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Back from the White House and Moving Forward

For the last year it was my privilege to serve the Biden-Harris administration as Director for Building Technology at the White House Council on Environmental Quality (CEQ). The CEQ advises the President and develops policies on climate change, environmental justice, federal sustainability, public lands, oceans, and wildlife conservation. My colleagues and I worked daily to implement the President's domestic climate agenda, coordinating an all-of-government approach to tackle the climate crisis, create good-paying jobs, and advance environmental justice.

I'm glad to now be back at Berkeley Lab, continuing my work and championing the important decarbonization and clean energy research that ETA is advancing. Highlights from the last quarter include hosting a FLEXLAB® visit from Energy Secretary Granholm and her Advisory Board, contributions to the Intergovernmental Panel on Climate Change's (IPCC's) Working Group III Sixth Assessment Report on Mitigation of Climate Change, and leadership roles in the Net Zero World Action Center.

Please read on for more, and we offer our best wishes to you and your families this summer.

— Jessica Granderson is the Deputy for Research: Building Technology & Urban Systems (BTUS) Division and Staff Scientist

News

Secretary of Energy Visits Berkeley Lab; Tours FLEXLAB®

U.S. Energy Secretary Jennifer Granholm recently visited Berkeley Lab and toured FLEXLAB®, which has testbed capabilities that are key to reaching the Biden Administration's decarbonization and integrated energy solutions goals.

Granholm was at Berkeley Lab in mid-April to host a two-day meeting of the Department of Energy (DOE) Advisory Board. To the right is a tweet the Lab sent out the day of the FLEXLAB tour.

At FLEXLAB, Granholm and the Advisory Board learned about project summaries

Berkeley Lab ✓ @BerkeleyLab · Apr 19
A tool to help "Build a Better America," #FLEXLAB® allows users to develop and test #energyefficient building and grid tech, under real-world conditions. This afternoon we welcomed @SecGranholm and @ENERGY Advisory Board. Experience it for yourself at flexlab.lbl.gov/animation.

related to retrofits in schools for decarbonization and indoor air quality, technologies to link distributed energy resources with buildings such as photovoltaic (PV), electrochemical (batteries) and thermal storage, and heat pump controls that can respond to price and greenhouse gas signals to lower carbon emissions.

BTUS staff Cindy Regnier, Paul Mathew and Christian Kohler gave presentations focusing on innovative technologies, such as the thin-triple-pane window, and packages of technologies to support energy efficiency and decarbonization in offices and schools. Noel Bakhtian and Armando Casillas focused on thermal energy storage and heat pump controls that offer 50% carbon savings, including research from Spencer Dutton.

Sascha von Meier gave a presentation on how micro synchrophasors can support reliable grid operations with growing renewable energy supply, and she provided a summary of the Oakland EcoBlock project, which brings the benefits of batteries and solar to underserved communities.

Granholm tweeted about the visit: "So great to be with the brilliant researchers and innovators and engineers at @BerkeleyLab — thank you for welcoming our team on a beautiful East Bay day."

More photos: photos.lbl.gov
Video of Granholm's tour of FLEXLAB

Achieving Climate Goals Will Require Transformational Changes

Four ETA researchers contributed to the third and final installment of the Intergovernmental Panel on Climate Change's (IPCC's) Working Group III Sixth Assessment Report on Mitigation of Climate Change. BTUS Senior Scientist Nan Zhou and Stephane de la Rue du Canwere lead authors, Nina Khanna was a contributing author, and Lynn Price served as a U.S. government expert reviewer. Additionally Mary Ann Piette and Michael McNeil served as government reviewers on the Buildings chapter.

The researchers shown in the accompanying picture from top left clockwise are: de la Rue du Can, Zhou, Khanna and Price.

The message is clear from the report that achieving climate goals will require aggressive and comprehensive actions, which are a must to achieve net zero emissions worldwide by mid-century.

Read more at buildings.lbl.gov/news/achieving-climate-goals-will-require

How Venice, Italy Can Cut Carbon Emissions from Social Housing

Research using software developed at the Berkeley Lab by BTUS' Tianzhen Hong and others in BTUS recently pinpointed actions that could help the historic canal city of Venice, Italy, slash energy use and reduce carbon dioxide emissions. The study looked at how upgrades to existing housing could impact emissions and energy use.

The BTUS researchers teamed with researchers from three Italian universities to apply the CityBES tool to a set of multifamily residential buildings in Venice, all built before 1936. The analysis revealed a potential 67% energy savings from retrofits in four areas.

Read more: buildings.lbl.gov/news/how-venice-italy-can-cut-carbon

Leadership in Net Zero World Action Center

Experts from Berkeley Lab will play leading managerial and technical roles in the recently established Net Zero World Action Center to bolster DOE's Net Zero World Initiative (NZWI). The NZW Action Center brings together 10 DOE national laboratories, nine U.S. government agencies, and philanthropy organizations to promote net zero emission energy systems around the world that are inclusive, equitable, and resilient.

BTUS Division Director Mary Ann Piette serves as Lab Lead for NZWI, Senior Scientist Nan Zhou serves as Technical Program Manager, and Program Manager Carolyn Szum serves as Investment Program Deputy Manager to the NZW Action Center. In addition, Berkeley Lab Program Managers Reshma Singh and Stephane de la Rue du Can serve as the India Country Co-Coordinator and the South Africa Country Coordinator respectively.

To learn more: buildings.lbl.gov/news/leadership-net-zero-world-action

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Energy-Saving Tool Cited by White House

In an April briefing, Vice President Kamala Harris gave a shout out to a new tool developed by Berkeley Lab that will help manage energy-saving projects. The tool, eProject eXpress (ePX), supports money-saving energy retrofit projects for state and local governments, schools and hospitals.

Read more: buildings.lbl.gov/news/energy-saving-tool-cited-white-house

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Sign Up for Virtual Field Trips on Energy Storage!

Join Berkeley Lab's Energy Storage Center and SLAC National Accelerator Laboratory for a virtual field trip seminar series exploring the sometimes surprising role energy storage plays in the world around us.

To learn more, sign up for upcoming virtual field trips and watch event recordings, including the first virtual trip to the International Space Station and the second virtual trip to Bad River Band Reservation's microgrid, visit secretlifeofenergystorage.lbl.gov.

Featured Publications

A Systematic Method for Selecting Molecular Descriptors as Features When Training Models for Predicting Physiochemical Properties

Machine learning is a powerful tool that can be used to facilitate biofuel development. Predicting properties of sustainable aviation fuels early in the R&D cycle can enable faster, less-expensive bioprocess optimization and scale-up. However, the prediction of molecular properties comes with a trade-off between interpretability and performance. Complex models, such as neural networks, provide high accuracy at the expense of interpretability, while simpler models tend to lack accuracy, which puts the relationships derived from them into question. This paper presents a

method for systematically selecting molecular descriptors and developing accurate and interpretable machine learning models for the prediction of melting point, flash point, boiling point, yield sooting index, and heat of combustion. The method enables researchers to explore sets of features that significantly contribute to the prediction of the property, offering new scientific insights. The data and models have also been integrated into an open-source, interactive web tool to help accelerate early stage biofuel research and development (feedstock-to-function.lbl.gov).

Comesana, A.E., Huntington, T.T., Scown, C.D., Niemeyer, K.E., Rapp, V.H. **A systematic method for selecting molecular descriptors as features when training models for predicting physiochemical properties.** *Elsevier, Fuel 321 (2022) 123836.* doi.org/10.1016/j.fuel.2022.123836

Field Demonstration and Implementation Analysis of Model Predictive Control in an Office HVAC system

Model Predictive Control (MPC) is a promising technique to address growing needs for heating, ventilation, and air-conditioning (HVAC) systems to operate more efficiently and with greater flexibility. While many previous studies have shown the advantages of MPC, few analyzed the implementation effort and associated practical challenges. In addition, previous work has developed an open-source, Modelica-based tool-chain that automatically generates optimal control, parameter estimation, and state estimation problems aimed at

facilitating MPC implementation. Therefore, this study demonstrates usage of this tool-chain to implement MPC in a real office building, discusses practical challenges of implementing MPC, and estimates the implementation effort associated with various tasks. This study finds that the implemented MPC saves approximately 40% of HVAC energy over the existing control during a two-month trial period and that tasks related to data collection and controller deployment activities can each require as much effort as model generation.
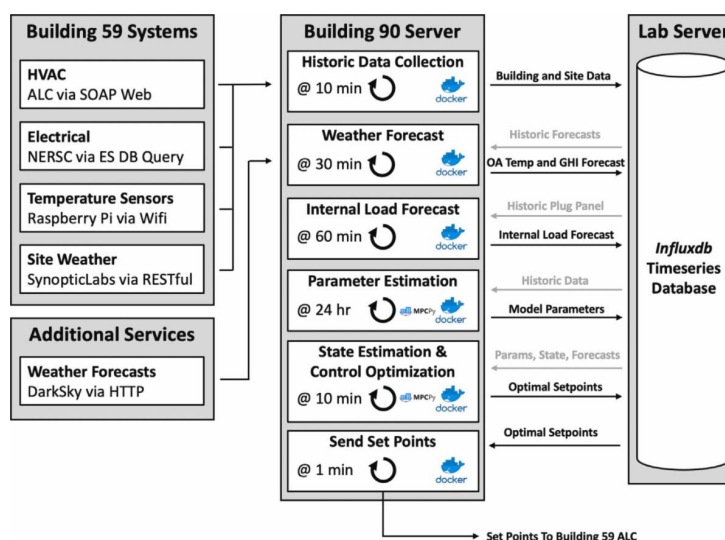
Blum, D., Wang, Z., Weyandt, C., Kim, D., Wetter, M., Hong, T., and Piette, M.A.. **"Field demonstration and implementation analysis of model predictive control in an office HVAC system."** *Applied Energy* 318 (2022) 119104.
buildings.lbl.gov/publications/field-demonstration-and

Other Recent Publications

Ward, G.J., Bueno, B., Geisler-Moroder, D., Grobe, L.O., Jonsson, J.C., Lee, E.S., Wang, T. and Wilson, H.R. **Daylight Simulation Workflows Incorporating Measured Bidirectional Scattering Distribution Functions.** *Energy and Buildings 2022 (259): 111890.*
buildings.lbl.gov/publications/daylight-simulation-workflows

Regnier, C., Mathew, P.A., Rainer, L., and CaraDonna, C. **"Systems Packages for Washington State Building Performance Standard Incentive Program: Phase 1 Analysis."** (2022).
buildings.lbl.gov/publications/systems-packages-washington-state

Zeng, Z., Zhang, W., Sun, S. Wei, M., and Hong, T. **"Investigation of pre-cooling as a recommended measure to improve residential buildings' thermal resilience during heat waves."** *Building and Environment* 210 (2022) 108694.

buildings.lbl.gov/publications/investigation-pre-cooling-recommended

Pinto, G., Wang, Z., Roy, A., Hong, T., and Capozzoli, A. **"Transfer learning for smart buildings: A critical review of algorithms, applications, and future perspectives."** *Advances in Applied Energy* 5 (2022) 100084.
buildings.lbl.gov/publications/transfer-learning-smart-buildings

Chen, Y., Lin, G., Chen, Z., Wen, J., Granderson, J. **"A simulation-based evaluation of fan coil unit fault effects."** *Energy* and Buildings 263 (2022) 112041.
buildings.lbl.gov/publications/simulation-based-evaluation-fan-coil

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 University of California (UC) Berkeley and conducts scientific research on behalf of the United States Department of Energy (DOE). The Laboratory overlooks the UC 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 14 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.