BUILDING TECHNOLOGY & URBAN SYSTEMS
ENERGY TECHNOLOGIES AREA
BERKELEY LAB

Working Now on Solutions to Today's Challenges

Our homes and buildings consume huge amounts of energy – 40 percent of all energy use in the United States. Research at Berkeley Lab has greatly boosted energy efficiency in buildings, from new lighting technologies and materials to refrigerators that cut energy use in half. But our energy systems are changing.

Our challenge now is not just to better manage how much energy we use, but also how our buildings integrate with the grid. New demands on the grid system will require the ability to dynamically shift building loads, reduce them, or store energy, depending on time-based conditions.

Appliances and cooling systems, for example, can receive automated signals and reduce or shift the timing of electricity use. Thermostats with "Rush Hour Rewards" cut air conditioning use after sunset when demand on the electrical grid peaks. And sensors will enable us to see – and control – our energy use in real time, not just read our energy bill at the end of the month.

Watch Piette's recent talk at UC Berkeley Cal Future Forum: Responsive Low-Carbon Buildings.

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Future Building Simulation Tool

As the demands on buildings and community energy systems increase, all the while requiring better energy performance, building energy simulation programs need to keep pace.

These programs do important work, including integrating renewable energy and waste heat, providing grid services and generally making people more comfortable in the spaces they occupy.

Michael Wetter, Staff Scientist at Berkeley Lab, recently spoke at an International Building Performance Simulation Association (IBPSA) hosted seminar. He presented Department of Energy sponsored technologies and open-source standards that are well positioned to address the more integrated and complex building systems we have today. These technologies include Spawn of EnergyPlus, OpenBuildingControl, Modelica and Functional Mock-up Interface (FMI) Technologies.

- *video made by Rajan Rawal of CEPT University, India, on behalf of IBPSA.*

Smart Energy Analytics

Four participants and one provider were recently honored for their work on the Smart Energy Analytics Campaign that enables building owners to reap savings with sophisticated software. Campaign recognition was conferred at Smart Cities Week and the National Building Commissioning Conference by Department of Energy (DOE), Energy Efficiency and Renewable Energy (EERE) leaders: David Nemtzow, Director of Building Technologies Office (BTO) and Kathleen Hogan, Deputy Assistant Secretary for Energy Efficiency, respectively.

In addition, a new research report summarizes best practices implemented across the 46 portfolios (185 million square feet) that have joined the Smart Energy Analytics campaign in its first year.

Read the report: Synthesis of Year One Outcomes in the SEA Campaign

Learn about the honorees recognized at Smart Cities Week: smart-energy-analytics.org/

Join the Campaign now - it's a great money-saver for building owners: smart-energy-analytics.org/join-campaign

Saving Money With Retrofit Toolkit

The California Energy Commission's Public Interest Energy Research program (CEC-PIER) funds the building energy retrofit analysis toolkit, Commercial Building Energy Saver (CBES), developed at Berkeley Lab.

CBES is a web-based application with a suite of tools to help building owners, managers, engineers and consultants identify and evaluate energy saving measures and economic benefits of building retrofits.

CBES has recently expanded to add new features:

- Covering more building types such as large offices, hotels and restaurants
- Covering all U.S. climates
- Adding renewable energy measures such as solar PV and electric battery
- Adding incentives and rebates
- Supporting the Linux operating system

These new features are funded by several projects, including the DOE's Commercial Building Integration (CBI) whole building retrofit toolkit, California Energy Commission (CEC) EPIC ZNE commercial retrofit, DOE small business voucher program, and DOE's technology commercialization fund.

CBES was adopted as the whole building retrofit analysis tool as part of the 2030 Districts Toolkits for high-performance buildings. CBES was selected as the tool to train 40 faculty members from 27 community and technical colleges across the United States, as part of the National Science Foundation (NSF) funded Laney College's BEST Center, which advances education for tomorrow's building technicians in topics including HVAC (heating, ventilating, air conditioning), building operations and energy management.

The Berkeley Lab team has also been collaborating with industry to support the CBES adoption. The team is working with Lucid Design Group to integrate the CBES software development kit with Lucid's BuildingOS
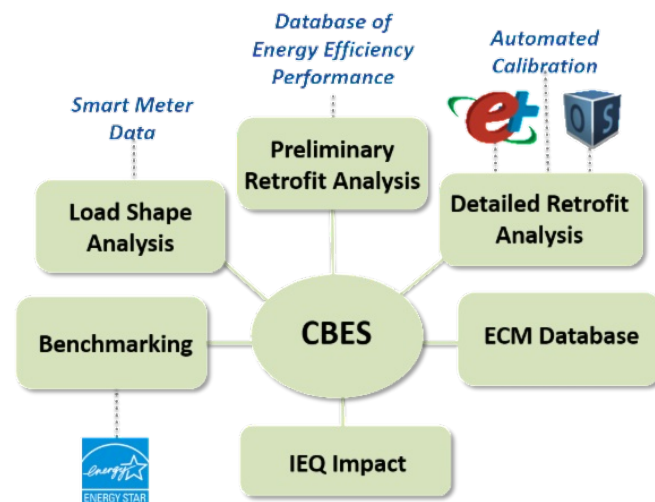
platform to enable automatic large-scale (10,000s) building retrofit analysis, which supports Lucid customers on decision making to reduce energy use and utility cost of their buildings.

CBES also powers the city-scale building energy efficiency platform, CityBES.lbl.gov, which enables district and city-wide building energy retrofit analysis to support city's programs on reducing energy use in its building stock.

Find out more at CBES.lbl.gov

Read about recent funding from DOE that will advance CBES to provide quick and reliable energy retrofit recommendations for small to medium sized commercial buildings: energy.gov/eere/buildings/articles/working-national-labs-expand-commercial-impact

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Berkeley Lab Hosts AERC Training

BTUS staff recently hosted and taught a three-day software training session for eight members of the Attachment Energy Rating Council (AERC) on the use of the WINDOW, THERM and AERCalc simulation tools.

AERCalc can be used to calculate the annual heating and cooling energy impact of fenestration attachments like cellular shades, venetian blinds, solar screens, roller shades, and storm window panels. Results from AERCalc will be used to rate the performance of window attachments.

For more information go to: energy.gov/eere/buildings/downloads/attachments-energy-ratings-council

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Final Report: IEA EBC Annex 60

A five-year collaboration among 42 institutes from 16 countries, organized within IEA EBC Annex 60 and co-led by Michael Wetter from Berkeley Lab and Christoph van Treeck from RWTH Aachen, Germany, has concluded.

The final report consists of 500 pages that describe new generation computational tools for the design and operation of building and community energy systems. The report summarizes the development of Modelica models, approaches and tools for co-simulation based on the FMI standard, Building Information Modeling technologies based on the Industry Foundation Classes, as well as tools for workflow automation that have been developed in Annex 60. The Modelica library developed in Annex 60 is the core of the model library used for Spawn of EnergyPlus, and MPC technology has been used in CERC 2.0. The report also demonstrates how these technologies have been used in applications such as rapid virtual prototyping, design of local and supervisory control algorithms, and deployment of models in support of commissioning and operation.

The target audience of the report is the building energy research community, design firms and energy service companies, equipment and tool manufacturers, as well as students in building energy.

The report along with several research papers resulting from the collaboration can be found at this link: www.iea-annex60.org/pubs.html.

BTUS' Heat Island Group in the News

KPCC-FM/Southern California Public Radio story on the impact of cool roofs quoted **Ronnen Levinson,** Staff Scientist, Berkeley Lab.

Levinson was also interviewed about Cool Pavement research on the Marketplace Morning Report, August 24, 2017, as well as a recent edition of California Magazine.

Read more about [Urban Heat Islands.](#)
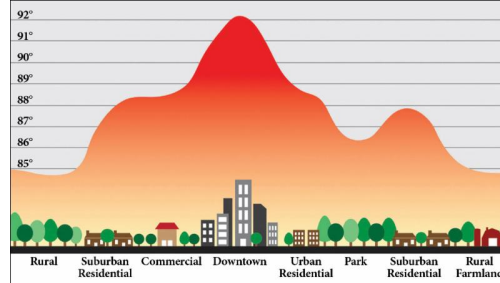
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See also: Department of Energy [Building Technologies Office](#)

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Lawrence Berkeley National Lab (Berkeley Lab) is located in the Berkeley Hills near UC Berkeley and conducts scientific research on behalf of the United States Department of Energy (DOE). It is managed and operated by the University of California (UC). The Laboratory overlooks the University of California, Berkeley. Berkeley Lab addresses the world's most urgent scientific challenges by advancing sustainable energy, protecting human health, creating new materials, and revealing the origin and fate of the universe. Founded in 1931, Berkeley Lab's scientific expertise has been recognized with 13 Nobel prizes. The University of California manages Berkeley Lab for the U.S. Department of Energy's Office of Science. For more information, visit www.lbl.gov.

DOE's Office of Science is the single largest supporter of basic research in the physical sciences in the United States, and is working to address some of the most pressing challenges of our time. For more information, see science.energy.gov.