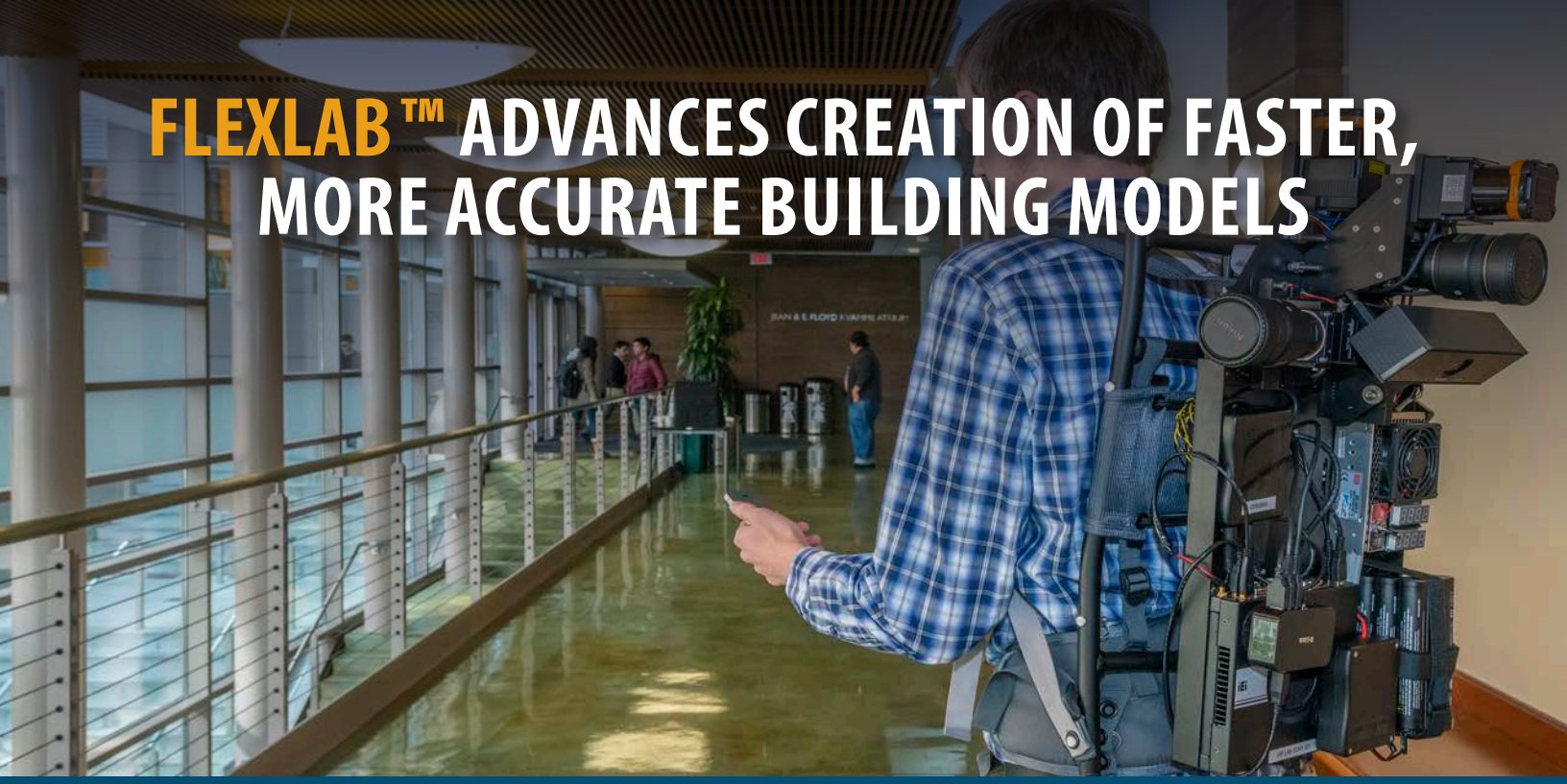
FLEXLAB™ ADVANCES CREATION OF FASTER, MORE ACCURATE BUILDING MODELS



VERIFYING BREAKTHROUGH RAPMOD TOOL BRINGS RAPID ENERGY MODELING CLOSER TO MARKET

THE CHALLENGE: Proving that an exciting new building modeling technology works.

The Rapid Building Energy Modeler (RAPMOD) easily and automatically maps a building and interacts with energy modeling tools, saving time and money while boosting accuracy. Deployed on all commercial buildings with a floor area greater than 50,000 sq ft, RAPMOD could save ~$3B by reducing energy modeling costs for major retrofits, retro-commissioning and performance monitoring. But how could researchers prove that it can quickly and accurately determine how building components perform – in this case windows?

THE SOLUTION: FLEXLAB

Testing RAPMOD in FLEXLAB's life-size, controlled environment while precisely measuring conditions across a range of interior temperatures allowed researchers to verify RAPMOD's window-measuring capabilities. The experiment showed RAPMOD can quickly and accurately evaluate a window's performance in terms of energy and visual quality, revealing new possibilities for energy efficiency and occupant comfort.

THE BOTTOM LINE:

The FLEXLAB experiment verified RAPMOD's performance while helping fine-tune the measurement method for windows, contributing to RAPMOD's ability to cut building energy model creation time by 30 percent.

- The FLEXLAB tests helped to speed the development of RAPMOD and increase the accuracy of its window-measuring capabilities.
- FLEXLAB provided a unique controlled environment to test a wide variety of window conditions, solar orientations and interior temperature conditions, all at a realistic scale.
- FLEXLAB testing also suggested ways to improve the RAPMOD system.

> ***"LBNL's FLEXLAB facility provided a perfect platform to experimentally verify our method of measuring the U-values of windows, which are key to predicting the energy use of real buildings."***

ANNIE MARSTON | BAUMANN CONSULTING
Head of Building Performance

Advanced Research Projects Agency • ENERGY

THE EXPERIMENT

- The research team performed two sets of experiments at FLEXLAB: a window U-value measurement and a window solar/visual transmittance measurement.
- The U-value measurements were performed in twin FLEXLAB test beds with different glazing systems, typical of two different eras of construction. The solar and visible transmittance measurements were performed in FLEXLAB's unique, large-scale rotating test bed, which enabled testing under the different solar exposure conditions, occurring with south-facing and west-facing glazing.
- For the U-value measurement, the researchers used a handheld laser tool to identify the thickness of the panes, and their separation, in a window, together with the presence of a low-e coating, in order to estimate the U-value of the glazing. Then they used an infrared camera, a digital camera, and two temperature sensors to determine the area and U-value of the window frame. The U-value of the whole window assembly was then determined from the U-value of the glazing, the U-value of the frame, and the ratio of the area of the frame to the area of the glazing.
- The researchers then tested a procedure to estimate the solar and visual transmittances of glazing systems. Two pyranometers were used to determine the solar transmittance, which is used by energy simulation programs to predict solar heat gain. Two photometers were used to determine the visual transmittance, which is used to predict daylight levels inside the building.
- One pyranometer and one photometer were installed on a tripod on the inside of the window, facing out, to measure the transmitted irradiance and illuminance. The other pyranometer and photometer were mounted outside the window, to measure the incident irradiance and illuminance. The ratios of the inside and outside measurements then provided estimates of the corresponding transmittances.

"RAPMOD is a really exciting idea. It's wild, out of the box, and has the potential to be a practical energy tool. We use engineers for now, but looking to the future, this would enable us to use technicians instead."

MATT GANSER | CARBON LIGHTHOUSE
Director of Engineering

THE RESULTS

- Energy simulation is key to identifying deep energy savings for existing buildings. By verifying RAPMOD's ability to accurately and quickly measure the characteristics of the windows in a building, the FLEXLAB experiment has brought RAPMOD—which can cut building energy model creation time by 30 percent—closer to market.
- The FLEXLAB experiment proved RAPMOD could correctly and quickly determine a window's U-value, well within the accuracy benchmark specified by ARPA-E, the project's funding agency. (The average error was 0.22W/m^2K, well within the ±0.7 W/m^2K target agreed with ARPA-E.)
- FLEXLAB testing was especially helpful in supporting accurate U-value measurements. FLEXLAB provided a stable temperature environment at different interior temperatures, enabling measurement performance to be demonstrated over a range of conditions.

CONCLUSION

FLEXLAB played a significant role in the development of RAPMOD, which, if deployed on all commercial buildings with a floor area greater than 50,000 sq ft, could save ~$3B by reducing energy modeling costs.

FOR MORE INFORMATION ABOUT FLEXLAB, VISIT flexlab.lbl.gov.

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