FLEXLAB®

THE WORLD'S MOST ADVANCED BUILDING EFFICIENCY & ENERGY SYSTEMS TEST BED

FLEXLAB®: DELIVERS DEEP ENERGY SAVINGS AND GRID EFFICIENT CONTROLS

Solves building to grid and renewable energy integration challenges

THE PROBLEM

A recent study[1] found building retrofit systems based approaches save 49% to 82% more energy than a component based approach. However systems solutions are not well understood, and need to be designed to work with dynamic grid conditions to make best use of renewable energy while saving energy costs. This poses a huge obstacle to reaching ambitious CA and US clean energy goals.

OUR SOLUTION

FLEXLAB® offers a way to test-drive energy efficient systems, identifying problems and optimizing performance before breaking ground. FLEXLAB unleashes the real potential of energy efficiency in buildings. FLEXLAB also studies real-time building energy, renewables and storage integration challenges, through FLEXGRID, a distributed energy resources R&D platform.

FLEXLAB LEADING THE WAY

FLEXLAB is the brainchild of our nation's leading energy efficiency experts at the U.S. Department of Energy's Lawrence Berkeley National Laboratory (Berkeley Lab)—the home of energy innovation for decades.

> **This facility could be the most important building in the country.**
>
> **Jes Pedersen,**
> CEO, Webcor Builders

Berkeley Lab's scientists are developing game-changing innovations, including: window coatings, simulation software, electronic ballasts, and appliance standards that have saved consumers a combined $484 billion.[2,3]

FLEXLAB launches the next chapter of Berkeley Lab's leadership by unlocking the mysteries of integrated design, and developing new technologies creating transparency throughout the construction process which will eventually transform the way buildings perform. Now, for the first time, the full spectrum of building loads, energy demand, controls and distributed energy resources technologies can be studied and compared in real-time.

> **FLEXLAB® is an exciting contribution that will help industry.**
>
> **David Danielson,**
> Assistant Secretary,
> U.S. Dept. of Energy

WHAT FLEXLAB CAN DO FOR YOU

FLEXLAB® is the first test bed in the world that can evaluate the energy performance of major building systems, as an integrated system, under real-world conditions, integrating with photovoltaic, storage and electric vehicle charging. Stakeholders can evaluate energy-efficient building technologies individually or as integrated systems in advance of building projects or retrofits, in order to:

- Optimize integrated systems to maximize energy savings, under varying grid conditions
- Ensure occupant comfort and user-friendliness
- Verify cost-benefit numbers
- Train building operators
- Build confidence in new technologies and control strategies

> **"FLEXLAB® can help solve the integrated design problem."**
>
> **Kevin Hydes,**
> Chair, Integral Group

FLEXGRID

FLEXLAB has added new distributed energy resources testing capabilities with FLEXGRID, a system that enables real-time comparisons between demand, renewables, inverters, storage and bidirectional electric vehicle charging. FLEXGRID's installed hardware includes photovoltaic arrays, a battery bank, inverters, Opal-RT grid simulator, Ametek regenerative power supply, programmable load banks, and has the capability to integrate EV charging with buildings and the grid.

Four large test beds:
Multiple testbeds, including one that rotates, allow a variety of testing scenarios.

Test-drive technologies:
Users can test-drive different technologies for HVAC systems, lighting, windows, shading, building envelope, control systems, and plug loads in different locations globally.

Comparison testing:
Two cell test beds allow side-by-side tests for comparisons of energy efficiency technologies.

Individual circuits and meters:
Every outlet and device has its own circuit and power metering and device.

High accuracy sensors and instrumentation:
Embedded sensors are included throughout the facility.

Interchangible elements:
Flexible components allow users to swap out windows, walls, skylights, floors, lighting, HVAC systems, and other architectural elements.

Technology performance metrics:
Energy, power, and technology performance are measured and more subjective factors, such as visual comfort and user-friendliness are evaluated.

On-site training:
FLEXLAB users save time on ramping-up efficiency operations.

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1 Cynthia Regnier, Paul A Mathew, Alastair Robinson, Peter Schwartz, Jordan Shackelford, Travis Walter, 2018. Energy Cost Savings of Systems-Based Building Retrofits: A Study of Three Integrated Lighting Systems in Comparison with Component Based Retrofits (https://flexlab.lbl.gov/publications/energy-cost-savings-systems-based)

2 National Research Council. Energy Research at DOE: Was It Worth It? Energy Efficiency and Fossil Energy Research 1978 to 2000. Washington, DC: The National Academies Press, 2001. ISBN: 0-309-07448-7 (http://www.nap.edu/catalog/10165.html)

3 Stephen Meyers, Alison Williams, and Peter Chan, 2013. Energy and Economic Impacts of U.S. Federal Energy and Water Conservation Standards Adopted from 1987 through 2012. LBNL-6217E (http://escholarship.org/uc/item/54b4782q)

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ENERGY TECHNOLOGIES AREA