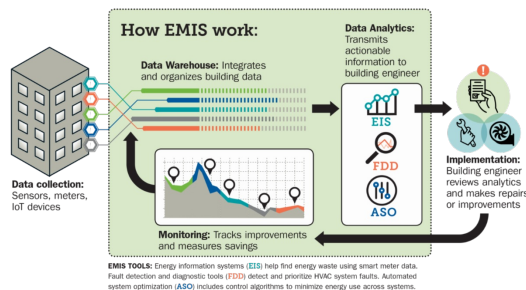## Taking Building Energy Savings to a New Level

The culmination of a four-year Department of Energy (DOE) building energy efficiency effort, the Smart Energy Analytics Campaign, confirms what we have long known about energy management and information systems: They can deliver huge value across sectors, from private companies to schools and governments. The Smart Energy Analytics Campaign reduced participants' energy bills by a total of $95 million each year.

The campaign's success is accompanied by some well-deserved recognition for our researchers, namely a distinguished achievement award for Michael Wetter from the International Building Performance Simulation Association and a DOE lifetime achievement honor in sustainability for Dale Sartor, who recently retired. Below you'll learn more about important modeling tool releases that support our continuing progress in making buildings more energy efficient.

— *Mary Ann Piette, Division Director, Building Technology and Urban Systems*

Smart Energy Analytics Campaign Drives $95M in Annual Savings

How EMIS work:

Data Warehouse: Integrates and organizes building data

Data Analytics: Transmits actionable information to building engineer

Data collection: Sensors, meters, IoT devices

EIS
FDD
ASO

Implementation: Building engineer reviews analytics and makes repairs or improvements

Monitoring: Tracks improvements and measures savings

EMIS TOOLS: Energy information systems (EIS) help find energy waste using smart meter data. Fault detection and diagnostic tools (FDD) detect and prioritize HVAC system faults. Automated system optimization (ASO) includes control algorithms to minimize energy use across systems.

One hundred and four U.S. companies, schools, governments, and institutions boosted their building energy savings with the Department of Energy's Smart Energy Analytics Campaign, a four-year initiative funded through the Building Technologies Office and facilitated by Berkeley Lab to expand the use of energy management and information systems (EMIS) in commercial buildings.

The Smart Energy Analytics Campaign helped drive approximately 4 trillion BTUs of annual energy savings — enough to power more than 44,000 U.S. households for a year — reducing the campaign participants' collective energy bills by $95 million a year. The research also enabled Berkeley Lab to create the world's biggest collection of data on building energy analytics. This dataset represents the first real-world, large-scale body of evidence of EMIS' value to commercial buildings.

Read more: buildings.lbl.gov/news/article/berkeley-lab-building-efficiency

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Distinguished Achievement in Building Simulation Award for Michael Wetter

Michael Wetter, computational staff scientist at Berkeley Lab, was recently awarded the 2020 Award for Distinguished Achievement in Building Simulation from IBPSA-USA, the International Building Performance Simulation Association. The Distinguished Achievement Award recognizes an individual who has a distinguished record of contributions to the field of building performance simulation for more than 15 years.

See more: www.ibpsa.us/awards

U.S. Department of Energy Releases Updated Versions of EnergyPlus and OpenStudio Building Energy Modeling Tools

DOE and its National Laboratories have released updated versions of their state-of-the-art, open-source, whole-building energy modeling tools: the EnergyPlus™ engine and the OpenStudio™ software development kit.

EnergyPlus 9.4.0 continues to emphasize object-oriented refactoring and defect resolution, as well as adding new features to improve usability and supporting new use cases including the Python Plugin and resilience metrics reporting. EnergyPlus 9.4.0 also incorporates several performance enhancements from the EnergyPlus 10X project, including a user-configurable fast simulation mode that runs simulations at hourly time step.

Both EnergyPlus and OpenStudio are available for Windows, Mac OS X, and Linux Ubuntu platforms. Peer-to-peer and developer support is provided via the unmethours.com forum. More information about all of DOE's energy-modeling software and research projects can be found at energy.gov/eere/buildings/building-energy-modeling/.

Dale Sartor Receives 2020 Sustainability Award

Dale Sartor recently was selected for a 2020 Department of Energy Sustainability Award for Lifetime Achievement. His efforts and commitment to sustainability have been essential in ensuring DOE's continued success as a federal leader in sustainability. Sartor, who was a staff scientist/engineer at Berkeley Lab, retired in June 2020 after more than 45 years focused on building energy efficiency.

More about the sustainability awards: www.energy.gov/management/spo/2020-us-department-energy-sustainability-award-winners

Modelica Buildings Library 7.0.0 Released

The Simulation Research Group has issued a major release of its Modelica Buildings Library, a free open-source library with dynamic simulation models for building and district energy and control systems.Version 7.0.0 is a major release that contains various new packages, new models and improvements to existing models.

See the details: simulationresearch.lbl.gov/modelica/download.html

Let the Breeze In

Nari Yoon, a Rosenfeld Postdoc from the Energy Technologies Area, recently competed in the Berkeley Lab Research SLAM for Early Career Scientists and Postdocs. She was one of twelve finalists to take the stage to communicate their science in a clear and concise three minutes to wow the panel of judges. Nari explores methodologies to harness natural
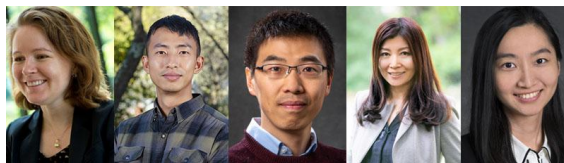
ventilation in building design and operations to save energy and enhance personal comfort.

Watch Nari's SLAM presentation here: youtu.be/BQMhRnAVX7g

R&D 100 Award: Building Efficiency Targeting Tool for Energy Retrofits (BETTER)

The Building Efficiency Targeting Tool for Energy Retrofits (BETTER) allows municipalities, building and portfolio owners and managers, and energy service providers to quickly and easily identify the most effective cost-saving and energy-efficiency measures in their buildings. With an open-source, data-driven analytical engine, BETTER uses readily available building and monthly energy data to quantify energy, cost, and greenhouse gas reduction potential, and to recommend efficiency interventions at the building and portfolio levels to capture that potential.

The development team includes Berkeley Lab scientists Nan Zhou, Carolyn Szum, Han Li, Chao Ding, Xu Liu, and William Huang, along with collaborators from Johnson Controls and ICF.

It is estimated that BETTER will help reduce about 165.8 megatons of carbon dioxide equivalent (MtCO2e) globally by 2030. This is equivalent to the CO2 sequestered by growing 2.7 billion tree seedlings for 10 years.

High-Performance Windows to Benefit Low-Income California Communities
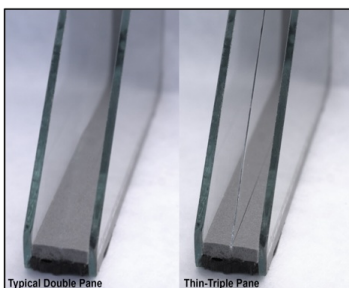
Thanks to a new grant of nearly $2 million from DOE and the California Energy Commission (CEC), many homes in the state will have energy-saving, thin-glass triple-pane windows installed. The funding will allow a retrofit that adds thin-glass triple-pane windows into two multi-family buildings, each with eight tenant units, and 30 single-family housing units, all located in low-income California communities.

With continued support from the CEC and DOE, Berkeley Lab researchers now aim to provide a rigorous evaluation of the long-term performance and verify the quality of installed thin-glass triple-pane windows in disadvantaged communities.

See more: buildings.lbl.gov/news/article/high-performance-windows-benefit-low

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Cool Roof Ratings Council Approves Wall Rating Program

The Cool Roof Rating Council (CRRC) Board of Directors affirmed the organization's commitment to urban heat island mitigation and building energy efficiency in its approval of a new CRRC rating program for exterior wall products on September 24, 2020.

The anticipated launch of the new CRRC Wall Rating Program is early 2022. Findings from a project evaluating solar reflective walls, led by Berkeley Lab's Ronnen Levinson in partnership with nine manufacturers and two universities, helped support the CRRC's official exploration of a rating program for exterior wall products. The research project was sponsored by the Electric Program Investment Charge (EPIC) program of the California Energy Commission.

Read more: coolroofs.org/documents/CRRC_Wall_Rating_Program_Approval_Press_Release_-_2020-10-07.pdf

Mary Ann Piette Featured in Demand Flexibility Video

In a new video from Berkeley Lab's Energy Technologies Area, Building Technology and Urban Systems Division Director Mary Ann Piette introduces the concept of demand response and the importance of the Lab's research in this area. "The research we're doing here ... is transitioning from static energy efficiency to dynamic energy management," she said.

Watch the video: youtu.be/AgTZZ7oSFW8

Energy Savings by Using Reflective Paint on Exterior Walls at the UC Davis Campus

Student researcher Chloë Celniker presented the video "Energy Savings by Using Reflective Paint on Exterior Walls at the UC Davis Campus" at the 2020 UC Davis Undergraduate Research, Scholarship, and Creative Activities Conference. She calculated the energy, costs, and greenhouse gas emissions savings involved with using higher-albedo paint on campus walls.

Thermal infrared images during the summer

Thermal infrared images of a West Village building, Sciences Lab Building and Kerr Hall. Taken with a FLIR One camera.

Celniker was a UC Davis senior and Berkeley Lab affiliate working under the direction of Berkeley Lab and UC Davis staff. The video describes her in-progress honors thesis.

Watch the video: youtu.be/v6bEB6yKc6M
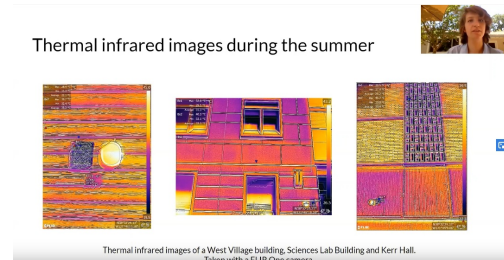
IMPEL Your Building Innovation

Applications are now open for building and energy technology scientists and innovators to participate in the unique IMPEL+ program to help propel your ideas to market.

While millions of dollars are spent for R&D and small businesses for energy technologies, only a small portion of these reach users and create value.

IMPEL offers unique pitch-training workshops coached by Silicon Valley experts, access to national lab and innovation networks, potential eligibility for tech-to-market public grants, and private pipeline opportunities through partners Greentown Labs and the Austin Technology Incubator.

IMPEL Innovator alumni have already begun to win grants and awards, kick-off project demonstrations, and gain recognition. Read about success stories here: impel.lbl.gov/success-stories

The one-day, free virtual IMPEL workshops will be held starting in December 2020.

IMPEL+, Incubating Market-Propelled Entrepreneurial-mindset at the Labs and Beyond (impel.lbl.gov) is sponsored by the U.S. Department of Energy's Building Technologies Office, and implemented by the Lawrence Berkeley National Laboratory.

Applications are open for the IMPEL+ 2021 season! Apply early to be selected and placed in the cohort that is the right fit for you.

More information: Email: impel@lbl.gov, visit impel.lbl.gov or watch youtu.be/o5-ZXtHC2QI
View IMPEL + 2021 Launch Webinar and slides.

Recent Publications

- Spatio-temporal impacts of a utility's efficiency portfolio on the distribution grid by Jessica Granderson, Samuel Fernandes, Samir Touzani, Chi-Cheng Lee, Eliot Crowe and Margaret Sheridan
- Harvesting the low-hanging fruit of high energy savings -- Virtual Occupancy using Wi-Fi Data by Callie Clark, Anand Prakash, Marco Pritoni, Margarita Kloss, Pranav Gupta, Bruce Nordman and Mary Ann Piette
- Package deals for deep savings: Scaling deep retrofits in commercial buildings with integrated systems packages by Paul Mathew, Philip Coleman, Cindy Regnier, Jordan Shackelford, Duane Kubischata, Sarah Zaleski and Blake Dressel
- Experimental comparison of pyranometer, reflectometer, and spectrophotometer methods for the measurement of roofing product albedo by Ronnen Levinson, Mischa Egolf, Sharon Chen, and Paul Berdahl
- Potential annual daylighting performance of a high-efficiency daylight redirecting slat system by Luis Fernandes, Eleanor S. Lee, Anothai Thanachareonkit, Stephen E. Selkowitz
- Messaging for Impact: Behavioral Science-Based Communication Strategies to Advance Energy Efficiency by Sravan Chalasani, Clayton Johnson, Molly Morabito, Alexander Newkirk, Liyang Wang, Ian M. Hoffman, Christopher T. Payne
- Non-invasive (non-contact) measurements of human thermal physiology signals and thermal comfort/discomfort poses -A review by Alan K. Meier et al.

See more:

buildings.lbl.gov/publications

Building Technology & Urban Systems | Energy Technologies Area | Berkeley Lab

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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.