BUILDING TECHNOLOGY & URBAN SYSTEMS
ENERGY TECHNOLOGIES AREA

Research for the Real World

One of the reasons we launched the FLEXLAB® testbed five years ago was to bridge the gap between lab findings and what happens in the real world. Today, whether it's working with partners at FLEXLAB, helping to model urban growth in Toronto, attending National Lab Day in the nation's capital, or training the next generation of scientists, our researchers are engaging with the wider world to expand knowledge about how to make our buildings and cities smarter. Read on to learn more.

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

Modeling for 'Sidewalk Labs' Project

Energy Technologies Area researcher Michael Wetter and his team contributed modeling of the energy performance of various district heating and cooling systems to a "Sidewalk Labs" project for Google (Alphabet) that re-imagines an urban space in Toronto, Canada. Support from Berkeley Lab's Lab-Directed Research and Development (LDRD) program set the stage for the work.

See the analysis: simulationresearch.lbl.gov/wetter/download/LBNL-2001197.pdf

About the project: www.sidewalktoronto.ca/documents/

Summer Interns Set Sights on Building Efficiency

When Hannah Moring was growing up, she loved tinkering around with her Dad in his woodworking shop and learning how things worked and were put together.

That experience led her to a prestigious summer internship in the Windows Lab with Howdy Goudey, a scientific engineering associate, and Charlie Curcija, a mechanical engineer. The main project they are working on is a new method of measuring thermal comfort.

Read more: buildings.lbl.gov/news/article/unique-opportunities-energy

Representing at National Lab Day

Energy Technologies Area staff represented the Division at National Lab Day in Washington, D.C., on July 24. Exhibitions at the event featured researchers showcasing the DOE Lab system's collective strength in finding science and technology solutions for the country.

The Interruption Cost Estimate (ICE) Calculator was exhibited under the Reliability subtheme, while Model Predictive Control to evaluate the capabilities of flexible loads, was exhibited under the Flexibility subtheme. Berkeley Lab's Paul Mathew, pictured at center, led the latter demo with Johnson Controls' Clay Nesler, right.

Modeling Data Center Energy Use

Data centers in the United States consume about 2% of electricity. A team in the Simulation Research Group (Kaiyu Sun, Na Luo, Xuan Luo, and Tianzhen Hong) at Berkeley Lab developed prototype data center energy models in EnergyPlus and OpenStudio to enable the evaluation of energy efficient design of data centers. These models are new additions to the USDOE prototype building models. A novel approach was developed in EnergyPlus to capture the non-uniform thermal and air flow distribution in data centers under different configurations, using pre-computed lookup tables from detailed Computational Fluid Dynamics (CFD) simulations.

Read more about data center work here: datacenters.lbl.gov

EERE's Dan Simmons Visits Berkeley Lab

During a visit on September 12, 2019, DOE Office of Energy Efficiency and Renewable Energy Assistant Secretary Daniel Simmons (2nd from left) toured the FLEXLAB® testbed facility. He also participated in a roundtable with Lab leadership on Lab initiatives, met with Cyclotron Road fellows, and toured the Advanced Light Source.

Pictured, from left, Cindy Regnier, FLEXLAB manager; Simmons; Mary Ann Piette, BTUS division director; Ravi Prasher, ETA associate lab director; Christian Kohler, BTUS; and a FLEXLAB mannequin which simulates humans in the built environment.

A Path Toward Building Emissions Cuts

A team of National Lab researchers led by Berkeley Lab's Jared Langevin recently published a study finding that a combination of aggressive efficiency measures, electrification, and high renewable energy penetration can reduce carbon dioxide emissions by up to 78% relative to 2005 levels, just short of the 80% target set in the the U.S. Mid-Century Strategy. The team used DOE's Scout, a reproducible and granular model of U.S. building energy use.

See the study: linkinghub.elsevier.com/retrieve/pii/S2542435119303575
Read more about Scout here: scout.energy.gov

FLEXLAB Turns Five

In summer 2014, FLEXLAB® opened for business as the world's most advanced integrated building and grid technologies testbed, helping a range of organizations—including companies, utilities and government agencies—evaluate technologies for maximum energy efficiency. The facility is humming along with innovative projects.

Read more: buildings.lbl.gov/news/article/flexlab-testbed-marks-five-year

Innovative Testing for 'Smog-Eating' Roof Shingles
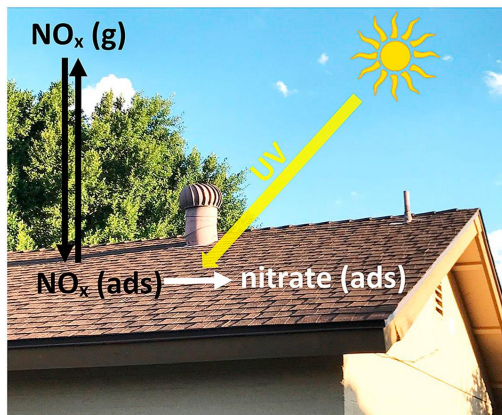
Our researchers recently collaborated on the development of a new kind of roof shingle that will help reduce air pollution.

The shingles' photocatalytic granules, developed by 3M, were evaluated at Berkeley Lab during a three-year testing period to determine effectiveness and performance. The innovative methodology researchers developed during the testing can also be used in evaluations of other roof and wall materials.

Read more: buildings.lbl.gov/news/article/innovative-testing-smog-eating-roof

Rosenfeld Building Scientific Workforce Development Program

A new program designed to draw scientists and engineers who want to contribute to society through fundamental scientific and technological advances in the field of building technology research has been launched at ETA.

Hyeunguk (Henry) Ahn is the second candidate selected to this program and started at ETA on September 16, 2019. He is a postdoctoral researcher focusing on performance assessments of distributed energy systems for various building types. He recently completed a Ph.D. from Penn State Architectural Engineering Department. The title of his doctoral dissertation is "Feasibility Assessments of Combined Cooling,

Heating, and Power Systems For Commercial Buildings".

The program is based in ETA's Building Technology and Urban Systems Division, in partnership with the Building Technologies Office of the Office of Energy Efficiency & Renewable Energy, Department of Energy.

Doctoral Dissertation: https://etda.libraries.psu.edu/catalog/16756hka5116
Read more: buildings.lbl.gov/rosenfeld-building-scientific-workforce

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BTUS in the News

- NPR Science Friday featured Ronnen Levinson, leader of the Berkeley Lab Heat Island Group, to discuss cool surfaces and other city-cooling strategies.
- An opinion piece in Utility Dive about demand response cites our 2025 California Demand Response Potential Study.
- Forbes mentioned testing by the Lab (ETA) in an article on expanding the use of smog-reducing roofing granules.
- Mary Ann Piette was featured in a podcast by Marketplace Tech on keeping the air clean when fires strike.

Recent BTUS Publications

- Kramer, H., Lin, G., Curtin, C., Crowe, E., Granderson, J. Building analytics and monitoring-based commissioning: industry practice, costs, and savings. *Energy Efficiency* (2019).
- Langevin et al,. Assessing the Potential to Reduce U.S. Building CO2 Emissions 80% by 2050. *Joule* (2019).
- Granderson, J., Lin, G., Blum, D., Page, J., Spears, M., Piette, M.A. 2019. Integrating diagnostics and model-based optimization. *Energy and Buildings* 182:187-195.
- Blum, D., Arendt, K., Rivalin, L., Piette, M.A., Wetter, M., Veje, C.T. 2019. Practical factors of envelope model setup and their effects on the performance of model predictive control for building heating, ventilating, and air conditioning systems. *Applied Energy* 236. 410 - 425.
- Less, B. D., Dutton, S. M., Walker, I. S., Sherman, M. H., & Clark, J. D. 2019. Energy savings with outdoor temperature-based smart ventilation control strategies in advanced California homes. *Energy and Buildings*, 194, 317–327.

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.