Vol. 5 | Issue 2 | March 31, 2022

Coming Back Together

As many of us return to onsite work, this is a wonderful moment to collectively thank one another for the support and care shown over the past two years. Coming back onsite may be a bumpy transition; together we can make a success with compassion and patience for ourselves and one another.

The announcement that Berkeley Lab (LBNL) is leading the Better Climate Challenge Technical Account management team for commercial partners is a thrilling development in our collective work to fight climate change. Building Technology & Urban Systems (BTUS) has a long history of research and development and technical assistance activities aimed at reducing climate emissions. The selection of the Berkeley Lab as a key lab supporting the high-profile Better Climate Challenge affirms BTUS as a leader in Department of Energy's climate change strategy.

I look forward to seeing you soon on the hill as we continue our work tackling the most pressing energy challenges of the day.

— Peter Therkelsen, Ph.D. is a Research Scientist and Deputy of the Building and Industrial Applications Department

News

BTO and LBNL Launch Connected Communities Awardee Projects

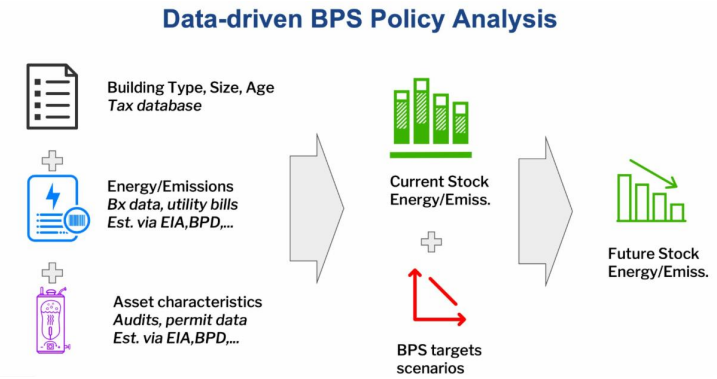
Connected Communities
U.S. DEPARTMENT OF ENERGY

DOE has competitively awarded a total of $61 million dollars to 10 comprehensive large-scale projects through its Connected Communities initiative to help accelerate decarbonization of buildings and the electric grid. Connected Communities are groups of efficient buildings with coordinated controls and smart technologies (e.g., smart thermostats, smart water heaters, batteries) that coordinate load flexibility within buildings and across multiple buildings.

Berkeley Lab is the Connected Communities National Coordinator. In that role, LBNL will provide extensive technical assistance to the Connected Communities projects and lead broad industry stakeholder engagement over the next two years. BTUS is collaborating with both the Energy Analysis & Environmental Impacts and Energy Storage and Distributed Resources Divisions on the Connected Communities program, which is led by BTUS' Cindy Regnier.

Please sign up for the Connected Communities newsletter to learn about resources and upcoming events!

Berkeley Lab Providing Technical Assistance for Building Performance Standards



Berkeley Lab is providing technical assistance to several cities to plan and implement Building Performance Standards (BPS). BPS are a powerful new policy tool to help cities address decarbonization of existing buildings. BPS require existing buildings to meet a specific energy or emissions target by a specified date. Policymakers in cities planning a BPS are grappling with a host policy design questions, such as: *What metrics should be used? What are the building-level targets needed to meet 2040 goals? What is the impact of exempting certain building types and sizes? What is the impact of requiring electrification at equipment replacement? How much do different technology packages help meet BPS targets? What tools are needed for compliance with these policies?*And many more. BTUS researchers Paul Mathew, Travis Walter and Robin Mitchell are helping cities address these questions using energy epidemiological approaches, combining data from tax records, energy benchmarking ordinances, the Building Performance Database, ComStock, and other data sources. We also provide technical support on software tools to support BPS compliance. To date, BTUS researchers have provided or are providing technical assistance to **Aspen, Berkeley, New York City, San Francisco, Seattle, Washington DC** and the **State of Washington**. In addition, Berkeley Lab is collaborating with Pacific Northwest National Lab (PNNL) to support an ASHRAE guide on BPS, expected to be completed in Summer 2022.

Learn about BPS: buildings.lbl.gov/cbs/building-performance-standards
Read more in related publications: doi.org/10.5334/bc.81 and doi.org/10.20357/B7831V

BTUS is working with DOE to scale Better Climate Challenge

Better Climate™ CHALLENGE U.S. DEPARTMENT OF ENERGY

The DOE recently launched the Better Climate Challenge. White House National Climate Advisor Gina McCarthy joined Energy Secretary Granholm and HUD Secretary Fudge for a virtual executive roundtable with the inaugural class of more than 90 Better Climate Challenge commercial and industrial partners This national public-private partnership calls on organizations across the U.S. economy to set bold, ambitious, portfolio-wide greenhouse gas (GHG) reduction targets and to share their innovative solutions.

The DOE provides technical assistance and opportunities to learn and share actionable best practices to organizations making commitments through the Better Climate Challenge. BTUS researchers, including Hannah Kramer and Valerie Nibler, have been working closely with DOE on strategies to scale this new program offering. To aid Better Climate Challenge commercial partners on their decarbonization journey, we will be building a new Technical Account Management (TAM) team. The TAM team will be composed of technical experts from LBNL and National Renewable Energy Lab (NREL), as well as representatives from other organizations and contractors with decarbonization expertise. We are excited to be expanding our role in support of this important Better Buildings program and engaging commercial partners to reduce the carbon footprint of their building portfolios.

Read more: betterbuildingssolutioncenter.energy.gov/climate-challenge

Indoor Air Quality Road Map: A Smart Range Hood

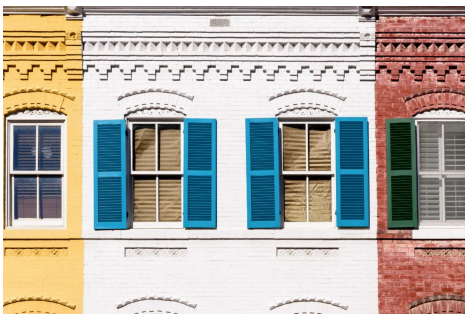
A new market-ready smart range hood switches on and off automatically to improve indoor air quality, energy efficiency, and occupant health. In 2022, manufacturer Broan-NuTone will begin producing the first commercially available “smart” range hood to improve indoor air quality, energy efficiency, and occupant health. Programmed with pollutant-monitoring sensors, the range hood's fan automatically turns on when cooking activity is detected and switches off once pollutants have returned to acceptable levels.

A range hood’s ventilation rate, expressed in cubic feet per minute (cfm), has been a proxy for how effectively a given fan will ventilate a kitchen—the higher the cfm, the more polluted air is removed, at least in theory. “But when we started doing field and lab testing of kitchen range hoods, we found that their performance was all over the place,” says Dr. Iain Walker, a scientist at Berkeley Lab.

Walker’s team determined that simply specifying an airflow rate is not good enough, and ASHRAE’s minimum standard for cfm is likely too low.“We wanted to come up with a metric that was more about what we actually care about, which is removing contaminants,” he explains.

Read more: Indoor Air Quality Road Map: A Smart Range Hood, and commercialization plans for 2022

Cool Walls Rating Program Launches



Recently, the Cool Roof Rating Council (CRRC) debuted the world’s first energy efficiency ratings program for exterior wall materials. BTUS Staff Scientist Ronnen Levinson contributed critical technical guidance for development of the program, including research that explored the benefits, technologies, and implementation of solar-reflective cool walls. He also created incentives to spur cool-wall adoption, such as a recently published LEED pilot credit

The ratings will inform consumers about a product’s ability to reflect sunlight and emit any absorbed heat.

Check out the wall rating program: coolroofs.org/programs/wall-rating-program
Read more about cool walls: newscenter.lbl.gov/2019/07/09/cool-walls-can-reduce-energy-costs-pollution

Berkeley Lab a “Build Back Better” Regional Challenge Finalist

Researchers from the Berkeley Lab will join fellow industry leaders in a coalition to bring to market new technologies and products to address the converging crises of housing, economic inequity, supply chain volatility, and climate change in California and the U.S.

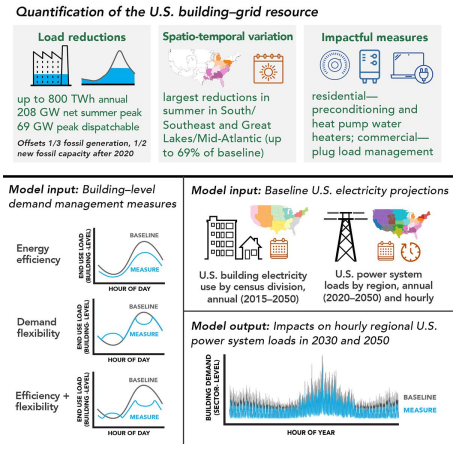
Berkeley Lab scientists will lead on forming testbed innovation centers to develop and improve new construction products and approaches for industrialized construction (IC) – including waste-to-feedstock production and concrete alternatives, integrated energy systems, and advanced building construction methods – that will enable zero-emission, climate-resilient, and affordable buildings.

“We’re very excited to have this opportunity to bring innovations that help improve productivity and sustainability of the construction sector,” said Berkeley Lab project lead Nan Zhou. “While the issues of housing crisis and climate change are highly complex, we will lead R&D and work closely with StopWaste and other coalition members, as well as local governments, trade associations, industry leaders, and community organizations, to ensure the innovations we help to support will be feasible and beneficial for

those in need."

To learn more: buildings.lbl.gov/news/berkeley-lab-build-back-better

How Managing Building Energy Demand Can Aid the Clean Energy Transition



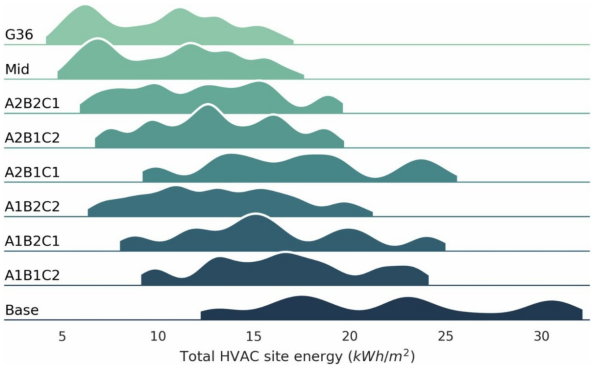
A comprehensive study led by Berkeley Lab researchers detailed what can be done to make buildings more energy-efficient and flexible. Managing building demand could reduce need for up to one-third of coal- or gas-fired power generation, eliminating the need for half of all scheduled power plant builds through 2050.

"A key reason why we don't hear more about the role of our buildings as a significant resource for the clean energy transition is because it's been challenging to quantify that resource at a large scale – and without hard numbers at scale, it's hard for policy makers or grid operators to plan around it," said Berkeley Lab researcher Jared Langevin, lead author of the study. "Our overarching belief here was that producing these kinds of estimates that make the role of these demand-side building technologies more concrete will help ensure that we do more to encourage the deployment of those technologies alongside the deployment of renewable generation and batteries."

Read more: newscenter.lbl.gov/2021/07/21/how-managing-building-energy-demand-can-aid-the-clean-energy-transition

Featured Publications

Estimating ASHRAE Guideline 36 energy savings for multi-zone variable air volume systems using Spawn of EnergyPlus



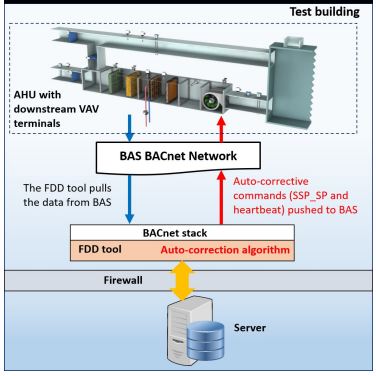
ASHRAE Guideline 36 (G36) publishes high-performance control sequences for Variable Air Volume (VAV) system operation. Retrofitting existing VAV control sequences to G36 promises to have a large potential for energy savings. This paper evaluates the energy use of a multi-zone VAV system with terminal reheat using the G36 sequences and compares it to a group of baseline control sequences that represent existing practices. The study also includes a parametric analysis on climate, internal load, and schedules. Spawn of EnergyPlus is used for the whole building simulation. For a medium-sized commercial building, the G36 sequences provide a wide range of HVAC energy savings with an average of 31%. A simple savings calculator in the form of an excel spreadsheet was also created using the results of this study and is available at https://github.com/LBNL-ETA/G36SavingsCalculator, along with the models used for the study.

Zhang, K., Blum, D., Cheng, H.,Paliaga, G., Wetter, M., Granderson, J. **Estimating ASHRAE Guideline 36 energy savings for multi-zone variable air volume systems using Spawn of EnergyPlus.** *Journal of Building Performance Simulation, Volume 15, 2022.* doi.org/10.1080/19401493.2021.2021286

From fault-detection to automated fault correction: A field study

This paper presents the field study of seven fault auto-correction algorithms implemented in two commercial Fault Detection and

Diagnostics (FDD) platforms. The research is a joint effort of researchers and engineers at Berkeley Lab and two FDD technology providers. Fault auto-correction integrating with commercial FDD technology offerings can increase the savings generated by FDD tools and reduce the reliance on human intervention. The auto-correction algorithms are tested across four buildings and successfully correct faults and improve the operation of large built-up HVAC systems. Technology benefits, market drivers, and scalability changes are drawn from the implementation effort and test results, to drive future research and industry engagement.



Pritoni, M., Lin, G., Chen, Y., Vitti, R., Weyandt, C., Granderson, J. **From fault detection to automated fault correction: A field study**, *Building and Environment (2022).* doi.org/10.1016/j.buildenv.2022.108900doi.org/10.1016/j.buildenv.2022.108900

Other Recent Publications

Gao, Y., Zheng, Q., Jonsson, J.C., Lubner, S.D., Curcija, D.C., Fernandes, L., Kaur, S., Kohler, C. **Parametric study of solid-solid translucent phase change materials in building windows.** *Applied Energy 301, 2021.*
buildings.lbl.gov/publications/parametric-study-solid-solid

Wetter, M., Ehrlich, P., Gautier, A., Grahovac, M., Haves, P., Hu, J., Prakash, A. et al. **OpenBuildingControl: Digitizing the control delivery from building energy modeling to specification, implementation and formal verification.** *Energy* 238, 2022.
buildings.lbl.gov/publications/openbuildingcontrol-digitizing

Hinkelman, K., Wang, J., Zuo, W., Gautier, A., Wetter, M. et al. **Modelica-based modeling and simulation of district cooling systems: A case study.** *Applied Energy, Volume 311, April 2022.*
doi.org/10.1016/j.apenergy.2022.118654

Walker, I.S., Less, B., Casquero-Modrego, N. **Carbon and Energy Cost Impacts of Electrification of Space Heating with Heat Pumps in the US.** *Energy and Buildings, Volume 259, 2022.*
buildings.lbl.gov/publications/carbon-and-energy-cost-impacts

Vahmani, P., Luo, X., Jones, A., Hong, T. **Anthropogenic heating of the urban environment: An investigation of feedback dynamics between urban micro-climate and decomposed anthropogenic heating from buildings.** *Building and Environment 213, 2022.*
doi.org/10.1016/j.buildenv.2022.108841

Blum, D., Arroyo, J., Huang, S., Wetter, M., et al. **Building optimization testing framework (BOPTEST) for simulation-based benchmarking of control strategies in buildings.** *Journal of Building Performance Simulation, Vol. 14, 2021.*
buildings.lbl.gov/publications/building-optimization-testing

Vossos, V., Gerber, D.L., Gaillet-Tournier, M., Nordman, B., Brown, R.E. et al **Adoption Pathways for DC Power Distribution in Buildings.** *MDPI, 2022.*
doi.org/10.3390/en15030786

See more:
buildings.lbl.gov/publications

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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.

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