Trying to get more pressure from an electric motor runs the risk of pulling too many amps and popping breakers. It's better to use a gas powered jet. You get twice the pressure and flow rate of electric jets to handle larger and longer lines. Gas jets can also clear indoor drain lines with a portable reel. It lets you use the power of gas jets in buildings and confined spaces where exhaust fumes could be hazardous, while the jet stays safely outside.

But beware of trying to convert your pressure washer into a water jet. Jets use vibration to overcome the friction in the pipe and help the hose glide around bends and farther down the line. If you don't have pulse, the hose could get stuck in the pipe

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talking points

Thinking Small(er)

Dan Hounsell, Editor-in-Chief

The growth in new construction among institutional and commercial organizations is likely to continue in 2016, according to analysts.

That trend is a welcome indication of improving economic conditions nationwide.

But not all organizations are growing, at least not physically. Some large institutional and commercial organizations actually want to shrink their facilities footprint. In recent months, three large organizations — the U.S. General Services Administration, the University of Minnesota, and the University of Maine — have announced plans to sell, decommission or demolish some facilities.

Such a move is not necessarily an act of desperation. In fact, it often is a careful, strategic plan that can benefit an organization's bottom line. But its impact on maintenance and engineering departments can be another story.

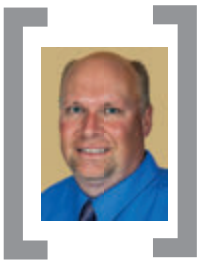
The factors driving these actions have been obvious for years. As buildings age, many organizations face huge maintenance needs, especially among the oldest facilities in their portfolios.

Coupled with tighter budgets, this burden has prompted organizations to rethink their facilities strategies. Some have drastically cut maintenance budgets in response, and the results have been disastrous.

Here's where data can help. In recent years, more managers have turned to data-gathering technology that tracks facility use levels and uncovers energy waste. The results of this process can reveal opportunities to shed facilities and save money.

But in shrinking the facilities footprint, the temptation is to go too far when estimating the funds needed for maintenance and engineering duties. The ongoing challenge for managers is to remind their organizations of the dire results of too little maintenance funding, as well as the central role their departments play in creating energy-efficient and cost-effective facilities.

Dan Hounsell offers observations about trends in maintenance and engineering management and the evolving role of managers in facilities. ***Agree? Disagree?*** *Have something to say? We want to hear from you. Visit myfacilitiesnet.com/danhounsell, and start a conversation.*



Investing in Facilities: Timing Is Everything

Dave Lubach, Associate Editor

Thanks to smart planning and timing, David Dement created some good fortune for the Medical University of South Carolina.

Planning and timing are critical for maintenance and engineering managers, as the university learned last month when record-setting storms dropped 17 inches of rain on the Charleston area.

A 2010 study had indicated that the university's critical systems — emergency generators, boilers, condensate-pumping systems, and chilled-water and medical-gas systems — might be vulnerable to heavy flooding. Seeking to avoid possible threats to hospital operations and systems, the university undertook a $40 million project to relocate the critical systems to a new energy plant and out of harm's way.

Completed in 2014, the plant passed an important test in October as the systems remained operational despite the historic rains. The project also has saved the facility $75,000 a year in maintenance costs and reduced annual fuel use by 10 percent.

The project earned the university a 2015 *Facility Maintenance Decisions* Achievement Award.

"Because of the project, we had no utility system issues and no concern that they were going to be at risk for us," says Dement, the university's director of facilities and maintenance.

The university's good fortune had nothing to do with luck and everything to do with smart planning and timing by Dement and his staff. Maybe the lesson for managers wrestling with the challenges of securing funding for major capital projects is to stress to top executives that the only truly bad time to invest in maintenance is when the crisis already has passed.

Dave Lubach offers insights gleaned from conversations with managers who make key maintenance and engineering decisions in commercial and institutional facilities. ***Agree? Disagree?*** *Have something to say? We want to hear from you. Visit myfacilitiesnet.com/davelubach, and start a conversation.*

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Laurie Gilmer

Solar Solutions? The Future Looks Bright

The use of solar energy in institutional and commercial facilities has seen many advances over the past few decades. In fact, our use of solar technologies in facilities dates back as early as the 3rd Century B.C., when Greeks and Romans used burning mirrors to light torches.

It took several hundred years for discoveries and advances to be made before we finally saw the first silicon photovoltaic (PV) cell capable of powering everyday electronics. That was in 1954, and it was about 6 percent efficient.

Fast forward to the energy crisis of the mid-1970s, when the cost of fossil fuels soared, kindling an interest in solar energy technologies. At that time, the conversation was about energy, both using less and switching to alternate energy sources. The conservation conversation has continued more strongly in the past decade, but the content has changed. It is no longer about energy. Now, it is about emissions.

Raising the energy bar

Energy conservation and demand management are still very important from a facilities cost perspective. Energy is still considered the largest controllable cost in facilities. But emissions reduction is the real goal. In the world of facility management, requirements have been defined for both federal and commercial facilities.

The Energy Independence and Security Act required federal facilities to cut energy use for new and existing facilities. It also defined the Zero Net Energy Commercial Buildings Initiative, which has a goal to "develop and disseminate technologies, practices, and policies for the development and establishment of zero net energy commercial buildings." The effort aims to achieve net zero energy in newly constructed buildings by 2030, in one-half of existing buildings by 2040, and in all existing buildings by 2050.

Executive Order 13693, signed in March 2015, further defined emission-reduction goals for federal facilities, with goals of reducing Scope 1 and 2 emissions 46 percent and Scope 3 emissions 35 percent by fiscal year 2025 against a fiscal year 2008 baseline.

With the focus on emissions, this means buildings not only must become more energy efficient. They also need to employ renewable and clean-energy technologies to reduce the overall emissions footprint.

Solar energy accounts for about 0.4 percent of the total utility-produced energy used in the United States, according to the Institute for Energy Research. That figure may seem small when compared with other clean and renewable sources that account for an additional 17.9 percent. It is important to note that the 0.4 percent quantity does not account for solar energy located directly on commercial and residential sites. If it did, the number would still be relatively small.

Bumps in the road

The solar market continues to grow, though it does face a few key challenges:

Weather. Solar energy collection relies on the availability of sunlight, which can vary greatly depending on weather conditions.

Cost of panels. PV panels have been relatively costly to produce and install for their estimated 20-25 year life span. With that said, tax credits and incentives are available that can bring the overall cost down. The costs of the panels are also continuing to decrease.

Space. PV panels take up space. Typically relegated to roofs and site structures, the amount of space needed to meet a facility's energy needs might not be readily available.

What about maintenance of panels? While manufacturers might say that panels require very little maintenance, to get the best performance out of installed systems, managers should include these steps in any preventive maintenance program:

- Clean panels every 6-12 months or as needed based on monitoring.
- Inspect system quarterly, including inverters, meters, and tracking systems, if present.
- Inspect surroundings for vegetation, pest and other unwanted materials, and maintain the area as needed to ensure access and performance.

Research indicates that nanotechnology can improve light absorption and increase the conversion of light energy to electrical energy

Future focus

Managers exploring the possibilities of solar technologies for their facilities should be aware of exciting new developments that go beyond what we know and see in facilities today.

Perovskites. A new study by Northwestern University and the U.S. Department of Energy's Argonne National Laboratory has found a class of materials called perovskites that is much less costly when used in solar panel production than their traditional silicon-based counter parts. These materials come in at a few months rather than a few years in a life-cycle-cost assessment. The efficiencies are lower than those of silicon-based panels — 11 percent compared to 20-21 percent — but the cost of production is much lower. The product is not yet commercially available, and more research will need to be conducted to provide a viable product.

Nanotechnologies. The U.S. National Nanotechnology Initiative is working to improve solar energy technologies through the use of nanoparticles and nanostructures. Research indicates that nanotechnology can improve light absorption and increase the conversion of light energy to electrical energy, perhaps by several percentage points. While research is still in the early stages, some of the anticipated benefits include:

- Lower production costs using printing-type processes, which are less complex and energy-intensive
- Lower installations costs because collectors could be flexible film rather than rigid panels, making them more adaptable to surfaces and potentially lighter
- More efficient compared with current technologies.

Solar windows. Windows are typically one of the largest areas of heat gain in a facility. Imagine harnessing that energy and using it rather than merely having to condition its heating or cooling load contribution. This product, still reportedly in development, is a liquid coating that turns windows into electricity generators.

Managers clearly have challenges ahead in balancing emissions reduction requirements with reducing the cost of operations. Managers also must balance financial requirements with those of the environment.

Solar technologies provide an excellent answer to goals for reducing emissions. Incentives make current solar-energy technologies more attractive, but these future innovations might allow facilities to excel beyond current capabilities more cost-effectively. ■

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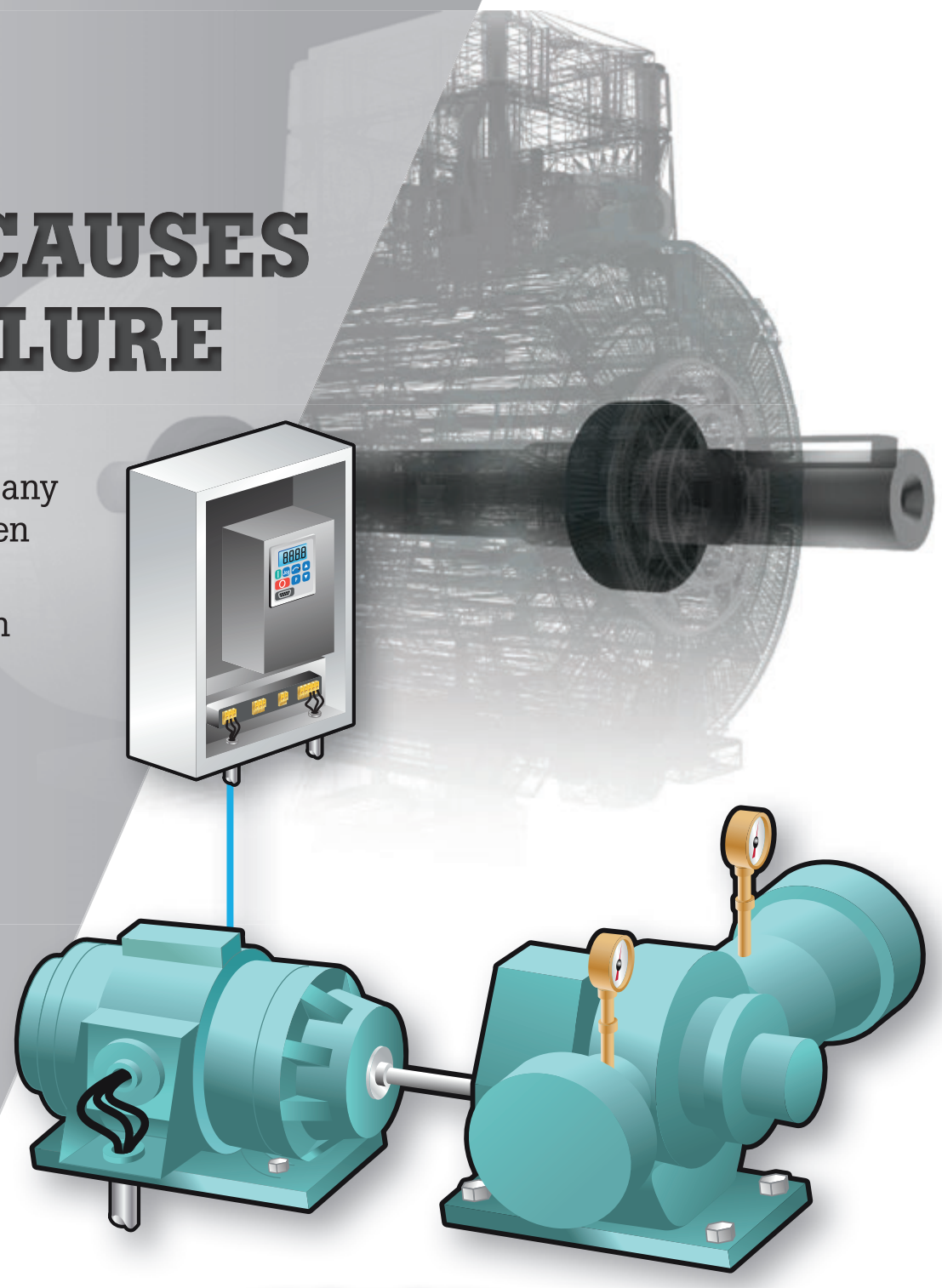
13 COMMON CAUSES OF MOTOR FAILURE



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Daylight harvesting, which can result in energy savings of up to 28 percent, is an ideal lighting control strategy for work spaces that receive consistent and ample sunlight.

Lighting Controls for **Next-Generation Benefits**

A range of strategies and technologies offer opportunities to control costs and improve work environments

By Craig DiLouie

Upgrading lighting systems in institutional and commercial facilities to next-generation lighting technologies can deliver energy and maintenance cost savings of more than 50 percent while maintaining or improving lighting quality. By incorporating advanced lighting controls into a lighting upgrade, maintenance and engineering managers can accelerate cost savings and maximize the value of the upgrade investment in labor, as well as convert lighting from an ongoing expense into a managed building asset.

Lighting controls introduce operational flexibility into lighting systems to support visual needs and energy management. Automatic controls save energy by reducing or turning off lights when occupants do not need them. Implemented in a standalone project or as part of a lighting upgrade, controls can generate energy savings of 24-38 percent or more.

By understanding lighting control strategies, common equipment types suitable for new and existing buildings of almost any type, and applicable energy-code obligations, managers can identify rebate opportunities and maximize the investment in the upgrade.

Control considerations

Lighting control devices and systems accept an input, make a decision about whether to reduce the lighting and by how much, and control the load as an output. The inputs can be manual — based on human initiative — or automatic, meaning they are based on time, occupancy, ambient light levels or instructions from a building management system. The outputs are switching or dimming — or control data.

The unique combinations of inputs and outputs enables a variety of strategies that, when properly matched to the application, can deliver average lighting energy cost savings up to 38 percent.

Manual controls. Manual controls enable users to turn lights on or off or to reduce lighting in response to visual needs. Incorporating flexibility provides a selection of light levels, and it can increase user workplace satisfaction while producing energy cost savings. Lawrence Berkeley National Laboratory (LBNL) estimates average lighting energy savings of 31-36 percent from manual controls. Manual control is ideal for personal work spaces, such as private offices, and for group work spaces, such as classrooms.

Time-based controls. These controls turn lighting on and off, or they reduce it based on a time event, thus saving energy and maintenance costs by reducing unnecessary lighting. LBNL estimates average lighting energy savings of 24 percent using this strategy.

This type of control is ideal for spaces consistently occupied on a predictable schedule, in addition to site lighting applications, where the lighting must remain on even when the area is unoccupied.

Occupancy sensing. Occupancy-sensing controls turn off lighting or reduce it in response to occupancy in the space. The sensor automatically might turn on the lights to full output or a reduced light level, or require manual-on operation for vacancy sensing. LBNL estimates average lighting energy savings of 24 percent from using this strategy. This type of control is ideal for spaces that are intermittently occupied, such as private offices, classrooms, and utility spaces. It also can be effective for lighting that must be on but can be dimmed while the area is unoccupied.

Automatic controls save energy by dimming or turning off lights when occupants do not need them. Implemented in a standalone project or as part of a lighting upgrade, controls can generate savings of 24-38 percent or more

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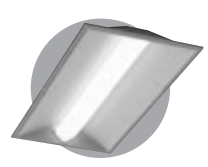
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Classrooms are an ideal setting for occupancy-sensing controls because the spaces are intermittently occupied and require that lights be on but occasionally dimmed when the area is unoccupied.

Daylight harvesting. These controls turn off lights or reduce light levels based on the contribution of daylight to task lighting needs. LBNL estimates average lighting energy savings of 28 percent from this strategy. This type of control is ideal for spaces receiving consistent, ample daylight. If people performing intensive visual tasks regularly occupy the space, dimming is recommended. For other spaces, managers should consider on/off or stepped switching.

Task tuning. This lighting control stretegy involves analyzing the local lighting needs in each space and dimming it in various areas based on the identified need of the space. LBNL estimates average lighting energy savings of 36 percent from using this strategy. This type of strategy is well suited to older buildings that were designed to now-obsolete light level recommendations.

Managers can economically combine these and other lighting control strategies, such as demand response, and layer them within the same space. LBNL estimates average lighting energy savings of 38 percent from using this approach.

Eye on technology

Managers can specify a variety of equipment and options to enact one lighting control strategy or a combination of strategies.

Manual controls. These controls allow local adjustment of light levels. They include switches, wall box dimmers, programmable integrated dimmers, and wall stations interacting with a remote dimming panel.

Panel-based lighting controls. These control systems feature a logic controller and power-output device to switch or dim lights. The logic controller can schedule loads to switch or dimming according to occupancy and in response to input from other control devices, such as light sensors.

Panel-based controls include contactors, controllable circuit breakers and relays housed in a metal enclosure. Various dimmers can enable dimming. These systems commonly are networked to provide remote programming, monitoring and override control. Some offer onboard metering capability.

Occupancy-based controls. Occupancy sensors save energy by automatically reducing lighting when a space becomes unoccupied.

The sensors might be manual-on — vacancy sensor — auto-on-to-50-percent, or auto-to-full-on. They might switch or dim the load. Sensors can use various technologies, including: passive-infrared sensing, which detects the movement of heat; ultrasonic, which detects changes in reflected sound waves; acoustic, which detects sounds indicating human occupancy; or a combination of the technologies.

The sensor can mount on the wall or ceiling or within a light fixture or workstation. One other occupancy-based option is a simple timer switch, which is well suited to small spaces that are used briefly and intermittently, such as utility closets.

Photocontrols. These systems are based on a light sensor that generates a control signal indicating the lights should reduce to save energy in response to available daylight. The control system can be open-loop, which responds only to daylight, or closed-loop, which responds to both electric and daylight to maintain a target light level. Dual-loop sensors are available that claim greater reliability. The sensor might mount on the wall or ceiling or within a light fixture or control device. Some occupancy-based controls offer a daylight hold-back feature, which prevents the lights from turning on automatically when current light levels are sufficient.

Dimmable ballasts and drivers. All lighting systems, aside from incandescent lamps, require a dimmable ballast or driver. This device might communicate with control devices using low- or line-voltage wiring, and it might offer continuous dimming, which is the smooth transition between output levels expressed in imperceptible increments across a range, or step dimming, which is the abrupt or smooth fade transition between one or more output levels between off and full on.

Lighting controls can be standalone devices or systems used to control single lighting loads, rooms, buildings or entire campuses. Devices can communicate via low- or line-voltage wiring to interact as systems. Tying the system to one control point, such as a PC loaded with graphical software, enables centralized commands and scheduling, as well as the potential for generating information managers can use for measurement, verification and analysis.

Application issues

Fully realizing the value of lighting controls requires proper application. This process involves gathering information about the application, complying with energy codes where applicable, taking advantage of available rebates, and choosing the most appropriate equipment based on the application and physical limitations to installation.

Before planning a lighting control upgrade, managers should conduct a walk-through of the building to evaluate control opportunities and needs. The goal is to identify visual needs, occupancy patterns, areas of ample daylight, energy use and physical limitations. Lighting audits that use data loggers to measure lighting use can provide detailed, useful information.

Managers also must consider code issues. Most commercial building energy codes require that a new device replacing a lighting control device must comply with the code's lighting-control requirements. Energy codes based on ASHRAE/IES Standard 90.1-2010/13 require compliance with automatic shutoff lighting control requirements if 10 percent or more of the connected lighting load is replaced as part of a lamp-ballast or light fixture upgrade. Managers should check the local code to understand the requirements that apply to a project.

As for rebates, active commercial lighting rebate programs cover more than 70 percent of the United States. These rebates reward energy efficiency with a cash payment that can significantly reduce the cost of installation and make the investment more attractive.

Existing building applications

Seventy percent of lamps in existing institutional and commercial buildings are not controlled by a manual dimmer or automatic light-reduction or shutoff device, according to the U.S. Department of Energy, presenting managers with major opportunities for energy savings.

For spaces that are consistently occupied, managers should consider time-based controls. This approach involves installing lighting control panels with time-clocks next to the circuit breaker panel or upgrading the panel itself to programmable circuit breakers. For intermittently occupied spaces, managers can consider occupancy sensors and interval timer switches. In spaces with ample daylight, consider daylight harvesting controls, which involves installing photosensors and, where applicable, dimmable lighting.

The primary challenge to incorporating advanced lighting controls in existing buildings are physical limitations related to installing new wiring. When installers must use existing wiring, a good first step is to install wall-switch replacement controls, such as occupancy sensors, and use power line carrier technologies, such as line-voltage dimming ballasts. Some control systems feature a line-voltage conductor as a communication bus, simplifying wiring installation.

Alternately, managers can specify wireless controls to gain flexibility and establish allow control points anywhere within range. Another option is to replace existing fixtures with those featuring onboard controls. For example, consider installing bi-level light fixtures with integral occupancy sensors in stairwells and on the building perimeter.

When new wiring is an option — either within an accessible ceiling or within a raceway surface-mounted on an inaccessible ceiling — low-voltage wiring can connect devices within local systems and to a central point for building lighting control.

Intelligent lighting control systems are suited to existing buildings because installers can use one low-voltage wiring bus to connect intelligent devices implementing multiple strategies, which reduces cost.

With intelligent control systems, zoning and rezoning is implemented based on software, not rewiring, and zoning can be as small as individual light fixtures. Installers can calibrate the controls remotely, reducing commissioning, and the devices can report information about energy use and operating status to a central control point.

LED lessons

LED lighting, with its superior efficiency and service life, is now a popular retrofit choice. This light source is ideal for advanced lighting control. LED is instant-on, and frequent switching cycles do not reduce performance life, making it well-suited to occupancy-based control.

Dimming, available as a standard feature or option with many LED products, can extend service life and delay color shift. A dimmable LED product can be part of virtually any lighting control strategy, but pay attention to the specific product and the way it should be controlled — 0-10V, DALI, DMX, forward or reverse phase-control — to ensure good performance.

A range of advanced lighting control options is available to optimize the performance and energy efficiency of existing-building lighting systems. These options can generate up to 38 percent energy savings while turning lighting into a managed building asset, either as a standalone system or as part of an integrated building management system.

Whether upgrading to next-generation fluorescent and HID lighting or to LEDs, advanced lighting controls can be a critical part of the solution. ■

Craig DiLouie is education director for the Lighting Controls Association, www.lightingcontrolsassociation.org

By submetering their facilities' largest energy-using systems, including boilers, managers can produce detailed data on system performance that is critical in detecting energy waste and developing retrofit plans.

Meter, Monitor, Maximize

Advances in submetering technology give managers enhanced tools to optimize the performance of energy-using systems

By Derek Tynan

The arrival of submetering technology is good news for maintenance and engineering managers in institutional and commercial facilities, even if many do not realize it yet. By submetering their facilities' power systems, managers can produce detailed data on system performance that is critical in detecting system malfunctions, as well as in focusing design and retrofit activities on the most cost-effective energy improvements.

The stakes are high for facilities. Consider this nation's stock of education facilities, which spend more than $14 billion on energy each year, of which 30 percent is used inefficiently, according to the U.S. Department of Energy's Energy Star program.

The deployment of smart meters is increasing rapidly. Currently, 38 states pursue smart-meter deployment, and 60 million meters are expected to be in place by 2019. State programs involved in these efforts range from large investor-owned utilities to municipal utilities. In most cases, the utility provides and installs the meters, making the initial investment for the program, and rolls the program costs into customer rates.

Submetering is an essential component of operational improvements to enhance energy efficiency, perform monitor-based continuous commissioning, and improve sustainability. By staying up to date on new-generation submetering technology and identifying facility needs related to submetering, managers can deploy the technology to maximize the benefit to their organizations' bottom lines.

Dollars from data

Most institutional and commercial facilities depend on a master meter to monitor electricity use. Organizations use this information to bill non-residential occupants at a standard rate, regardless of each tenant's actual use. Submetering allows managers to bill occupants based on actual use. This tactic promotes energy conservation due to the direct effect of energy costs by the end user. In this way, submetering provides immediate savings that persist over time.

These savings fall into two categories. The first category relates to power quality and the energy efficiency of each energy-consuming system and device. The second category relates to the human effect of occupants. An energy professional can quantify these savings by estimating the energy consumption of each major energy-consuming system based on past energy bills. This process is known as energy benchmarking.

Once this process is complete, managers can compare energy consumption in a given facility to that of other buildings or to the facility's historical energy use, or they can conduct an in-depth energy audit to determine the expected energy consumption of each device during each season as a way to identify potential improvements that would provide a quick payback.

Many managers might not know that submeters also can provide key energy data that allows engineers and financial managers to identify areas within the buildings that are not energy efficient and need improvement. Installing submeters can foster energy savings of up to 15 percent of total energy usage.

By knowing when their electricity costs more, building occupants can shift their demand to non-peak times. Managers can use reduced maintenance costs

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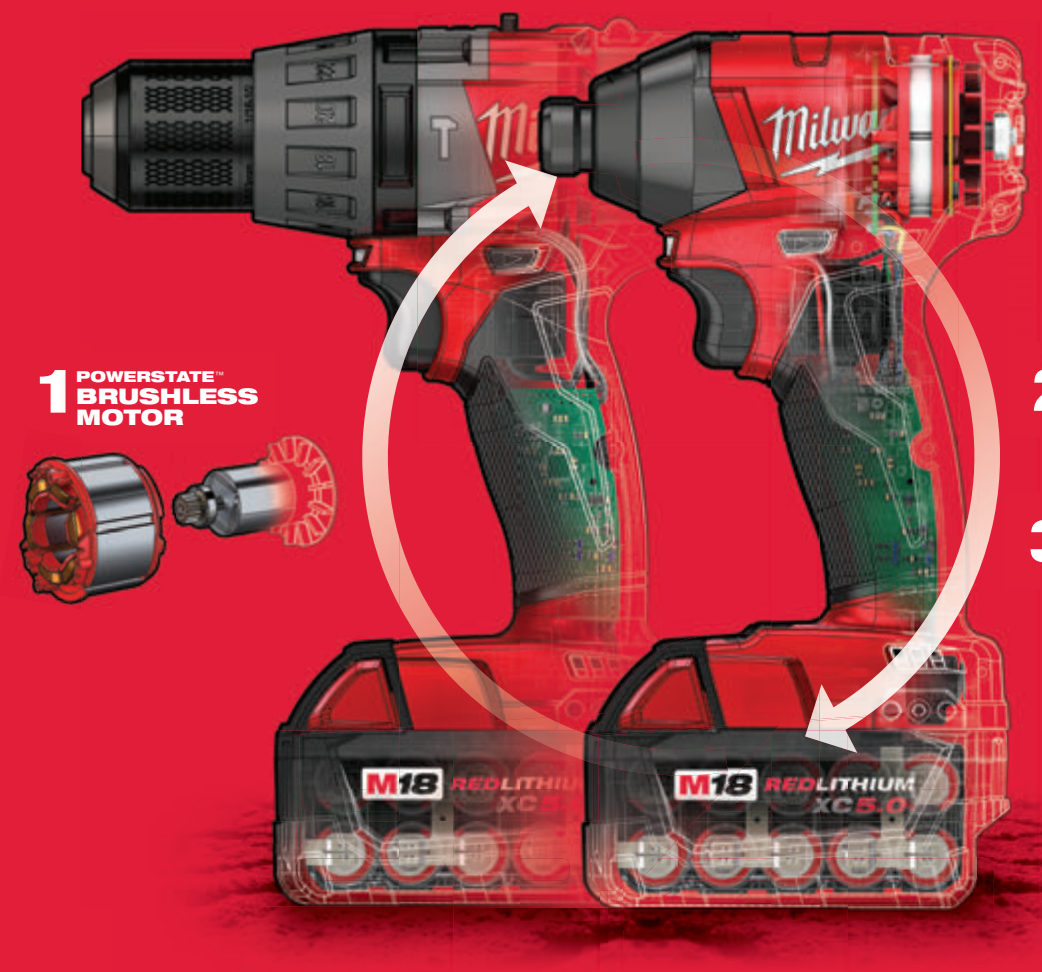

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and enhanced load management to justify these programs.

By submetering each major energy-consuming system in a facility, managers can precisely measure and compare the true cost of these systems. Energy-reporting software also allows managers to create detailed usage reports for areas and times.

Traditional meters cannot be read continuously and trended over time, but new generation smart meters have the ability to integrate into a network and report to a central station or device known as an energy monitoring system.

Technology advances allow managers to install these meters into an active system that was not designed to be divided into various energy-consuming categories. These applications include wireless connectivity and multi-point meters that can measure total kilowatt hours on a select few breakers.

Because they reduce first costs to hard wire meters to a common network, these advances allow front-line technicians to install the meters in existing facilities to track individual energy use types when several energy consuming components, such as plug loads and lighting loads, are wired to a common electrical distribution panel.

Planning for savings

When planning upgrades of submetering and monitoring systems or capital improvement projects involving this technology, managers need to be aware of several important factors.

The first factor is cost. Smart meters range in price from $50 to $250, depending on quantities and level of technology employed, and they can cost less than traditional time-of-use meters.

The second factor pertains to data accuracy. If technicians do not properly calibrate and tune the devices being measured, the information the submetering system gathers will be inaccurate and misleading.

The actual meter or a networked panel can store the trended information, which also can be remotely archived in a database. The location of the stored information and the way it is communicated to other integrated systems will affect technicians' ability to monitor information in real time, as well as the information's level of security.

Managers should select the system provider to ensure technicians can use the system efficiently and that systems can be added so technicians can scale the submetering system to meet future requirements.

More advanced energy monitoring systems can automatically predict energy use levels and compare them to actual use based on the equipment in the buildings, weather forecasts, and occupant loads. Technicians also can integrate this measured or predicted data into existing building management systems to adjust in real time when warm-up and cool-down periods begin, as well as when equipment, lighting systems, and plug loads are activated.

A continuous-commissioning program can help managers ensure that investments in submetering technology generate the highest possible payback for their organizations

The industry has been slow to adapt these systems for several reasons. Different departments within an organization tend to program the energy monitoring and building management systems. The systems can be integrated using a common network protocol, such as BacNET, but the rate at which each system reads and writes to this common network can vary.

One limitation that contributes to this issue is if the local control programs can broadcast the information or send a signal to each common device simultaneously, instead of sending or receiving the same signal from each common

Spotlight on **Smart Buildings**

The U.S. government is conducting research into the potential of fully integrated smart buildings. The General Service Administration (GSA) is in the first phase of upgrading government buildings into smart buildings by adding smart-metering technology. The second phase will integrate these systems with existing building management systems to adjust energy use loads and schedules in real time.

The GSA also is planning to install energy dashboards in these facilities. These web-based systems provide real-time data on system performance. These platforms can represent building energy use as tangible performance evaluations, such as letter grades and scores instead of expected kilowatt hours compared to weather data.

This more tangible energy score allows building occupants to clearly see and better understand the cause and effect of energy use due to inefficiencies of the human effect, which ultimately reduces energy by changing human behavior.

— Derek Tynan

device individually. Ultimately, trained consulting professionals can help managers properly select these systems.

Long-term benefits

Managers looking to generate the highest payback from energy-monitoring systems should consider a continuous-commissioning or monitoring-based commissioning program to interpret the data for use in making continuous improvements.

The U.S. Green Building Council is promoting such efforts by including requirements into LEED v4.0. This latest version allows participants to earn points under the rating system by implementing energy-monitoring programs and tracking points and metered values to compare them to calculated acceptable values. The goal is to evaluate performance, including identifying conflicts between systems and out-of-sequence operation of system components, as well as creating energy- and water-use profiles.

Continuous commissioning is a systematic process for investigating, analyzing, and optimizing the performance of building systems through the identification and implementation of low- and no-cost and capital-intensive facility improvements and ensuring their continued performance over time. This process helps managers make systems perform interactively to meet the facility requirements.

Existing building commissioning is a comprehensive term and process that encompasses more narrowly focused process variations — including retrocommissioning, recommissioning, and ongoing commissioning — that are commonly used in the industry.

Most existing buildings have not undergone any type of commissioning or quality assurance process since coming online. Over time, the facility's requirements change, and the operational efficiencies of buildings tend to degrade. Because of these factors, many buildings are performing well below their potential, use more energy than necessary and cost more to operate than they should. Existing building commissioning responds to a manager's desire to improve building performance, solve comfort and operational problems, and reduce operating costs.

Ultimately, buildings with more advanced energy monitoring systems can reduce energy use only so much, due to equipment performance limitations. As buildings maximize their energy efficiency, the human effect becomes a larger contributor to energy usage. No matter the age, size or type of facility or its components, the common element of successful energy management is a commitment that starts with top executives and is driven by both the occupants and managers. ■

Derek Tynan is a senior project engineer with Horizon Engineering Associates. He has experience executing and managing commissioning, retrocommissioning and energy auditing services for commercial, K-12, higher education, retail and LEED-certified buildings.

energy evolution

Vanderbilt University's shift to cleaner energy sources benefits maintenance and the bottom line

By Dave Lubach, Associate Editor

Vanderbilt University has at least one thing in common with many education facilities across the country. In the last year, it has moved away from coal to generate electricity, heating and cooling to the university's facilities and medical center.

When Vanderbilt stopped using coal at its cogeneration power plant, the conversion from coal and natural gas to exclusively natural gas checked plenty of boxes when it comes to improving sustainability, energy efficiency and the bottom line.

The $29 million upgrade of the university's power plant featured the installation of three new dual-fuel boilers to replace coal boilers. The new equipment helped the university save more than $11 million in plant maintenance costs, and it modernized plant operations at the 330-acre campus in Nashville, Tenn.

"We went from a control room that was all manual gauges and gauges that didn't work anymore to all automation with big-screen televisions," says Mitch Lampley, the university's director of operations and technical support for plant operations. "The thing I'm most proud about is the (new) control room. We gave them a control room that I'm not embarrassed to take a tour to."

Beyond coal

Vanderbilt University's power plant provides electricity and steam to about 250 buildings containing 12 million square feet of space at the university and its medical center. With the existing plant facing potentially hefty maintenance expenses, as well as government regulations that continue to tighten controls on power plant emissions, the university started the process of converting its plant to natural gas in fall 2013.

"We were getting to the point where we were spending a lot of money on (plant) maintenance, a lot of money just to keep it running," Lampley says. "And from a Vanderbilt student standpoint, we had a huge push to get off coal.

"Coal is a dirty word in some people's minds. I get reminded every time I talk about us going green and getting off coal that we're still burning fossil fuels. We're just not burning the dirty one. But in the grand scheme of things, this project brought our greenhouse gas and emissions numbers down."

The plant-upgrade project included the installation of three new dual-fuel boilers, including two standalone, high-efficiency natural gas boilers with fuel-oil backup. The third boiler is a heat-recovery steam generator attached to a new solar gas turbine that can use both natural gas and fuel oil.

The university also installed underground tanks capable of storing 100,000 gallons of fuel oil to support the dual-fuel option.

Vanderbilt last burned coal in November 2014, and officials are still determining the exact emission reduction impact, but Lampley anticipates a 20-40 percent reduction in greenhouse gas emissions. The addition of new boilers also helped streamline steam-producing operations.

"In the new plant, all three gas turbines can operate together," Lampley says. "The plan was to size them so that even in the summer during our minimum steam load that we would generate 100 percent of the electrical generation of all three turbines. The waste heat or steam delivered off three turbines, we wanted to keep that at or below what's needed for summertime steam usage.

"I'm probably losing a megawatt or so production capability, but in the past,I could never run my production at the same time. It was either the gas or the coal plant or some middle ground. With the new plant and layout with three gas turbines, I can operate them at maximum load all the time. I'm getting the most power generation that I can."

'We went from a control room that was all manual gauges and gauges that don't work anymore to all automation with big-screen televisions'

A boon for maintenance

The financial benefits of Vanderbilt's decision to replace its aging boilers and move away from coal produced some surprising numbers when Lampley learned of the potential savings opportunities.

An engineering firm helping with planning the project estimated the new plant could save the university $11 million in maintenance costs over a five-year period.

"At lot of the maintenance savings had to do with the aging coal plant," Lampley says. "Coal is very maintenance-intensive. You have all your coal-handling equipment, and it was delivered by truck here, but it was dumped and then conveyed to storage and then the boilers.

"The bag house was very labor-intensive and maintenance-intensive. You had to go in and exchange bags, and when you had a bag blow out, you had to go in and vacuum the bag house out, replace the bags, and then get rid of all the ash."

Technicians spent a significant amount of time during their shifts cleaning the plant.

"For every six trucks of coal we had coming, we had one bag of ash hauled away, and one truck would stop and pick up ash on the way out," Lampley says. "The coal and ash are both very corrosive to metal, especially when they get wet, so we had a lot of issues just keeping those systems up and running. That's where the major maintenance came from.

"You don't think about that you have to haul the coal around and handle it, and you've got feeders and stoker boilers that you fed the coal into, and they had to be maintained and greased every four hours. When you have gas, you just turn on the valve. You have an automated valve, and the gas comes out. From a maintenance standpoint, it's a lot better."

Vanderbilt University's power plant-upgrade project included the installation of three new dual-fuel boilers, including two standalone, high-efficiency natural gas boilers with fuel-oil backup.

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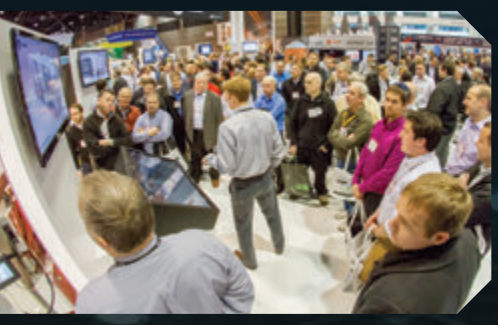

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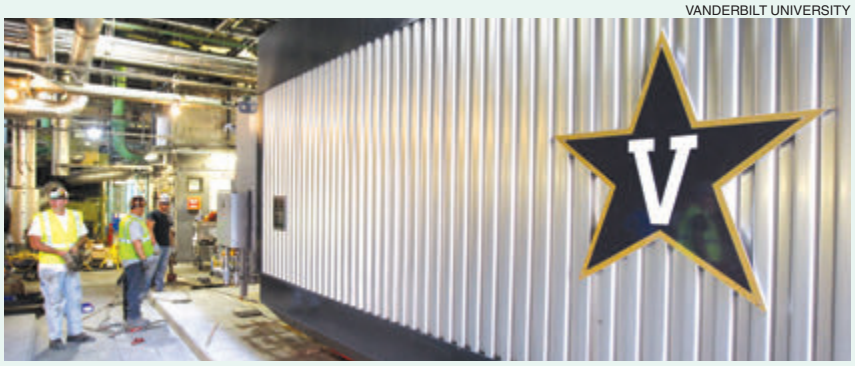

Vanderbilt University's new power plant included equipment upgrades that incorporated more automation, which required changes in the duties of plant operations staff, which is expected to expand as a result of the project.

Despite the challenges involved with handling the coal and ash, the university remained unsure if converting would lower energy costs. But the engineering firm estimated changing to natural gas could result in savings of $3.3 million yearly.

"That was a huge, 'Oh, my gosh,' for us," Lampley says of the savings estimate. "Everybody assumed that not only would it cost us the cost of the project, but it would also cost more burning natural gas over coal.

"We still have one boiler that's not operational that we're working on, and we still don't have a great feel for the savings, but we know we're saving money. It also doesn't hurt that gas prices are at an all-time low. That ($3.3 million estimate) was made two years ago, based on the gas price at that time, so we're doing better than that."

Priorities and opportunities

Vanderbilt's new power plant provided equipment upgrades that incorporated more automation, which required changes in duties for the plant operation staff of about 20 operators, who split their duties over three shifts. Additional staff members, like electricians, welders and support personnel, bring the total employee number in the plant to 30.

The first question Lampley typically hears about the new system concerns potential layoffs. But instead of layoffs, the department is recruiting four new employees.

"Traditionally, we have been undermanned," he says. "A powerhouse the size of ours, in the off hours, we've had two people here. To me, that's a skeleton crew, and at that point, if anything goes wrong, people have to rush in and help. I don't expect the numbers to go down. My goal is for the number (of employees) to go up." As the university reaches the final stages of the installation project, Lampley continues to organize a plan to shift priorities to the new, modern plant.

"There are still some things in the plant that need to be worked on from a steam valve and steam distribution standpoint," Lampley says. "We did a lot of upgrades during the project, and there's obviously always plenty to do in a powerhouse, but we're seeing a lot of the load changing from our operators replacing a steam valve or digging out the coal-handling equipment so we can work on more controls issues and equipment issues."

The new system also creates an opportunity to revamp the staff's training and certification process. Traditionally, most training for new employees consisted of veteran operators sharing their experiences on system operation, though no uniform training processes were in place.

"I'd like to teach the operators the right way of doing things," Lampley says. "Part of that problem is getting the right way on paper.

"We had a week-long training class that we put our operators through, walked them through every system in the gas turbine, and it was good training," Lampley says. "We had a four day class from the boiler manufacturer on how a boiler works. A lot of the guys said they know this information — they've been working on boilers their whole lives — but it never hurts to hear it again. It never hurts to hear how a boiler operates when you're here in the middle of the night all by yourself."

Lampley trusts his veteran staff to handle the upgraded boiler systems but prefers a uniform training method.

"We have two young operators who were put on a shift with two veterans and learned the university of hard knocks," Lampley says. "But the one day you're here by yourself or with one other person is going to be the day the makeup tank springs a leak and you don't know if you have water in the tank or not.

"If you've not lived that, then you're scratching your head, where if you've had a true qualification training program, you would have walked through most of those major incidents if not trained on them." ■

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Product Focus

Waging War on **Water Waste**

Managers and manufacturers team up to develop and deploy an arsenal of water-saving products

By Dave Lubach, Associate Editor

No matter where institutional and commercial facilities are located — whether in drought-stricken California or the rainy Pacific Northwest — water conservation remains a top priority for maintenance and engineering managers. As a result restrooms have become focal points for trying to achieve water-saving goals.

"The biggest water hog in most commercial buildings, with exception to process water, is the restroom," says Patrick Boyle of Sloan Valve Co. "It's the only room in the building, besides the lobby, that almost every occupant will visit. Updating that room to high-performing and highly efficient products can offer the building owner and management affordable water savings."

Flow rates for toilets, urinals and faucets have dropped dramatically in recent years as manufacturers have responded to the need of facilities to curtail water use due to rising costs and limited supply. They have developed products that meet the demand, but can flow rates go even lower, and what can managers do to help further curtail water use in their facilities?

Low-flow challenges

Toilets, urinals and faucets have experienced a significant drop in flow rates over the years. Toilets models now flush at 1.28 gallons per flush (gpf) or 1.1 gpf, compared to past models that used 3.5 gpf. Urinals flow rates are down to a pint or 0.25 gpf from 1.5 gpf. The flow rate for many faucets now is down to 0.5 gallons per minute and even lower for some products.

Because water restrictions vary by region, the challenge for manufacturers remains keeping up with changes.

"One thing we do is to try not to chase the standards," says Pat Tanzillo of Chicago Faucets. "If you chase the water standard, it will only go lower. As long as we can maintain and give the same performance with lower gallons per minute, we feel that we're accomplishing and satisfying the needs of the person that uses the product."

One challenge for manufacturers is producing the lowest-flow products possible without sacrificing quality.

"With the fixtures out on the market that we're offering now, especially high-efficiency products, there's really not much lower that we can go because of the older plumbing infrastructure that's out there, specifically on the drain side," says Tony D'Amato of American Standard. "If we go much lower, we're going to get into issues with drain-line clogging, which isn't good by any means."

'A misconception around low-flow (technology) is that because you're going lower flow, the product is not going to perform the function that it should. As the products continue to perform to standards, people's confidence will continue to grow'

Conservation roadblocks

Managers planning projects with water conservation in mind might encounter a number of different roadblocks in their facilities. For example, a perception remains among some managers that low-flow still means lower quality.

"A misconception around low-flow (technology) is that because you're going lower flow, the product is not going to perform to the function that it should," says Ben Fisher of Moen Commercial. "For example, a shower is not going to get shampoo out of hair because it doesn't have

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The Selectronic uses 0.25 gallons per flush and is sensor operated. The design eliminates routine maintenance and includes a self-cleaning piston with an integral wiper spring to reduce clogs and upkeep time. The valve also includes a fully mechanical override to allow it to flush without power. A fail-safe operation causes the valve to close automatically and stay closed upon the loss of power or water pressure. **Free Info: Circle 250**

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Toilet system

The 1.1 gallons per flush (gpf) model combines a vitreous china fixture with a manual- or sensor-operated 1.1 gpf flushometer. The system uses 14 percent less water than a 1.28 gpf model, and the products contribute to LEED credits for water-use reduction. The Royal manual valves and the battery-powered, sensor-activated ECOS valve and SOLIS electronic valve, which utilizes solar panels with battery back-up, can combine with floor-mounts and wall-hung bowls for a total of nine different combinations. **Free Info: Circle 254**

enough flow, or a toilet won't flush matter because of the low flow.

"(Manufacturers) test these things in-house and there's third-party testing out there that will show that you're doing more with less water and volume. That's something people still are wrapping their minds around as we continue to put out low-flow products. As they continue to perform to standards, I think people's confidence will continue to grow."

Building occupants who are unwilling to change their water-use habits also can hurt conservation efforts.

Facilities must "change peoples' performance expectations and associated behavior with activities such as how to wash their hands with less water and how much and what type of toilet paper to use and eliminating the toilet as a place to dispose of items they were not designed to handle," says Mark Lawringer of Sloan Valve Co.

Some of the roadblocks are cultural, Tanzillo says, adding, "The thinking that certain applications you need X amount of water, so whether you leave (faucets) running twice as long for the same amount of water or not."

The cost of plumbing-system upgrades also can create challenges for managers.

"A lot of times, a facility will agree (on a project), but it's not the biggest priority at the time," Fisher says. "They'll say there's water coming out of it and it's working, but when it's no longer working they'll replace it with a low-flow (product). (Plumbing projects) may not be at the top of the list when there's limited budget and resources. Someone can change a faucet that has water flowing out of it or choose to replace an air conditioner that's not completely working."

Convincing top management that investing in water-saving plumbing upgrades will likely produce savings can prove difficult.

"The roadblocks I see more of as I visit sites is just the ability to convince their boards of newer technologies and just having the money to spend," Tanzillo says. "Some of these facility people need to improvise the best they can and just work with the funds that are available at the time. I can say that some are a little more reluctant to look at the water side and conservation because of the costs or unfamiliarity with it."

Managers also must consider the long-term savings plumbing projects will generate before deciding whether to move forward with them.

"The big opportunity with return on investment is really looking at the total cost of ownership — not just the upfront purchase cost but looking at that product through the life cycle of it," Fisher says. "It ties into the water savings and energy savings. There's a ton of opportunities on labor, parts, and maintenance savings, a big opportunity for managers to dive into those upfront costs and really look at what the product is going to save over its life."

Managers need to play a role in convincing building owners that investing in plumbing projects can produce significant water and financial savings.

"They motivate building owners to upgrade existing plumbing equipment to meet high efficiency standards," Lawringer says. "Most conservation efforts focus on new construction, which is great.

"However, the efforts to encourage building owners to make the investments needed to upgrade equipment to new standards, such as through rebate programs, has not been enough to motivate them in large numbers."

Maximizing savings

Managers can take a number of steps during the specification process to establish a post-installation maintenance plan to help keep water use low.

When specifying products, managers should "have test areas set up where they can test new urinals, toilets, and faucets on a small trial basis before they roll it out to a campus or hospital," D'Amato says. "The (product managers) who run those are very savvy when it comes to the performance of these products and know them inside and out. They know how to gauge how well it will work in their building. They look at all the aspects of course and consider what kind of maintenance they think they might need over time."

When establishing a post-installation maintenance plan, finding leaks should always rank near the top of the priorities.

"Look for leaks during inspections," Fisher says. "From a manufacturing standpoint on maintenance, we design our products to be maintenance-free, but as different water uses, and other variables between facilities changes, it's kind of tough. Regular inspections can help detect leaks."

Full water traps also are essential for plumbing systems to function properly.

"With less use of water, the traps could dry out, and that's not a good thing," Tanzillo says. "One thing we've built into our electronic faucets is a hygiene flush. What the hygiene flush does is clear the line and keeps the trap full. Two important things need to be done — move stagnant water and fill the trap."

Into the future

Managers might consider finding ways to use reclaimed, or gray, water, for plumbing purposes as the next step in the efforts to reduce water use in their facilities.

"The use of gray water for non-potable applications is becoming more prevalent," says Gary Cole of T&S Brass and Bronze Works. "This requires major retrofitting for existing facilities but is more viable for new construction."

With flow rates already so low, manufacturers also might start expanding their quest to reduce water use by going beyond the restrooms.

Says D'Amato, "I think it's important for (manufacturers) to follow the lead of PMI (Plumbing Manufacturers International) and other associations, like PERC (Plumbing Efficiency Research Coalition), to measure the effects of different variables on drain-line carry and grow together as an industry to make sure the products and solutions we're putting out there are going to work in the real world." ■

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Building an **Attachment Arsenal**

Grounds equipment attachments can expand fleet flexibility and increase department productivity

By Mike Fitzpatrick

Mowers and utility vehicles are the backbones of grounds departments in institutional and commercial facilities, in part because of their ability to help grounds crews perform a variety of tasks. One key component of this versatility is the performance of attachments for these pieces of equipment, including mowing decks, snow plows, brooms, aerators and sprayers, to name a few.

By identifying the needs of their departments and understanding attachment options, managers can successfully specify attachments that increase worker productivity and maximize post-purchase equipment performance.

Needs and options

Grounds managers can devote a great deal of valuable time and energy researching and specifying attachments for mowers, tractors and utility vehicles. But before making a final decision, it is important to consider their departments' needs.

For example, if a department generally uses a mower to carry out landscaping duties but also to provide such services as slit seeding, aeration, pest control, leaf and debris removal, and snow and ice management periodically, it makes more sense to buy specific attachments for each task, rather than buying a separate piece of equipment for each task.

Financially speaking, investing in one large purchase, such as a mower or truck, and using one engine rather than buying three or four large pieces of equipment will save money in the short term and the long run. From an efficiency standpoint, equipment is not meant to sit idle for long periods, so if crews use select pieces of equipment just a few times a year, the chances of mechanical problems occurring actually increase. This is the point at which the value of investing in attachments rather than motorized pieces of equipment comes into play.

Most manufacturers of grounds equipment provide an array of attachments for their units. While mowers are the most common and expensive purchases among grounds departments, managers can use attachments up and down the range of equipment. The selection of attachments varies from large pieces of equipment to mid-size and small pieces, such as handheld tools.

Manufacturers of mowers now produce cutting-edge, multi-use technology for their customers. For example, they produce extremely efficient out-front mowers that help grounds crews accomplish a variety of tasks using just one motor.

Due to their increased visibility, out-front mowers are particularly accommodating for those grounds managers whose crews mow around and under obstacles, such as trees, signs, and light poles, because they increase proficiency and accuracy. Out-front mowers also have better drive traction and balance than some other types of mowers, so they offer increased performance on hillsides.

Most manufacturers have their own selection of attachments, but purchasing from a manufacturer of grounds attachments has become an increasingly popular option for managers to consider. These companies not only provide a selection of attachments for out-front mowers. Their attachments also are designed to fit with a variety of major manufacturers.

Savvy specification

Tasks that grounds crews do not perform frequently are ideal candidates to address with mower, utility vehicle or tractor attachments. To determine the specific attachments that will best support crews and budgets, managers need to consider location, terrain, and weather.

For example, in regions that experience above-average snowfall conditions, such as the Northeast, managers should consider buying saltboxes, snow blowers, salt spreaders, and snow blades for their departments' tractors or trucks.

The same reasoning holds true for those landscapes in seasonal markets that only

[Grounds: Going Green]

For grounds managers looking to enhance the sustainability of their departments' operations, buying equipment attachments can be an environmentally friendly strategy. Attachments enable crews to use only one motor to carry out a variety of different functions, so they reduce the amount of harmful exhaust gases emitted into the atmosphere.

The ability to use attachments instead of multiple motors is another way manufacturers are supporting the sustainability movement. By moving away from diesel fuel and offering more environmentally friendly options, such as propane and electricity, they also enable managers to make greener decisions.

To reduce waste further, managers can invest in a mulching system for their mowers, which also saves operators from having to collect grass clippings while mowing. Yard waste accounts for 18 percent of the waste left in landfills, according to he U.S. Environmental Protection Agency. Instead of throwing away grass clippings after mowing, a more environmentally sound option is to recycle them into the landscape. Grass composting adds nutrients into turf, and it improves the appearance of the landscape.

— Mike Fitzpatrick

PHOTO: POLARIS

To effectively identify and specify the specific equipment attachments that will best support grounds crews and department budgets, managers need to consider factors such as location, terrain and weather.

need to prune a few times a year. Buying a combination unit that serves as a pruning saw and a hedge trimmer is a proven strategy for grooming both high and low bushes and trees without investing in two different pieces of equipment. Managers also can buy attachments for string trimming, edging and blowing.

The landscape's size also will factor into the attachments the department needs. Departments responsible for large campuses need more accessories to maintain the overall appearance, while the smaller properties do not need as many.

To ensure a particular attachment actually performs as intended, managers and crews should schedule a demonstration before the purchase. By field-testing it, they also can see if the attachment fits with their current piece of equipment. This is extremely important when the purchase is not directly from the manufacturer.

Certain attachments fit differently and have their own mechanical makeup, so it is essential to test it beforehand. Ensuring the user-friendliness of the attachment is also a key part of the post-purchase inspection process. Even if the attachment fits, it might not attach or detach easily, thereby decreasing productivity.

When ordering an attachment online, make sure all parts are included. It is not uncommon for managers to order attachments — brooms, sprayers, blowers, aerators, etc. — in bulk before the season begins and store them before use.

Unfortunately, this strategy can increase the chances that the attachment is not what they expected, does not fit with their equipment, or is missing parts. To mitigate this risk, managers must make sure upon delivery that they have everything they need.

Beyond the buy

The challenges involved in successful specification and use of grounds equipment attachments do not end with the purchase. Although inspecting the attachment immediately before or after purchase is most ideal, many managers and technicians just do not take time to do this. Here is where the manufacturer's warranty comes in.

For example, if a department does not use the attachment for several months and a technician later discovers it does not work, the manufacturer's warranty covers the costs of replacing the product, saving the manager time and money.

Most technicians also will not spend the time and energy to attach a snowplow to a truck in the months leading up to winter, so they must make sure the warranty covers the appropriate period. If it does not, it might be a smart move to buy an extended warranty.

Storing commercial lawn equipment appropriately also is vital to the lifecycle of the attachment. To guarantee that attachments work when crews need them to, managers should create a comprehensive maintenance plan.

The plan should cover steps involved in cleaning and storing each piece of equipment. For instance, when a worker is finished using the attachment, clean it and remove any dirt and grease. If dirt and grease are left on the equipment for long periods, it can be difficult to reattach, and it can get rusty, leading to malfunctions and expensive repairs or replacements. Lubrication is equally important for proper equipment maintenance.

To maximize the performance of attachments, technicians should remember to use the appropriate industrial cleaner. When cleaning attachments and other equipment, use a heavy-duty degreaser.

Removing fuel left in the attachment before storing it long-term also can prevent any future damage. Storing attachments and other tools in a place where sun, rain, cold, and other elements can not affect them also will help prevent rust or damage from occurring.

It also is beneficial for managers and technicians to go through the manufacturer's manual to identify specific care and service timelines. Managers also should share the attachment's requirements with the rest of the department to ensure proper maintenance and care.

Attachments have become essential components of grounds care, but as the role of technology increases, so does the need for high-tech attachments. By keeping in mind a crew's specific needs and by investing in the right accessories, managers can ensure they make cost-effective, long-term product decisions. ■

Mike Fitzpatrick is vice president of U.S. Lawns — www.uslawns.com — which has about 260 franchise locations nationwide. He has more than 30 years of experience in the green industry.

In Case of Emergency: The Facilities Management Role

Arizona State University relies on its facilities department to play a central role in its effective preparation for and response to a crisis

By Dan Hounsell, Editor-in-Chief

The task of planning and preparing for an emergency is challenging under any circumstances, given the number of factors planners must consider and the number of operations, activities and resources that they must coordinate. The process becomes even more complex when the organization involved is spread across five campuses, contains 150 facilities with 15 million square feet of space, and must account for the location and movement of more than 15,000 campus residents.

Yet that is exactly the challenge faced daily by Allen Clark, director of emergency management with Arizona State University (ASU) in Tempe. Among the resources at Clark's disposal is the university's facilities management department, which plays a central role in seeking to ensure that campus facilities, assets and occupants remain safe in the event of an emergency.

"As the emergency manager, I rely heavily on Facilities (Management) for ongoing maintenance to keep our critical infrastructure working properly," Clark says. "In addition, they provide the valuable situational updates and technical information that is a major component of any incident or event planning cycle. Facilities personnel play an integral role in everything we do in emergency management, from preparation to recovery."

Defining a role

Emergency response and recovery plans are complex documents by their very nature, given the number of activities, resources and people that they must account for and coordinate in order to address situations as diverse as floods, fires, power outages and active shooters. Clark refers to the role of facilities management in campus emergency planning as, in part, "boots on the ground."

"ASU conforms to the National Incident Management System put in after 9/11 saying we must manage all domestic incidents," Clark says. "Part of NIMS is the incident command system, which has eight components. Facilities we classify as boots on the ground, or operations. So if we have an incident, we not only have them preparing sandbags. They're cutting trees, maintaining roadways, controlling ingress and egress."

The department also ensures that those involved in the recovery efforts have all of the materials and resources they need to complete their tasks.

"From the logistics perspectives, those are the people that get us stuff," Clark says of facilities management. "So if we need lights and generators, facilities management helps with the logistics of getting materials we need to secure our campuses."

For Rick Pretzman, the university's associate director of facilities management, his department's role in emergency planning and response is just one element — albeit an important one — of the department's role in overall facility safety and reliability.

"Managing the operations of such a diverse infrastructure requires some unique skills and a global perspective because of the ways in which the various campus functions are interrelated," Pretzman says. "Being a part of the emergency planning process gives (facilities management) the information needed to react in difficult situations and helps them understand the perspective of the authorities having jurisdiction under those circumstances."

Clark emphasizes the unique and often overlooked perspective Pretzman's department brings to the process.

"In a municipality, we think about police and fire and public works," Clark says. "But in universities, often times, our facilities management area gets overlooked. We've made a concerted effort not to do that. We bring them to the table. They've been a great partner and have a ton of resources. They're integrated and interwoven into everything we do at ASU, so they need to be at the table as part of emergency management.

"Our facilities department is heavily involved with proactive groups that calculate and address risk to our infrastructure and help the institution prepare for pre-planned events or unplanned incidents. In addition, they are a very important part of our exercise design group.

'They're integrated and interwoven into everything we do at ASU, so they need to be at the table as part of emergency management'

"ASU runs one full-scale exercise annually, full scale meaning boots on the ground with fire and police response and facilities response. Facilities is always invited to the table to help us design our exercises so we can include things that are pertinent to them in testing their processes and procedures."

In-house experts

The university relies on facilities management to play a central role in emergency response and recovery planning for the same reason that top executives in any organization rely on facility maintenance and engineering managers in a range of key situations: their knowledge of the facilities. No one in an organization has the breadth and depth of knowledge about facility materials, components and systems.

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Jeffrey J. Schenk, CFO

"Many times, the intimate knowledge of particular building systems and how they operate are a key part of this process, so having FM representation on the team is critical," Pretzman says.

One example involves the need to account for the age of any given facility when planning to respond to an emergency that occurs in it. The university's buildings range in age from two years old to 120 years old.

"We take into account the age and infrastructure that's available in a building when we discuss certain response scenarios," Pretzman says. "In other words, some of our newer buildings have a lot more capability in terms of metering, controls and power options than our older buildings do. The age and configuration of the buildings can affect our capabilities during an emergency."

"The newer facilities have capabilities that are enhanced beyond some of our older facilities, and we need to make sure we are utilizing those capabilities, whether it's different control systems or improved redundancy or newer life-safety capabilities."

As the nature of university life and operations change, campus facilities also change, and new facilities responding to these changes bring additional challenges for emergency response planning.

"ASU is seeing a much greater emphasis on research, and that requires newer buildings and higher technology to support it," Pretzman says. "With that increased emphasis on infrastructure, the reliability has to be higher and higher.

"The bar has been set higher for the performance of our buildings, and that is moving beyond research buildings into our academic buildings. We try to use that technology and stay current with it so we can provide a reliable and safe environment for the campus community."

Counting the benefits

While the emergency planning process — and, in turn the organization — benefits from the involvement of maintenance and engineering, the university's facilities management department also benefits from its role. One upside is the perspective the department's personnel get in gathering information used in emergency planning.

"As requests for information filter down to the shop supervisors and middle management level, it's an educational process for them," Pretzman says. "They grow by learning about the issues they need to be aware of to put together an effort like this."

"Working with Allen and his people gives us the perspective that we need to be able to answer their questions. Working with them, we begin to understand the issues they are trying to solve, and by doing that we can edit our response to them, so to speak, and focus on the information they really need to be more effective in their planning.

"Whether it's a question about emergency power or some other issue in a given building or situation, by working with them, we understand a little bit more about what they need to do and how our piece relates to their overall planning effort."

Involvement in emergency planning also offers Pretzman the opportunity to reassess the department's own processes and procedures.

"Being part of this process forces us to ask questions about our systems, and those are very pertinent questions for us in our day-to-day operations," he says. "It is a benefit to facilities management, and I think it helps both sides of the equation."

The benefits to the organization of the department's role in emergency planning come when a crisis occurs.

"We recently had a flood from a main break in a building that contains some of our critical infrastructure," Clark says. "Facilities management was not only helpful in getting the water out, but as far as the continuity of operations planning and relocation planning, facilities management also helps departments find locations to move to so they can maintain their operations."

The key to successful participation of maintenance and engineering in emergency response planning is early involvement.

"First and most importantly, invite them to the table before the incident or event happens," Clark says. "I recognize this seems elementary, but often times, we activate a center and have little or no understanding of those assembled with us. Emergency management is highly dependent on relationships, and we must build and foster those before we act." ■

Darrin Cary (left)
Chief of Operations
Wilbert Precast Concrete

Carlos Limón (right)
Commercial Industrial Engineer
Avista

Concrete evidence of energy savings.

Successfully running a precast concrete business is hard enough without having to deal with energy-related issues. It's why Wilbert Precast has cemented a long-term working relationship with Avista for expert energy assistance.

Wilbert Precast began in Spokane in 1906, primarily manufacturing concrete burial vaults. During the more than a century that has since followed, its product lines have greatly expanded and so did the company, adding two more manufacturing facilities in Lewiston, Idaho, and Yakima, Washington. Now a top regional supplier, Wilbert Precast pours everything from septic tanks and retaining walls to buildings and bridges. It has even poured nuclear storage containers for the Hanford Site in the Tri-Cities. If it's made of concrete, it's probably on the company's list of custom products.

"If you need a concrete pterodactyl, give us a call," jokes Darrin Cary, Chief of Operations at Wilbert. "Our state-of-the-art facilities let us do just about anything."

Improved lighting throughout the facility has boosted worker safety and morale.

According to Cary, Wilbert Precast products are known for consistency and reliability, much of which is owed to close monitoring of desired moisture during the curing process once the concrete is poured. That's when strength and durability are developed. Temperature is key. So when ceiling insulation at the Spokane plant began to fall on workers' heads, it caused quite a headache.

"The vapor barrier failed," explained Cary. "Industries like ours put a lot of moisture in the air. If we pour 60 yards of concrete, hydration as the concretes cures puts about 300 gallons of water into the air. When all that condensation rose to the ceiling, it was wicked up by the insulation. It wasn't long before everything started falling out piece by piece."

The problem stemmed from the way the plant's earlier insulation was installed. Wilbert elected to apply sag-and-bag insulation, typically used in metal buildings; however, local building codes required an insulation layer that was too thick to be screwed in, and so it had to be strapped to the ceiling. Seams were taped along the roof's main frames and purlins to keep the insulation dry, but the strap-and-tape system wasn't designed to endure the high moisture of concrete production.

"When soggy bats of insulation started falling, it became a major safety concern," affirmed Cary, "so management decided to just remove the rest of it."

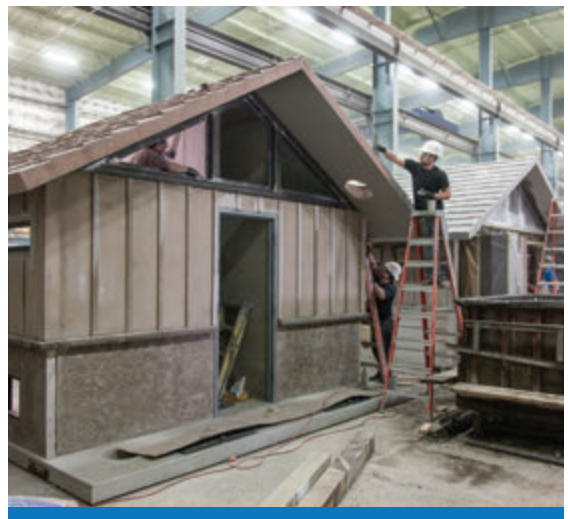
Their decision, however, led to other problems that consumed valuable production time. In summer the lack of insulation created higher indoor temperatures that would make the poured concrete release moisture too rapidly. Workers had to employ extra measures to slow down the curing process.

In winter the building would get colder and so curing blankets had to be placed over the concrete to maintain proper curing temperatures. Worse, production condensation would accumulate on the bottom of the cold metal ceiling and start dripping, forcing workers to cover and protect the newly painted finishes on precast buildings.

The company had to continue enduring production hassles because fixing the problem was prohibitively costly. They found the cost of installing new insulation was about $150,000, as it would require adding another layer of sheet metal to the roof to avoid the same problem later. Wilbert seemed caught between a rock and a hard place, at least until Avista stepped in.

As part of a program to better manage the region's growing energy needs, Avista provides rebates and incentives to help its large customers make energy-efficiency upgrades. Upon learning of the problem, Avista sent its engineers to inspect the plant and research options. They came back to Wilbert with a recommendation to use a new advanced closed-cell insulation technology better at blocking moisture. Avista also offered $25,790 in incentives to complete the project. For Wilbert, it was an easy decision.

"All the problems ended when we sprayed in the new rigid insulation," said Cary. "The raining stopped, and now it's nice and comfortable for everyone out there. We also saved quite a bit on natural gas over the last year [7,369 therms]."



Ending the condensation problem saved time formerly spent protecting product finishes.

Along with replacing the insulation, Wilbert chose to install new lighting at the plant as well. Taking advantage of an additional $21,983 in Avista rebates, the company replaced 36 halides with double that number of T-5 fluorescents throughout the manufacturing floor and mechanic shop. It also swapped T-12s with T-8s in the company office, and replaced exterior lights with LEDs. Despite adding a greater number of lights, the plant is now saving 141,249 kWh of electricity annually.

"It's way brighter than the halides, which always yellowed with age," said Cary. "Now we have more usable light, even around our large crane hooks where the lights are 36 feet off the floor. It's also better for safety and employee morale."

Cary expressed that he is pretty happy with all of the changes. Avista is happy, too. Because helping its customers save energy is always a solid undertaking.

For more, visit **avistautilities.com/bizrebates**

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William Ellis, Pepco Program Manager, explaining the different types of CHP technologies.

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Trending NOW

WARRANTY WARS: WHY THE BEST CARS WIN.

Utility vehicle warranties vary considerably. An industry insider tells you why that is, what it means to you and how to keep your warranty intact.

Utility vehicles are long-term investments. Buyers generally rely on them for five to ten years, with warranties to protect them from unforeseen expenses. Yet many buyers don't give warranties the consideration they deserve.

"A durable vehicle, backed by a strong warranty, may save you thousands of dollars. More importantly, it indicates the confidence a manufacturer has in its vehicles. It is, in effect, a statement of quality." says Kurt Meyer, commercial product management specialist at Club Car.

Manufacturers who have less confidence in their vehicles, on the other hand, may offer shorter warranties. These are often supplemented by "extended" warranties that costs $250 or more to cover your second or third year of ownership. Be sure to consider this cost when choosing vehicles.

"Companies test their products as part of the engineering & product development process. The quality of the components they use, how well the vehicles are built, internal testing and customer experiences in the field are all factored into the manufacturer's final warranty," Meyer says.

A COMPETITIVE COMPARISON. Weak warranties can cause your total cost of ownership to spiral out of control.

To demonstrate, lets see how the warranty on the Carryall® 500 utility vehicle stacks up to warranties on comparable vehicles made by other manufacturers.

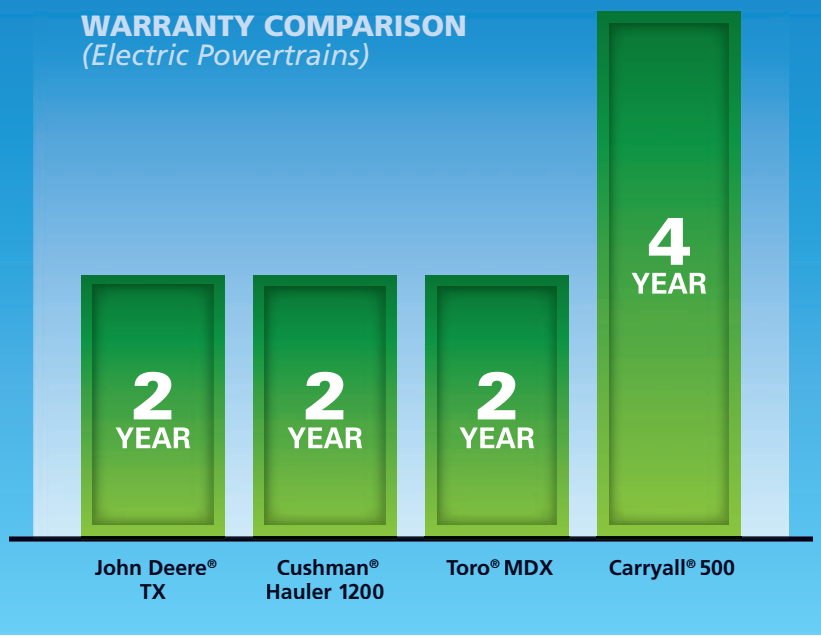
In 2014, Club Car introduced a new line of Carryall utility vehicles, with gasoline models driven by a powerful Subaru overhead cam engine with electronic fuel injection. "Club Car was so sure of the product that we extended the vehicle warranty to a best-in-class three years/3,000 hours. That covers the engine assembly, transaxle assembly, starter/generator and main frame assembly," Meyer says.

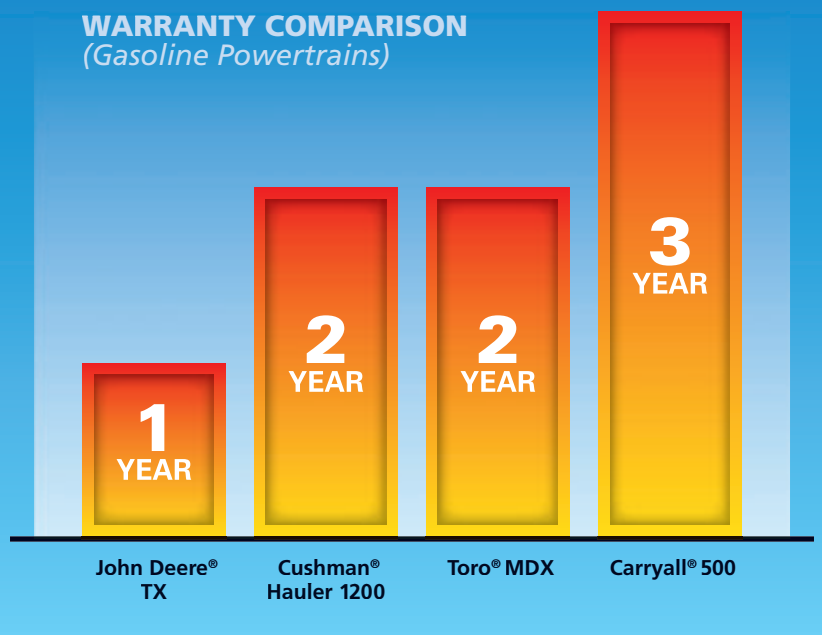
Indeed, the Carryall 500, like all two-wheel drive Carryall models, is protected by the longest warranty in its class.

"Even though commercial UTVs are long-term investments, you could be facing expensive repairs with competitive vehicles in as little as a year," says Meyer. "Engine, frame and transaxle repairs can costs $1,000 - $1,500."

"A strong warranty indicates the confidence a manufacturer has in its vehicles. It is, in effect, a statement of quality." *— Kurt Meyer, Club Car*

Compare the warranty on the Club Car Carryall® 500 utility vehicle to three competitors, and you'll discover that there is no comparison, whether you're looking at gasoline or electric powertrains.





BATTERY, CHARGER & CONTROLLER WARRANTIES: CLUB CAR WINS AGAIN. Electric vehicles can save you as much as $500 a year in operating costs over gasoline models, but make sure your warranty covers electrical components for an extended period.

Carryall electric utility vehicles with standard batteries carry a four-year/18,000-Ah (amp hour) warranty. Optional extended-range batteries are covered for four years/23,000 Ah.

In addition, the controller, motor and battery charger on the Carryall 500 electric utility vehicle are covered for four years. That's twice as long as the nearest competitor.

PROTECT YOUR WARRANTY WITH OEM PARTS & ACCESSORIES. Improper installation of accessories, installation of non-OEM parts or accessories, and non-approved alterations to vehicles are not covered under most manufacturers' warranties.

"Club Car has options and accessories designed exclusively for the Carryall that will not impact your vehicle. In fact, Club Car carries the largest range of commercial accessories in the market," Meyer says.

Strong warranties can also indicate how well utility vehicles withstand water, salt, chemicals and other environmental factors. Those built on aluminum frames, like the Carryall utility vehicle, stop rust in its tracks. Competitive UTVs are build on less durable steel frames that don't withstand environment factors as well and tend to rust over time.

DON'T LET ABUSE, NEGLECT & IMPROPER MAINTENANCE VOID YOUR WARRANTY. To keep your warranty active, be sure to perform routine vehicle maintenance as noted in your owner's manual.

The new EFI engine in gasoline Carryall utility vehicles makes this easy. A splash lubrication system simplifies oil changes, eliminates oil filters and reduces the risk of neglect. "The Carryall 500's service intervals are also longer than those on competitive products, further reducing maintenance costs," Meyer says.

Electric utility vehicles need regular maintenance as well, as daily charging and watering affect the life of the battery pack.

"We sometimes see electric vehicles with bad batteries because they have not been watered properly. That kind of neglect can destroy the battery, impact the warranty and set you back more than $1,000," says Daniel Hedges, commercial vehicle sales manager at Specialty Car Company, an authorized Club Car Dealer in Stone Mountain, Georgia.

CHECK THE DEALER NETWORK UPFRONT. Make sure the manufacturer and dealer are as focused on service as they are on sales. Ask about their response times, access to critical parts, and technician training programs.

Some utility vehicles are covered by warranties that look good on paper, but don't have a dealer network to supply parts and service. You can't wait months for repairs. That's not a problem with major manufacturers like Club Car.

The Carryall 300 UTV (shown left) is equipped with an optional canopy top, fold-down windshield, heavy-duty front bumper and Versattach™ accessories. The industry-exclusive Versattach bed system can be equipped to organize and protect your equipment while freeing up valuable cargo space, thus improving overall work efficiency. Ask an authorized Club Car dealer for the full lineup of optional Versattach accessories.

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FREE INFO: Circle 426

product pipeline

BOILERS & WATER HEATERS

WEIL-MCLAIN
Gas boilers
The SlimFit high-efficiency condensing line includes improved boiler-to-boiler communication, Modbus and BACnet for linking with building automation systems, an express setup wizard, 10 preset typical heating systems, and an updated controls interface for easier navigation, at-a-glance boiler status, diagnostics and troubleshooting. The boilers are tested to achieve 96.1 percent combustion efficiency and 95.8 percent thermal efficiency. **Free Info: Circle 200**

NORITZ AMERICA
Water heater

The NCC1991 features a thermal efficiency of 94 percent and saves money on installation and ongoing operations. Using a quick connect cable, two units can be coupled to provide an input of nearly 400,000 Btus, with a turndown ratio of more than 36 to 1. The water heater contains a secondary stainless steel heat exchanger that preheats incoming cold water with heat from escaping flue gases. **Free Info: Circle 201**

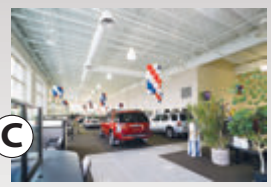
MIURA AMERICA CO.
Steam boilers

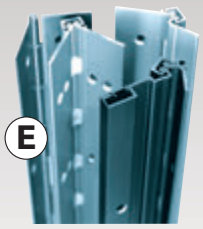
The LX-300 model is a once-through forced-circulation unit that produces steam in five minutes while maintaining an 85 percent fuel-to-steam efficiency. Its modular design allows flexibility to customize the unit to meet any demand and provides equivalent boiler capacity in less than one-half the space. The unit reduces carbon dioxide and nitrous oxide emissions while saving up to 20 percent on average annual fuel costs. **Free Info: Circle 202**

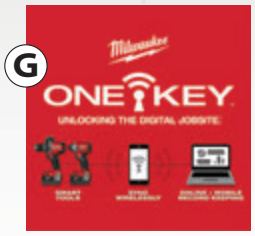
RINNAI CORP.
Tankless water heater
The multi-unit tankless rack system makes installation easier and more flexible for commercial facilities. The system is available in free-standing or wall-mounted options for indoor and outdoor applications and can be ordered, built and shipped fully assembled. Individual racks can hold from two-six of 199,000 Btu condensing units with an energy factor of 0.95. For even larger tankless systems, multiple racks can be banked for up to 25 units and nearly 5 million Btus of input capacity. **Free Info: Circle 203**

For more information on boilers and water heaters, see article on page 16











A THE GRASSHOPPER CO.
Zero-turn mowers
The expanded 100V Series includes 61-inch cutting decks capable of mowing up to 4½ acres per hour and features single-fill, 6½-gallon fuel tanks located under the seat for a lower center of gravity, enhanced traction, longer intervals between fill ups, and a fuel gauge located in front of the operator seat. The mowers are available with 41-, 48-, and 52-inch decks to more easily navigate tighter spaces. **Free Info: Circle 204**

B BLACK+DECKER
Cordless jigsaw
The 20-volt max lithium ion battery-powered unit, model BDCJS20B, features a compact trigger, clear line of sight, and batteries that are part of an interchangeable system powering more than 30 tools and outdoor products. The jigsaw includes a keyless blade clamp, bevel shoe, dust blower, trigger lock, electric brake, and fan-cooled motor. **Free Info: Circle 206**

C BUTLER MANUFACTURING CO.
Metal roofing system
The CMR-24 system features a designed bearing plate that evenly distributes weight of roof panels and clips to support the structural steel, rigid insulation boards in a variety of thicknesses and insulating values, an interior metal liner that protects the insulation to give the building interior a finished look, and a UL Class 90 wind uplift rating. **Free Info: Circle 208**

D ALLEGRO INDUSTRIES
Faceguard
The Browguard provides full-face protection against spatters, small particles, and non-hazardous liquids. A wraparound design can be worn comfortably with impact-resistant safety glasses. Polycarbonate lenses are available in clear, dark green, IR3 and IR5 and meet ANSI Z87.1 standards. The lenses do not yellow over time. **Free Info: Circle 210**

E ZERO INTERNATIONAL
Door hinge
The Unigear high-performance, tamper-proof, integrated hinge dissipates kickback and impact shock while maintaining door swing. The hinge spreads the stress along the full length of the door and frame. The unit is designed with heavy-gauge, aluminum alloy with self-lubricating support blocks. Fire-rated options are available for doors up to 9 feet tall. **Free Info: Circle 205**

F MEGGER GROUP LIMITED
Clamp meter
The DCM1500 measures alternating and direct currents up to 1,500 amperes and resistance up to 400 ohms with a frequency range of 20-400 hertz. The tester can check feeder lines and incomers, measure current during load balancing on three-phase supplies, and diagnose faults on systems and equipment. With a 51-millimeter jaw, the meter accommodates larger current instruments. **Free Info: Circle 207**

G MILWAUKEE TOOL
Inventory management system
One-Key™ enhances tool control, inventory management and tool reporting for technicians. The system uses the Internet and a mobile app to create a central place for users to manage all of their tools and equipment across a network of jobs and operators. The free platform allows companies to keep detailed records of each tool, regardless of brand. **Free Info: Circle 209**

H PHOENIX LIGHTING
Floodlight
The Sturdilite E-DC series offers three models for use on maintenance vehicles and portable equipment: E36 with 36 watts (W) and up to 2,400 lumens; the E56 with 56 W and up to 4,500 lumens; and the E90 with 90 watts and up to 7,100 lumens. The units feature LEDs with a 50,000 hour-rated life and operate in a wide temperature range. Spot and flood optics minimize glare and provide precise optical control. **Free Info: Circle 211**

I MODINE MANUFACTURING CO.
Heat pumps
The geothermal systems offer an enhanced control platform for units ranging from 1.5-12 tons. The control system includes quicker start-up, easier safety device wiring, multiple inputs and outputs, BACnet and Lon capability, and easier troubleshooting. Standard features include electronically commutated motors, dual-speed compressors, air filters with a minimum efficiency value rating of 13, and oversized heat exchangers. **Free Info: Circle 212**

J RAIN BIRD
Irrigation head
The QF Dripline Header speeds up the installation of drip-irrigation systems and reduces the need to build PVC headers. The pre-installed fittings are compatible with any manufacturer's 16-17 millimeter driplines that rotate 360 degrees and incorporate a protective ring to prevent barb damage and ensure a proper seal. Headers are available with 100 feet of self-dispensing coils of ¾- or 1-inch-wide tubing and fitting spacing of either 12 or 18 inches. The heads are designed for landscape designs that include sharp curves. **Free Info: Circle 213**

AD INDEX

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