

UC Berkeley

A FRAMEWORK FOR INDUSTRY/UNIVERSITY COLLABORATIVE RESEARCH

About Us

Our Mission

To improve the environmental quality and energy efficiency of buildings by providing timely, unbiased information on building technologies and design and operation techniques.

Our Approach

We believe that research about energy and the indoor environment must go hand-in-hand in order to create transformational change in the building industry. We study promising new energy conserving strategies and technologies, along with how people use and interact with buildings.

We actively participate in the development of new standards and guidelines to remove barriers to effective building technologies, and to speed their implementation. We also provide tools, guidance and training for design, building and operations.

Industry Collaborations

The center was founded in 1997 under the National Science Foundation Industry/University Cooperative Research Center program.

CBE is guided by an Industry Advisory Board that meets semi-annually to discuss research, approve annual budgets, and plan future research. The board represents the diversity of the building industry, including manufacturers, building owners, facility managers, contractors, architects, engineers, government agencies, and utilities.

Our Research

Our research portfolio is based on industry partner feedback, and represents relevant and timely topics in building science research. Our key areas of research are:



Indoor Environmental Quality

We have developed new methods to measure the performance of buildings in terms of occupant comfort, energy efficiency and operations, and we are testing new approaches to providing energy-efficient comfort.



HVAC Systems

We are a leader in HVAC systems research, and are investigating topics such as advanced integrated building systems, underfloor air distribution, radiant systems, and new methods for performance monitoring.



Envelope Systems

We are developing tools and criteria for evaluating facade performance in terms of occupant comfort and energy efficiency. We are evaluating the impacts of window view quality, operable windows, controllable facade features, and mixed-mode strategies.



Life Cycle Assessment & Embodied Carbon

The carbon embodied in buildings and infrastructure has become a critical concern for reducing GHG emissions. We are providing design guidance, tools and insights to support rapid and broad adoption of strategies that reduce both embodied and operational carbon impacts.

“

CBE provides us with **immediate, usable and innovative technical value**, while extending our professional network to a uniquely diverse cross section of professionals. **No other organization consistently expands our horizons like CBE.**

Phil Williams, Sustainable Real Estate and Construction Executive at Google

”



Genentech's Building 35 in South San Francisco: CBE's research team is working to reduce energy use in large commercial buildings in collaboration with many CBE consortium members.

Collaborations

CBE welcomes firms and organizations to become involved through membership in our industry consortium. This consortium is a rare opportunity to identify information needs and advance research in directions to benefit your organization, without the high costs of in-house research.

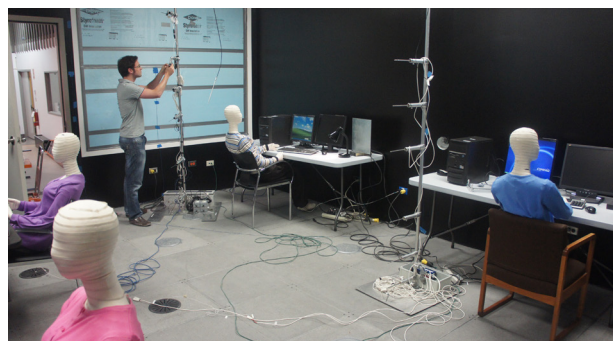
Benefits of Membership

- Participation in semi-annual Industry Advisory Board Conferences (Spring and Fall).
- The ability to direct research in areas relevant to your business, and opportunities to directly participate in high-impact research efforts.
- Access to specialized design and performance tools, including occupant surveys (four free per year).
- Networking opportunities with diverse sectors of the building industry.
- Priority access to specialized research tools, facilities, and staff, and the ability to recruit highly trained graduates.
- Advance review of internal reports and research results.
- Acknowledgment in CBE reports, websites, and publicity materials.
- Members' investments are also leveraged through research grants from institutional and governmental sources, providing access to an annual research portfolio of approximately \$3M.

Affiliation with UC Berkeley gives CBE's research a high level of credibility within the industry. Industry partners benefit from this research, by using empirical results to influence clients and regulators, and through recognition of their commitment to promoting sustainability and improving our built environment.



CBE's Industry Advisory Board guides research towards relevant and current topics, and provides a unique opportunity for collaboration.



Our research uses simulation, lab, and field study methods, taking advantage of advanced resources both in-house and external.



Our research team is testing new ideas for simultaneously improving energy efficiency and comfort in workplace environments.



During CBE's semi-annual Industry Advisory Board meetings, the research team and consortium members review recent findings, strategize around future directions and identify opportunities for collaboration.

“

The design and construction industry fundamentally needs to take a more **rigorous, science-based approach** to designing and operating buildings that really work for our clients. **CBE is leading the way on this critical transformation.**

Scott Shell, ClimateWorks Foundation

”

Research Portfolio 2025-2026

We study technologies that hold promise for making buildings more environmentally friendly, more productive to work in, and more economical to operate. Our portfolio takes into account feedback from industry partners and relevant and emerging trends. Below we provide an overview of our research portfolio for FY 2025-2026.

Indoor Occupant Experience and Health

- Using Air Movement to Manage Heat Stress in Manufacturing Environments
- Impact of Wide Temperature Ranges on Office Work Performance
- Validating the Winter Ankle Draft Model with Human Subject Tests
- Field Study of Air Quality and Thermal Comfort in Commercial Kitchens
- A Causal Inference Framework for Building and Occupant Data Analysis

Facade Systems

- Balancing Data Quantity and Quality in Window View Research
- Impacts of Window-to-Wall Ratio on Occupant Satisfaction

HVAC Systems and Building Analytics

- Case Studies of New All-Electric Hospitals and Laboratories
- Assessing HVAC Load Shift Impacts on Future Retrofits Across Different Grid Regions
- Calculating the Accuracy of Operational Emission Impacts from Commercial Buildings

Life Cycle Assessment and Embodied Carbon

- Classification of Embodied Emission Impacts of Landscape Architecture
- Computational Methods for Adaptive Reuse and Building Retrofits

Building Sector Resources

- Occupant Satisfaction Survey
- CBE Online Tool Development and Support

CBE Match-Funded Awards

CBE partner funding can be applied as match funding which is required for some external grants. By leveraging CBE partner funds, we increase the benefits to partners, to utility ratepayers, and to numerous industry and community stakeholders. Below we describe a few key examples.

Decarbonizing Large Commercial Buildings through Heat Recovery and Storage

We will demonstrate a nascent heat recovery chiller technology with ultra-low greenhouse warming potential. Funding: California Energy Commission, 5-yrs., \$6M

Cost Optimized Reset (CORE): Self Tuning Setpoints for VAV Systems

We are conducting field tests of a new control approach expected to save 15 – 30% of total HVAC energy. Funding: NYSERTA, 2-1/2-yrs., \$550k

Mainstreaming Personal Comfort Devices with Modular Controls

This work advances CBE's research on personal comfort devices, creating a PCD 'hub' integrated with an open-source ecosystem to connect to other devices or building management system.

Funding: California Energy Commission, 5-yrs., \$6M

Research Portfolio 2025-2026

Research supported by CBE's consortium is frequently used to seed and launch research in new directions, after which having demonstrated results is useful for gaining larger external funding from national, state, non-profit and corporate sources. Below we highlight several externally funded projects currently underway, listed in approximate reverse chronology.

ASHRAE Radiant Heating and Cooling Design Guide

In collaboration with Denmark Technical University, CBE is developing a radiant system design guide to serve building engineers, mechanical system designers, contractors, consultants, and other building stakeholders. Funding: ASHRAE.

Cost-Effectiveness and Mitigation Potential of Low-Carbon Building Material Alternatives

This project will investigate the greenhouse gas reduction potential associated with material efficiency, reuse, substitution strategies and supply chain interventions for the State of California. Funding: California Air Resources Board.

Low-GWP Heat Pump Retrofit Demonstration

This project is focused on the design, implementation, and evaluation of an electrification retrofit at a demonstration site in California, with a new-to-market ultra-low GWP heat recovery chiller, and exhaust air heat recovery. Funding: California Energy Commission.

Renew America's Schools

In coordination with Lawrence Berkeley National Laboratory (LBNL), we are using the CBE Occupant Survey to survey teachers and staff in participating schools to assess how retrofits impact perceptions of indoor conditions. Funding: Dept. of Energy.

Upscaling Grid-Friendly, Resilient, Affordable and Efficient Modular Housing

We are supporting this LBNL demonstration of modular homes with solar and energy storage, high efficiency electric heat pumps, low power operation for grid emergencies or outages, and at a lower cost of ownership than typical modular homes. Funding: California Energy Commission.

CBE Research Program on Embodied Carbon in the Built Environment

This multi-project program is advancing life cycle assessment (LCA) adoption within the built environment to support holistic decarbonization and enable sustainable growth. Funded by the ClimateWorks Foundation and other grants.

Personalized Indoor Environments for Surgical Microenvironments in Operating Rooms

We are developing personal comfort systems for the diverse thermal needs of surgical staff and patients, in collaboration with the Norwegian University of Science and Technology. Funded by the Peder Sather Grant Program.

Heat Exposure, Activity, and Sleep

This multi-year, multi-part project is investigating technological and behavioral strategies to reduce heat exposure and enhance sleep quality, and to identify solutions tailored for warm climates. Funding: Singapore National Research Foundation.

Simulation Study of Surface Convection Rates with Radiant Systems and Ceiling Fans

The goal of this study is to investigate the effect of elevated air movement induced by ceiling fans on the performance of thermally activated building radiant systems. Funding: Clark Pacific.

ASHRAE Guideline 36 Open-Source Supervisory Control Technology Development and Demonstration

We are performing a field demonstration of ASHRAE Guideline 36, created to allow HVAC and HVAC controls providers to centrally program and test control logic that can be distributed widely and quantify impacts on existing buildings. Funding: CalNEXT Program.

Our Research Team

CBE's faculty and researchers bring expertise from multiple disciplines — architecture, engineering and data science — to study design strategies and technologies that hold promise for making buildings more environmentally friendly, more productive to work in, and more economical to operate.



Edward Arens

CBE Founder and Prof.
Emeritus of Architecture



Gail Brager

CBE Director and
Professor of Architecture



Carlos Duarte

Assistant Professional
Researcher



Allison Herbert

Research Coordinator



Charlie Huizenga

Research Specialist



Tobias Kramer

Postdoctoral Researcher



David Lehrer

Communications and
Research Collaborations



Jaiyu Li

Postdoctoral Researcher



Therese Peffer

Program Director, CIEE



Paul Raftery

Professional Researcher



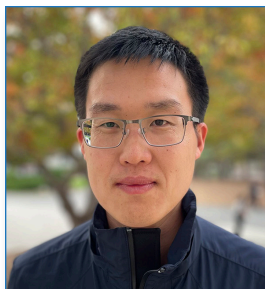
Matt Roberts

Postdoctoral Researcher



Stefano Schiavon

Assoc. Prof. of Architecture,
Civil & Environ. Engineering



Yan Wang

Postdoctoral Researcher



Ramon Weber

Assist. Prof. of Architecture



Hui Zhang

Research Specialist

Our Partners

CBE's partners represent a diverse set of industry and government organizations. Their perspectives and leadership help CBE to focus on relevant and timely topics, and many partners are actively involved in CBE research activities.

Sustaining Members

Armstrong World Industries
Azbil
Big Ass Fans
ClimateWorks Foundation
Daikin
FOTILE

Google, Inc.
Midea
Price Industries
REHAU
Southern California Edison
Trane

Small Business Partners

Dephina
Sulion
ThermoAnalytics

Architecture, Engineering and Construction Members

Affiliated Engineers, Inc.
Arcadis
Arup
Clark Pacific
DIALOG
Harris
HOK

Introba
JLG Architects
KieranTimberlake
LPA
M Moser Associates
McKinstry
PAE Engineers

Salter
Sanken
Skidmore, Owings, & Merrill
SmithGroup
Stantec
Turner Construction

Architecture, Engineering and Construction Teams

SERA Architects Team

CPP
EHDD Architecture
P2S Engineering
Perkins+Will
SERA Architects

Taylor Engineering Team

Atelier Ten
Taylor Engineering
TRC
Western Allied Mechanical, Inc.
WRNS Studio



Paul Jennings Residence Hall
2023 Livable Buildings
Award Winner

Arch: VMDO Architects
MEP: Lawrence Perry + Associates



www.cbe.berkeley.edu