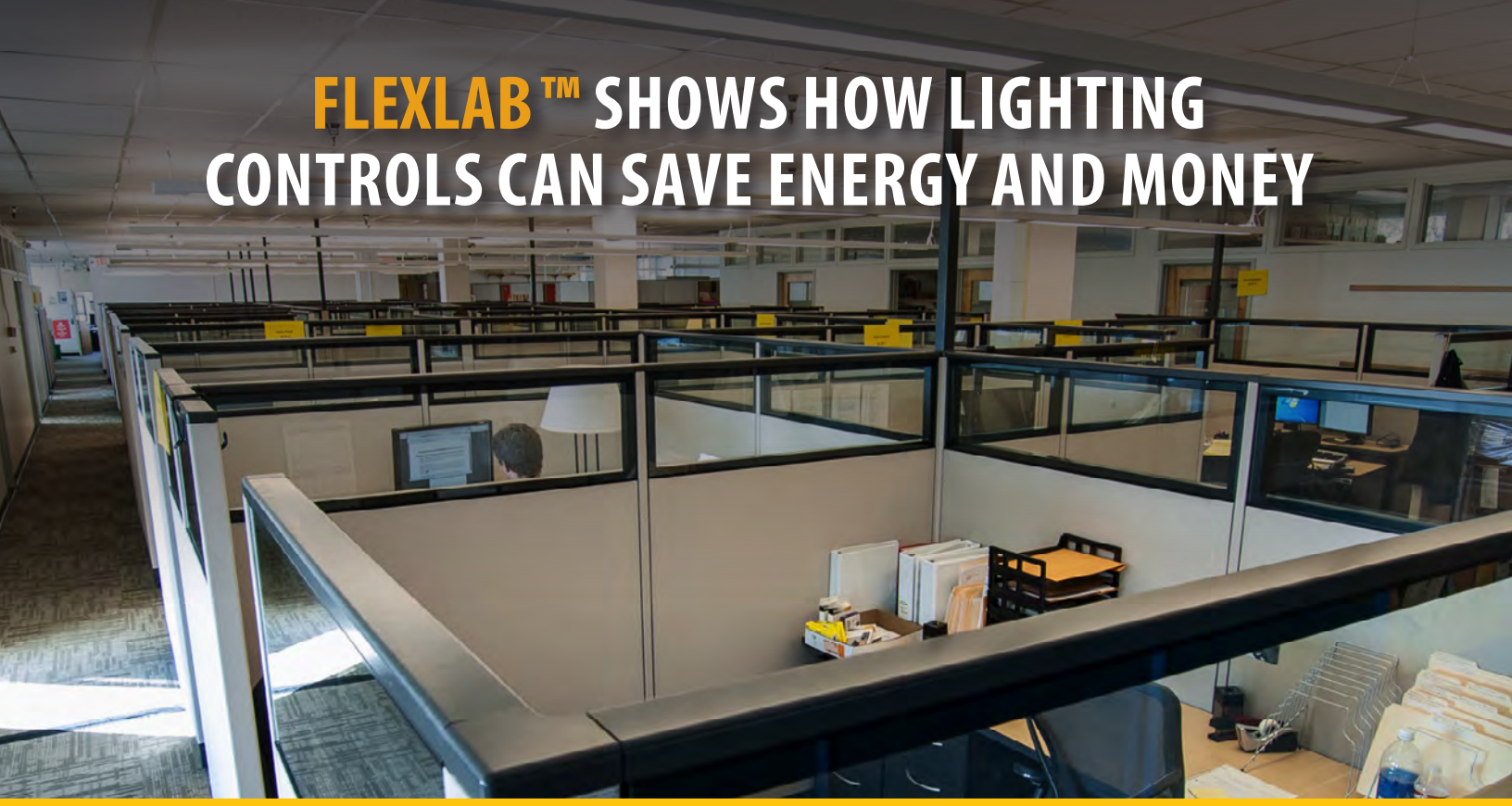
FLEXLAB ™ SHOWS HOW LIGHTING CONTROLS CAN SAVE ENERGY AND MONEY



BUILDING OWNERS AND OPERATORS ASSURED OF SAVINGS AND PERFORMANCE

THE CHALLENGE: How to ensure that lighting controls operate correctly, and are worth the investment.

It is well documented that controls that automatically adjust lighting as needed save energy and money. Scheduling alone could save the commercial building sector tens of trillions of Btus and billions of dollars in energy costs each year. But 70 percent of commercial buildings don't use any controls. Building owners and operators remain unconvinced of their value. And they don't know how to make sure lighting control systems are working properly – or delivering the savings they promise.

THE SOLUTION: FLEXLAB

With funding from the Department of Energy Building Technologies Office, Berkeley Lab researchers devised an experiment to show that open-source algorithms can provide the tools needed to monitor a building's lighting control systems, make sure they're performing as they should, and quantify a given building's energy savings. They developed open-source algorithms to conduct fault detection and diagnostics (FDD) and continuous savings measurement and verification (M&V) for lighting control systems. FLEXLAB's Lighting and Plug Load Testbed provided a realistic, occupied office environment that also features the ability to configure diverse control strategies and physical control zones.

> ***The configurability of physical control zones and lighting control strategies that FLEXLAB offers is unparalleled. The work we conducted in FLEXLAB is a test facility that offers critical benefits beyond the typical environments that we otherwise have access to in our field.***

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THE BOTTOM LINE:

FLEXLAB showed building stakeholders that lighting controls can be continuously monitored to ensure energy- and cost-saving benefits.

- The experiment focused on schedule-based lighting controls, which can save five to 15 percent of lighting energy use compared to a no-controls baseline. Automating lighting based on expected times of building occupancy saves energy. Occupant sensors and/or override switches can ensure flexibility.
- The experiment proved that automated measurement and verification can show building owners and operators exactly how much energy lighting controls are saving them – and can do it automatically, on an ongoing basis.
- The experiment showed that open-source algorithms for FDD and M&V can reliably tell when a lighting-control system isn't working as it should, giving building owners and operators clear guidance for making adjustments and enabling even greater energy savings.
- These algorithms can be readily adopted for inclusion in existing commercial lighting control solutions, or can be implemented using the Department of Energy's open-source VOLTTRON™ platform.

THE EXPERIMENT

- FLEXLAB's test bed – featuring occupied office space and state-of-the-art monitors – was configured to compare two cases: (1) business as usual, with manual switches used to control lights, and (2) schedule-based lighting controls, representing a cost-effective and underutilized control strategy.
- Algorithms for measurement and verification and fault detection and diagnostics were programmed to run on DOE'S VOLTTRON™ distributed sensing and control platform.
- FDD algorithms were run on data from the schedule-based control case in order to ensure correct configuration of the control strategy and correct activation of the lights.
- Researchers intentionally imposed faults to make sure the FDD agent correctly identified mistakes in programing and configuration, suboptimal on/off times, and suboptimal occupant-override timeouts.
- Data from the business-as-usual case was used in the M&V algorithm to set a baseline energy-use pattern, while data from the schedule-based control case was used to automatically calculate savings. The FDD agent verified that controls were implemented correctly.

THE RESULTS

- FLEXLAB testing proved that open-source automated savings verification algorithms can provide accurate, automated validation of energy savings from lighting controls in a specific building, using data collected from that building. For building owners and operators, this means quantifiable results they can count on – a key selling point for lighting control systems that can encourage broader uptake and greater energy savings.
- The experiment showed that open-source FDD algorithms can ensure ongoing correct operation of schedule-based lighting controls and appropriate on/off times and override options, based on the actual use of the building. For building owners and operators, this is further evidence that lighting-control systems can be implemented in ways that are user-friendly as well as effective.
- Proving that lighting control systems can work accurately and automatically to save energy and money is key to increasing the use of lighting controls in commercial buildings – and that has major ramifications for energy efficiency. Assuming just five percent savings due to lighting scheduling controls alone, the national technical potential for commercial building savings is approximately 47 TBtu and $4.1B every year. And more sophisticated control strategies can yield even greater benefits.

For more details about this project, see J. Granderson, P. Price, S. Czarnecki, J. Page, R. Brown, and M. A. Piette. "Development of Diagnostic and M&V Agents, and Implementation in an Occupied Office Environment." Lawrence Berkeley National Laboratory. LBNL-6973E. March 2015.

For more information about VOLTTRON, visit gridoptics.pnnl.gov/VOLTTRON/.
For more information about FLEXLAB, visit flexlab.lbl.gov.

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