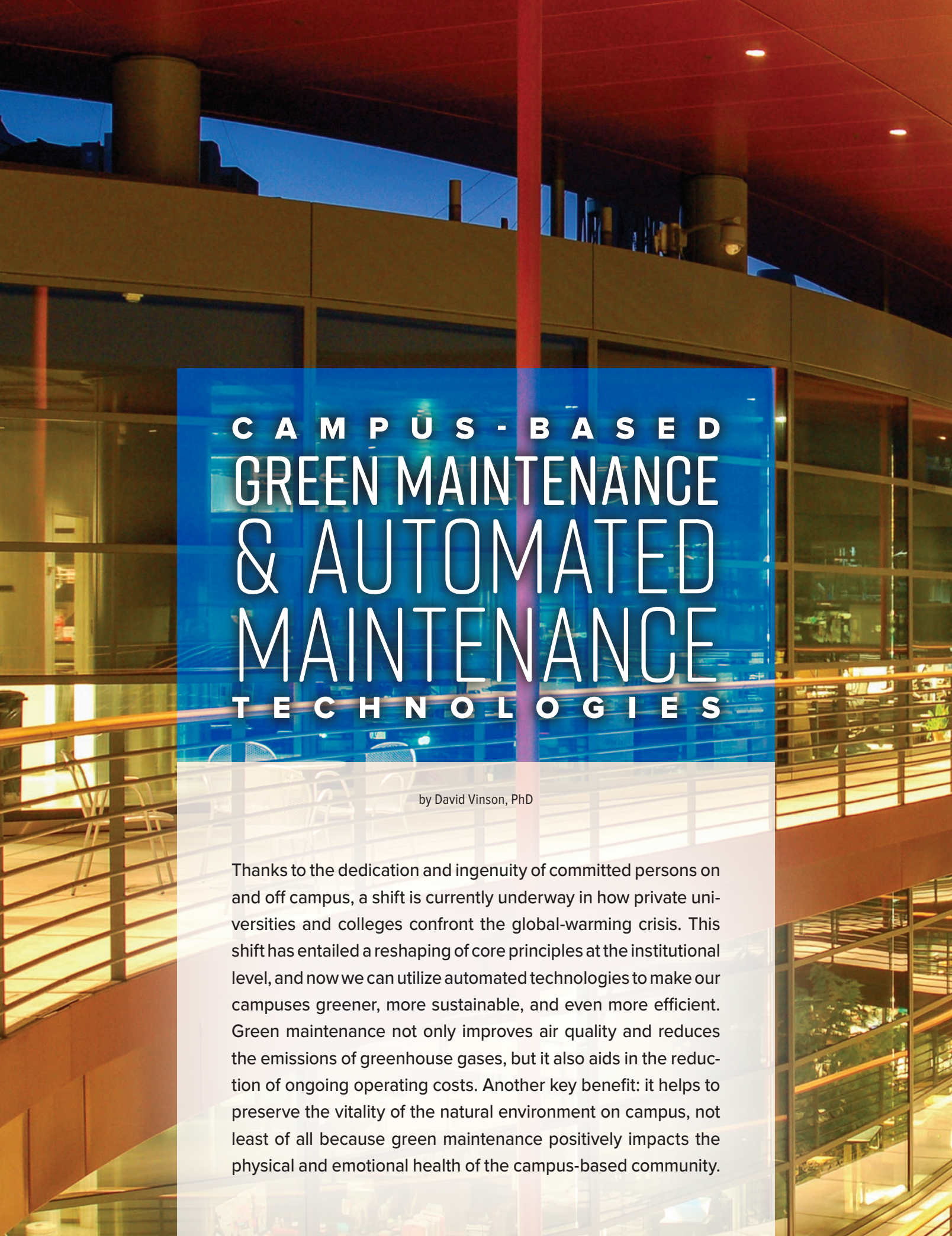
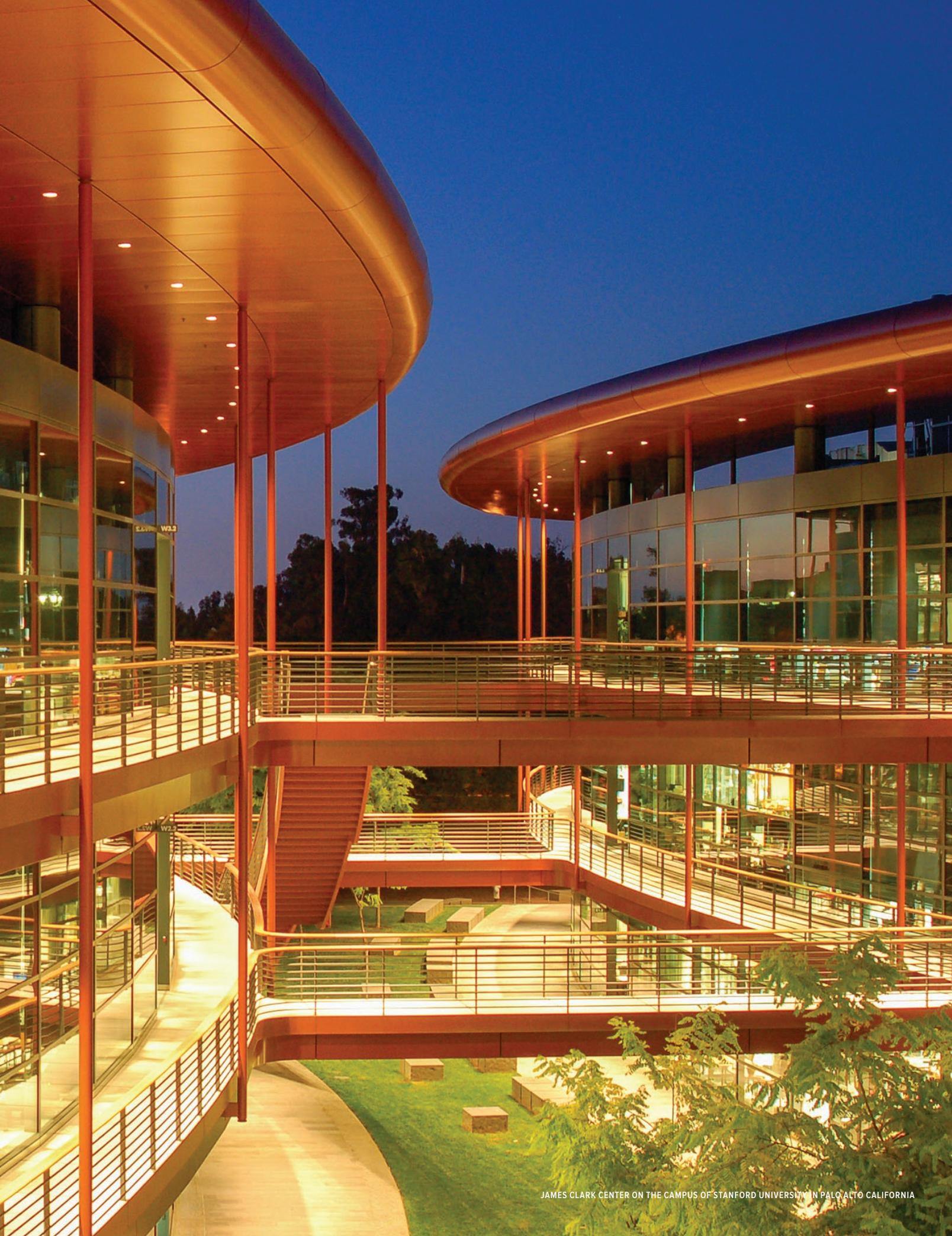


CAMPUS-BASED GREEN MAINTENANCE & AUTOMATED MAINTENANCE TECHNOLOGIES

by David Vinson, PhD

Thanks to the dedication and ingenuity of committed persons on and off campus, a shift is currently underway in how private universities and colleges confront the global-warming crisis. This shift has entailed a reshaping of core principles at the institutional level, and now we can utilize automated technologies to make our campuses greener, more sustainable, and even more efficient. Green maintenance not only improves air quality and reduces the emissions of greenhouse gases, but it also aids in the reduction of ongoing operating costs. Another key benefit: it helps to preserve the vitality of the natural environment on campus, not least of all because green maintenance positively impacts the physical and emotional health of the campus-based community.



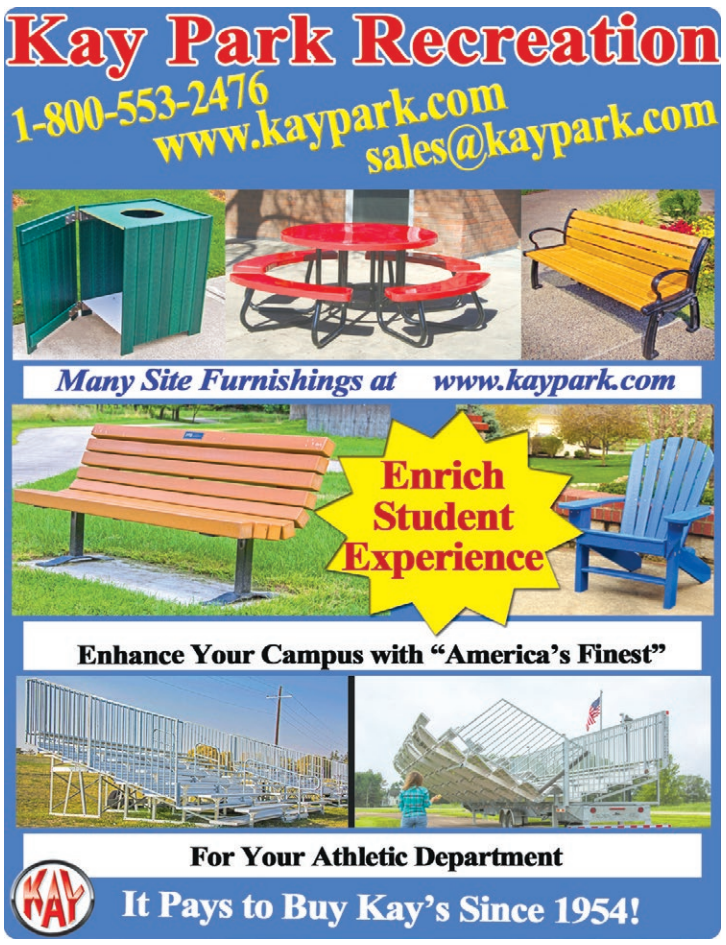
JAMES CLARK CENTER ON THE CAMPUS OF STANFORD UNIVERSITY IN PALO ALTO CALIFORNIA

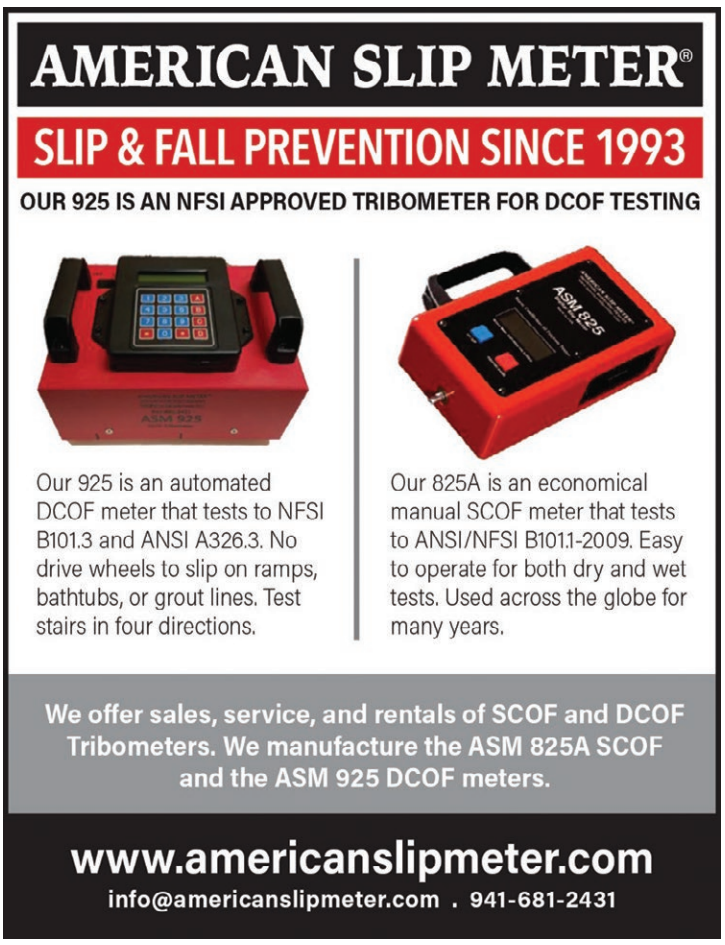
Moreover, automated maintenance technologies that take the form of building analytics can effectively treat on-campus buildings as self-contained ecosystems. These technologies bring building data to the cloud and subsequently to the user. In doing so, they provide system integrators and users alike the ability to see what actually is taking place inside the building. This information allows for the tracking and triggering of systems and devices securely from any location. Automated technologies make possible what was once believed to be impossible—the means of contextualizing a building's data. Users can monitor energy usage and in turn cut energy costs. Not only can users calculate CO2e (including greenhouse gas emissions, emissions reductions, and carbon credits), but they can use automated technologies to adopt text and email alarming, configure system schedules, create custom dashboards, implement built-in security, and use a fully supported application programming interface (API) that defines how applications or devices can connect to one another. One can now monitor every component of a building that may need maintenance, including the ability to check the history of maintenance work, track spare parts, schedule new tasks, and even determine which assets (machines, tools, etc.) are exhibiting increased signs of wear. Functioning with this kind of efficiency can transform campus-based operations.

Rethinking Construction on Campus with Automated Technologies

As the expectations and needs of students, faculty, and staff continue to develop, the need for expanding campuses with new construction projects has increased regularly. We can already trace the profound impact of automated maintenance technologies on how we monitor the ecosystems of campus buildings; perhaps unsurprisingly, the construction companies responsible for creating these new buildings are experiencing an automation revolution, as well. Builders can now deploy autonomous, self-driving machines to haul materials and transport items under minimum supervision. Autonomous survey drones are transforming the sight surveying process by taking minutes to monitor sites, identify safety hazards, and create maps—all tasks that would require days, if not weeks, to accomplish on foot. Further, automated and robot-controlled machines operate at least as efficiently as manually operated machines; and because there are few manual processes too complex for today's advanced automation systems to handle, the usage of automation will surely increase in the construction industry.

Automation also enhances worker safety at construction sites. Worker safety, of course, is an issue of serious and ongoing concern due to the presence of environment hazards and heavy equipment. In fact, the Bureau of Labor Statistics contends that construction is the single most dangerous industry in terms of occupational fatalities. But with automated robots doing the heavy lifting, workers and





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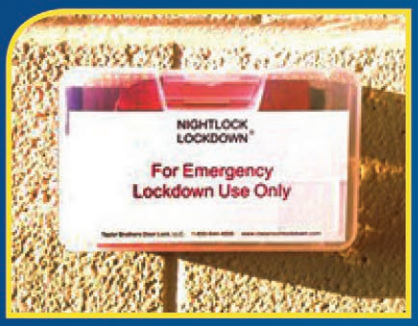

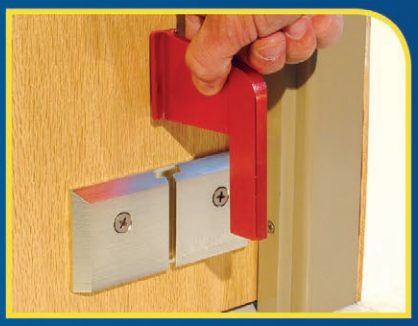

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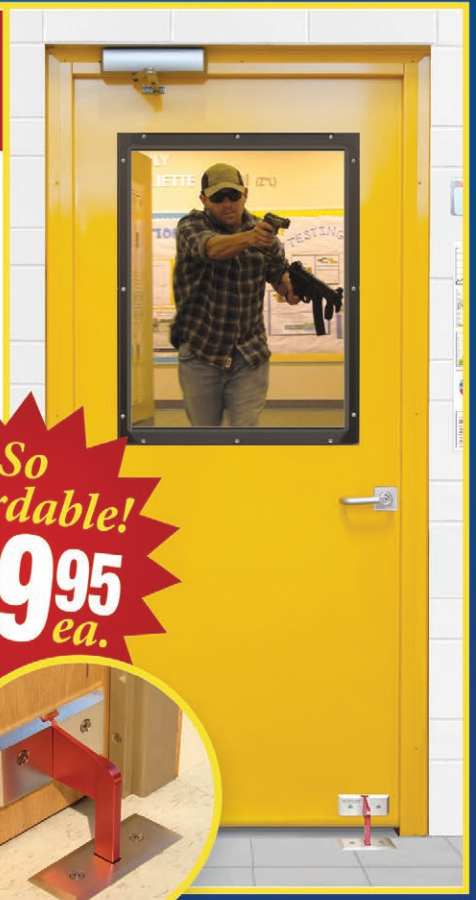

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MODULAR CONSTRUCTION

operators can avoid danger and instead focus on other tasks. Automated technologies, as such, can lead to campus-based construction projects being completed with more efficiency than ever.

Alongside automation, modular construction makes the construction process vastly more efficient. Modular construction breaks down buildings into discrete, modular components that can be mass manufactured. The general idea is to take advantage of how buildings are made up of discrete components such as doors, walls, and other units. The components can be mass-manufactured while still remaining customizable. In the context of economies of scale, modular construction brings material costs down. Some higher education institutions may even wish to utilize 3D-printed modular components for smaller facilities—it is not far-fetched to imagine why this approach to construction would be an on-campus attraction both to current and prospective students. That 3D-printed modular buildings are environmentally friendly is an added benefit, one that aligns with the core goals of producing greener and more sustainable campuses.

Promoting On-Campus Sustainability with Green IT Solutions

Information technology (IT) can provide another strategy for making campuses greener, more sustainable, and more efficient. Put simply, green IT is the practice of environmentally sustainable computing; this approach aims to minimize the negative impact of IT operations on the environment by designing, manufacturing, operating, and disposing of computers and computer-related products in an environmentally friendly manner. Green IT practices help to reduce the use of hazardous materials, to maximize energy efficiency during a product's lifetime, and to promote the biodegradability of unused and outdated products. Green IT is founded on a philosophy that defines an enterprise's success—higher education included—on its economic, environmental, and social performance.

Green IT solutions address a wide range of environmental issues, each with the goal of making campuses greener and more sustainable. One such solution is virtualization. At Stanford University, not unlike many other private universities and colleges, managed virtual servers are offered as an alternative to managed physical servers. This process takes advantage of virtualization technology by which a single server provides the virtual services that would otherwise need to be provided by multiple systems. The result is streamlined technology that reduces overall power, which in turn benefits the environment and cuts down on energy costs.

Another green IT solution is to reduce the use of computing systems during non-peak time periods. Few computing devices, for instance, are computing at full output at all times. Instead, the majority of computers are used intermittently, typically operating at their computational peak for 1-2% of the time. The best power-management designs make a computer "energy proportional," in that electricity use and computational output go up proportionally with utilization, and electricity use goes to zero (or nearly so) when the device is idle. Campus-based sustainability can also be managed by recycling physical technology components such as keyboards, monitors, CPUs, and so forth. Because these devices can be highly toxic and are often not biodegradable, several hardware manufacturers have developed biodegradable parts.

The Covid-19 pandemic has created an exponential demand for remote learning as well as telecommunication. While adapting to these changes has been a challenge for students, educators, and staff alike, an obvious upside is that the ability to learn or work from home reduces transportation emissions. Similarly, remote administration allows administrators to remotely access, monitor, and repair systems, all of which significantly decrease the need for physical travel; again, reduced travel eliminates unnecessary carbon emissions.

Creating Meaningful Change

Green maintenance and automated maintenance technologies empower us to create meaningful change on campus and beyond. Over the past several decades, the progress made by private universities and colleges to provide greener and more sustainable facilities has been remarkable—and we can be confident that as innovative technologies continue to emerge, we will continue to pursue the highest possible standards in terms of positively impacting our local communities, society at large, and the planet.

In our next issue (April 2022), we extend this conversation about sustainability and green living by focusing at some length on ways of transforming on-campus facilities into energy efficient, healthy, and cost-effective spaces.

ABOUT THE AUTHOR: Dr. David Vinson has a PhD in English with specializations in transatlantic literature and cultural studies. He is a committed scholar, teacher, and dad. If you ever meet David, avoid the subject of soccer. His fandom borders on the truly obnoxious.

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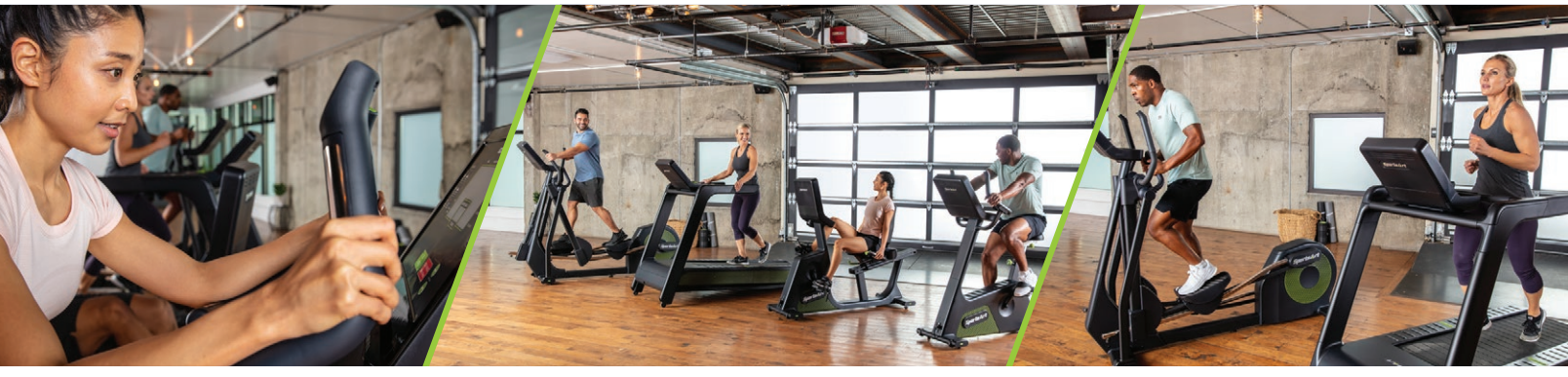

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