



U.S.-China Clean Energy Research Center Building Energy Efficiency (CERC-BEE)

What is CERC-BEE?

The [U.S.-China Clean Energy Research Center, Building Energy Efficiency \(CERC-BEE\)](#) program is a ten-year initiative to support leading scientists from United States and China in collaborative research to accelerate the development and deployment of advanced building technologies for the benefit of both countries. The U.S. Department of Energy (DOE) and Chinese Ministry of Science and Technology (MOST) lead the initiative, which is managed by Lawrence Berkeley National Laboratory (LBNL) in the United States and the Ministry of Housing and Urban-Rural Development (MOHURD) Center for Science and Technology of Construction in China.

Research and development (R&D) teams are comprised of more than 230 researchers from 75 U.S. and Chinese partner organizations in academia, non-profit, and the for-profit private sector. DOE's annual contribution of \$2.5 million is matched by the Chinese government. U.S. and Chinese partners contribute additionally at a rate of at least \$1.50 for every \$1 invested by DOE. Since its inception in 2010, CERC-BEE has generated 26 new products; 22 new copyrighted software tools; and 82 peer-reviewed publications to advance building performance. Its researchers have also earned awards for technological breakthroughs and innovation, including 2013, 2016, and 2020 R&D 100 Awards; a 2016 Gold Edison Award; a 2018 Best of Design Award for Digital Fabrication; a 2019 HIVE 50 Award; a 2019 Keeling Curve Prize Honorable Mention; a 2020 LBNL Director's Award for Tech Transfer; and a 2021 EarthX Climate Tech Prize Semi-Finalist. From 2016 to 2021, CERC-BEE research teams focus on five cost-shared initiatives to improve performance of both new and existing buildings as follows:

- [Integrated Building Design and Construction](#), including next-generation 3D printed precast building façade systems;
- [HVAC Energy Savings and Indoor Air Quality \(IAQ\)](#), to develop air cleaning technologies integrated with smart ventilation and sensors to enable efficient, load-flexible buildings with excellent IAQ for health and productivity.
- [Integrated Sensors, Controls, and Commissioning](#), including predictive control software for optimized whole building systems;
- [Direct Current \(DC\) Buildings and Smart Grid](#), including standards and controls that support greater adoption of DC power for improved power quality, reliability, resiliency, and capital cost reduction; and the
- [Systems, Economic Analyses, and Modeling](#) to inform and advance new software design and financing models to accelerate investment in advanced building technologies.

What are the Benefits of CERC-BEE to the United States?

U.S. Taxpayer Benefits:

- The U.S. taxpayer benefits from improvements to building services and availability of new technologies to increase energy efficiency in homes and buildings for occupants and developers.

U.S. Industry Benefits:

- Access to world-class scientists in both the United States and China, multiplying U.S. companies' investments in innovation and resulting in accelerated technology development.
- First-hand knowledge of China's energy policies, plans, and programs which helps U.S. companies target the most attractive market opportunities for U.S. products and technology for export to China.
- An intellectual property framework that establishes clear and enforceable guidelines on intellectual property

ownership and rights for U.S. and Chinese companies.

- The opportunity to build relationships and influence technology standards and practices in China, increasing the competitiveness of U.S. companies, and the buildings industry as a whole, in China.
- Expanded markets in the U.S. and export opportunities to China valued at US\$ 50 Billion per year.

U.S. Infrastructure Benefits:

- CERC-BEE supports the build-out of U.S. infrastructure at increased levels of energy productivity and energy performance as a result of research and testing of emerging building technologies at demonstration sites throughout the United States and China.

U.S. Domestic and Foreign Policy Benefits:

- Increased building energy efficiency results in decreased dependence on foreign oil, increasing the energy-independence of the United States.
- Joint scientific R&D programs, such as CERC-BEE, establish trust with foreign governments and provide a basis for expanded cooperation in areas such as trade, defense, and economy.

Testimonials from U.S. Industry



“Johnson Controls actively supports and greatly values its participation in the U.S.-China CERC-BEE consortium for a number of reasons. First, participation gives us access to leading researchers in both the United States and China, which leverages the investments we are making in innovation through our significant in-kind contributions. Second, the intellectual property framework developed as part of the CERC program establishes clear and enforceable guidelines on intellectual property ownership and rights through joint work activities, something that has never existed prior to this initiative. Third, working within CERC has helped U.S. companies gain first-hand knowledge of China’s energy policies, plans and programs which helps them target the most attractive market opportunities for U.S. products and technology. Finally, working collaboratively with key China ministries and institutions on policy, research and demonstration projects gives U.S. companies like ours the opportunity to build relationships and influence technology standards and practices in China, increasing the competitiveness of our company, and our industry as a whole, in this growing market.”

**Clay Nesler, Vice President, Global Energy and Sustainability, Johnson Controls,
Chair, U.S. Industrial Advisory Board, CERC-BEE**



“The Dow Chemical Company actively participates in the CERC-BEE program. We value access to world class research Institutes as well as shared building science with our Chinese counterparts and U.S. Industrial Advisory Board Members. Dow’s commitment will exceed US \$2.3 million dollars over the next 5 years within the CERC-BEE research portfolio.”

Greg Bergtold, Global Advocacy Director, Dow Building & Construction



“The Precast/Prestressed Concrete Institute (PCI) represents the precast concrete structures industry, which includes building enclosures as a significant market. The annual budget of PCI includes a generous percentage allocated to research. However, certain topics, like the Oak Ridge National Laboratory (ORNL) passive building envelope project under CER-BEE, are beyond our means. We contribute industry expertise, materials, and some funding to the ORNL project because we see great value in results that will benefit the industry and the built environment. Our experiences to date have shown that the research will lead us in directions we have not seen before while, at the same time, exposing the researchers to a new industry with exciting potential. We believe these experiences have been extremely positive from both the industry side and the researcher side. We could not ask for a better collaborative environment.”

Roger J. Becker, P.E., S.E., Vice President Technical Services, Precast/Prestressed Concrete Institute



“United Technologies Corporation is a member of the Industrial Advisory Board of the U.S.-China Clean Energy Research Center in Building Energy Efficiency (CERC-BEE) and actively participates in joint research in the areas of indoor environmental quality; systems, economic analysis, and modeling; and occupant responsive model-predictive control. We are honored to be part of a selected group of companies that are teaming up with national labs and university researchers in U.S. and China to advance and deploy technologies, remove non-technical barriers to accelerate building energy efficiency. The technical breadth and depth of the CERC-BEE research teams is allowing us to explore solutions that would not be able to carry out on our own. For instance, through our work in indoor environmental quality we have been able to establish strong partnerships with BASF, LBNL and Tsinghua University to explore new materials to control indoor CO₂ while reducing energy efficiency. Through these solutions will be able not only to tackle energy efficiency challenges on both countries but also indoor air quality in China. Long term will expect that these technologies and initiatives will allow us to advance our industry and companies competitiveness in the China market and pilot new solutions for the U.S. market.

Dr. Murilo W. Bonilha, General Manager, United Technologies Research Center (China)



“On behalf of my company, Nextek Power Systems, and as the Chairman of the EMerge Alliance, the international not-for-profit DC power standards organization, I would like to lend my voice to support the CERC-BEE Industrial Advisory Board. I believe we must nurture this kind of international cooperation on energy innovations, and share our experiences at the highest levels wherever possible. Creating paths for more renewable energy inputs to become integrated in our global economy must remain a top priority for the Chinese and U.S. governments. We are pleased to be a part of it, and will continue to support these goals into 2017 and beyond.”

Paul Savage, CEO, Nextek Power Systems, Inc.



“LumenCache is an innovative Direct Current (DC) Nanogrid platform that both the research and CERC-BEE Industry Advisory Board members have embraced as potentially game-changing for smartbuildings. The CERC-BEE program provides the opportunity to demonstrate the diverse capabilities of the platform over time, and engage multiple technology partners. As research and collaboration is at the core of the program, LumenCache is actively supporting projects in both countries, and will share the best practices and lessons learned. We are excited to participate and showcase world class efficiency and integration with any global power standard.”

Derek Cowburn, CEO, LumenCache, Inc.



“Lutron Electronics, a world leading manufacturer of lighting controls and private U.S. company with headquarters in Coopersburg P.A., was the first lighting company engaged with CERC-BEE, and we are committed to the success of this flagship U.S.-China collaboration. We are honored to have served as the second chair of the U.S. Industrial Advisory Board, through which we have had the opportunity to brief cabinet members of both U.S. and Chinese administrations. Lutron's participation in CERC-BEE allows us to contribute to world-class research, deepens relationships with world-class industrial partners, and demonstrates the national energy-saving potential of our lighting controls in the largest new construction market in the world.”

Dr. Robert Nachtrieb, Lead Scientist, Lutron Electronics



“Citi, as a participant in the U.S.-China CERC-BEE consortium, values this unique opportunity to collaborate with leading institutions in the U.S. and China to advance collective goals around advancing and scaling energy efficiency, including the development and deployment of new financing structures.”

Bruce Schlein, Vice President of Corporate Sustainability, Citi



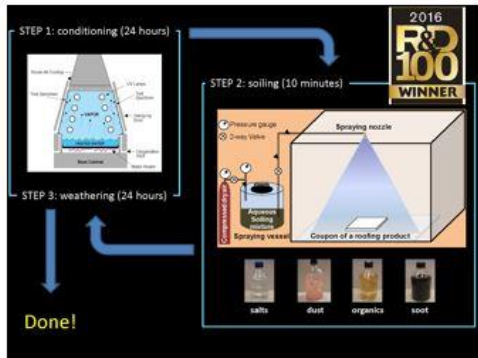
“Saint-Gobain North America is a leader in innovative materials and construction products, whose corporate emphasis is providing products for improved building energy efficiency. We greatly support the goals and objectives of the CERC BEE consortium. This consortium has given our

researchers in both the U.S. and China the opportunity for innovative and meaningful collaboration with CERC-BEE researchers in both countries to achieve our common energy efficiency goals.”

Bob Licht, Director, Government Programs, Saint-Gobain North America

Recent Award-Winning Innovation from CERC-BEE

Cool Roof and Surface Coatings High Performance, Superhydrophobic



- Dow, LBNL, ORNL, and partners from 10 Chinese universities and research institutes developed new materials and quantified impacts of high-performance cool roof and surface coatings.
- Surface coatings require no or very little incremental cost.
- LBNL's accelerated aging protocol speeds prototyping by reducing 3 year wait to 3 days.
- Achieves 5-20% reduction in annual cooling energy use on top floor of building in hot-summer climate.
- 3B m² upgradeable by 2025 in the U.S. and China.
- LBNL received a 2016 R&D 100 Award for the Cool Roof Time Machine. This award recognized the ability of this technology to dramatically accelerate and reduce the cost of prototyping and bringing to market high-performance cool roofing materials.

Liquid Flashing Easy to Apply, Low-toxicity



- Dow and ORNL developed a sprayable liquid flashing technology.
- Increases the air tightness of commercial and residential building envelopes.
- Decreases heating loads in commercial buildings in the U.S. by ~10%.
- Reduces installation time by 50 to 75% when compared to tape, making it more cost-effective.
- Selected as an R&D100 finalist in 2015 and won the 2016 Gold Edison Award for Building Construction & Lighting Innovations.
- Awarded a patent (US 8,641,846 B2).

Ground Source Heat Pumps (GSHP) Improved Energy Efficiency and Cost

- ORNL, ClimateMaster, Tongji University, Tianjin University, Chongqing University, and CABR conducted research to reduce the initial cost and improve the operational efficiency of GSHP systems.
- Designed new ground source heat exchangers (GHXs) that require 14-30% less drilling compared with conventional GHX while retaining same performance.
- Developed a first-of-a-kind research facility supporting development and verification of emerging technologies for GSHP applications.
- Created an innovative flow-demand-based pumping control, which has potential to reduce pumping energy of DGSHS systems by more than 20% (patent pending, Invention Disclosure #: 201403380, DOE S-number: S-138,004)
- Developed a new method and enabling tool for cost effectively monitoring performance and detecting faults of DGSHS systems (Invention Disclosure #: 201403381, DOE S-number: S-138,005)
- Launched the Climate Master Trilogy™ 45 Q-Mode™ series ground source integrated heat pump (GS-IHP), which earned the R&D 100 award. It was also the first GSHP unit certified by the Air Conditioning, Heating, and Refrigeration Institute (AHRI) to exceed a 45 energy efficiency ratio (EER) performance rating. This product provides space conditioning and 100% water heating, even when space conditioning is not required.

