



Building Energy Smart Technologies Research Center

November 2023 Newsletter

<https://best-iucrc.org/>

Updates from the BEST Center

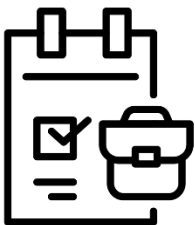
Fall Industry Advisory Board Meeting Recap

Thank you to everyone who joined us for the fall industry advisory board meeting at CCNY! It was great connecting and sharing the center's progress with our 48 in-person attendees, including 16 students from CCNY and CU Boulder, and 12 remote attendees. Thank you to Silvia Khurram from Con Edison for an inspiring keynote about decarbonization efforts in New York City, as well as to our industry advisory board members and affiliates for sharing updates from your organizations and providing feedback on funded projects. Thank you also to our students and faculty for presenting updates for the six funded projects for 2023-2024.



We are beginning to plan our next meeting to be held in Boulder in April 2024, so stay tuned for future opportunities to engage with the center. Keep an eye out for the fall quarterly report as well!

CU Civil, Environmental and Architectural Engineering Spring Career Fair



The [spring 2024 virtual career and internship fair](#) for CU Boulder's Civil, Environmental, and Architectural Engineering department is scheduled for 2/28/2024 from 12-4 PM MT. During the virtual career fair, you will have an opportunity to schedule one-on-one video sessions with students, host group meetings with students, review resumes online, and share information ahead of time about your organization.

Registration fills up quickly, so if you are interested in registering, please do so soon! Registration is through Handshake ([link](#)) and costs \$250. Additional information about virtual career fairs is available at this [link](#), and if you don't already have a Handshake account, you can create a new account by following this [link](#). Please reach out to Matt Morris (matthew.morris@colorado.edu) or Molly Bandimere (molly.bandimere@colorado.edu) with questions.

Student Highlight: S M Abdur Rob, CCNY ([LinkedIn](#), [Website](#))

1. Tell us about your background and how you got to where you are today.

I am currently doing my PhD in Mechanical Engineering at CCNY. I completed my MS in Manufacturing Engineering from The University of Texas Rio Grande Valley and BS in Industrial & Production Engineering from Bangladesh University of Engineering & Technology. I have experience in advanced manufacturing systems, instrumentation & control, building energy modeling, sustainable HVAC technologies, and decarbonization.



2. What got you interested in research, and why are you interested in the BEST Center research you are doing?

During my undergraduate senior design project, I got interested in doing research, which eventually pushed me to pursue a PhD. The BEST Center research project provides me with the opportunities to conduct research in advanced heat pump systems, which will contribute to the decarbonization efforts in the U.S. I am passionate to work on the BEST Center project because I find this project dynamic, challenging, highly implementable, and befitting to confront global warming.

3. Where do you see your project going in the future, and/or how will working on this project help your career in academia and/or industry?

The scope of our project will be broader in the future since new ideas are coming up from different perspectives, e.g., using different low GWP refrigerants, developing new control strategies, and developing robust design of different components. Since global leaders are seeking sustainable solutions to deal with the climate crisis, the outcomes of our project will pave the way for the team to pursue a career in academia or industry.

4. What are your career ambitions?

My career goals are to become an expert in sustainable energy, HVAC technologies, and environmental control and to work in academia, national laboratories, or in R&D for industry to continue conducting research and expand my expertise to serve the world.

5. What is an interesting fact about you?

One of the most interesting facts about me is that I am always very calm and patient. Even in serious and critical situations I can hold and control my composure smoothly without showing excitement or instability.

S M Abdur Rob is working on the BEST Center project “Sustainable Air Source Heat Pump Systems for Electrified Transition Markets in the Multi-Family Buildings Sector” with Prof. Jorge Gonzalez-Cruz and Prof. Prathap Ramamurthy. Student profiles are linked to on the [People](#) page of the BEST Center website.

Research Highlights

Recent Publications

- Harold Gamarro, **Jorge E. Gonzalez-Cruz** (2023). On the Electrification of Winter Season in Cold Climate Megacities – The Case of New York City. *J. Eng. Sustain. Bldgs. Cities*. 4(3): 031006. <https://doi.org/10.1115/1.4063377>.
- Madeline Corlourer, **Moncef Krarti** (2023). Analysis of Energy Efficiency Benefits of Smart Glazed Overhangs for Office Buildings in France. *J. Eng. Sustain. Bldgs. Cities*. 4(4): 041002.
- Tim Diller, Anton Soppelsa, Himanshu Nagpul, Roberto Fedrizzi, **Gregor Henze** (2023). A dynamic programming based method for optimal control of a cascaded heat pump system with thermal energy storage. *Optimization and Engineering*. <https://doi.org/10.1007/s11081-023-09853-5>.
- T. Agami Reddy, **Gregor Henze** (2023). Applied Data Analysis and Modeling for Energy Engineers and Scientists. Springer Cham. <https://doi.org/10.1007/978-3-031-34869-3>.
- Vahid Aryai, Nariman Mahdavi, Sam West, **Gregor Henze** (2023). An automated data-driven platform for buildings simulation. BuildSys '23: Proceedings of the 10th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation. <https://doi.org/10.1145/3600100.3623728>.
- Aisling Pigott, Kendall Baertlein, **Kyri Baker** (2023). Optimizing Solar Panel Placement through Passive Architectural Design. *Journal of Architectural Engineering*, 29(4). <https://doi.org/10.1061/JAEIED.AEENG-1649>.
- Yierfan Maierdan, Samuel J. Armistead, Rebecca A. Mikofsky, Qiqi Huang, Lola Ben-Alon, **Wil V. Srubar III**, Shiho Kawashima (2024). Rheology and 3D printing of alginate bio-stabilized earth concrete. *Cement and Concrete Research*, 175, 107380. <https://doi.org/10.1016/j.cemconres.2023.107380>.
- Sumit Sankhyan, **Nicholas Clements**, Allison Heckman, Aniya K. Hollo, Dulce Gonzalez-Beltran, Jonathan Aumann, Cora Morency, Luke Leiden, Shelly L. Miller (2023). Optimization of a Do-It-Yourself Air Cleaner Design to Reduce Residential Air Pollution Exposure for a Community Experiencing Environmental Injustices. *Atmosphere*, 14(12): 1734. <https://doi.org/10.3390/atmos14121734>.

Faculty and Building Industry News

Faculty News

- [CEAE group receives \\$8 million from DOE's Renew America Nonprofits program \(CU Boulder\)](#)

“The U.S. Department of Energy (DOE) launched the \$50 million [Renew America's Nonprofits Program](#) – referred to in President Biden's Bipartisan Infrastructure Law as the Energy Efficiency Materials Pilot Program – to reduce carbon emissions, improve health and safety, and lower utilities costs at buildings owned and operated by 501(c)(3) nonprofits. This first-of-its-kind investment in the nonprofit sector aims to help nonprofits make high-impact energy efficiency improvements that will create cleaner, healthier community spaces, while generating sustainable savings so that critical funds can be redirected toward mission-driven work. It also aims to stimulate widespread energy improvements in the nonprofit sector, promoting the formation of partnerships between stakeholders to create a pipeline of energy and cost-saving projects that will continue beyond the life of the grant.”
- [CU Boulder engineer selected as 2023 Schmidt Science Polymath \(CU Engineering\)](#)

“Wil Srubar, associate professor in civil, environmental and architectural engineering and the Materials Science and Engineering Program, has been named to the 2023 cohort of the Schmidt Science Polymath Program. Srubar was chosen from more than 58 applicants who outlined research ideas in STEM fields

that represent a substantive shift from their current portfolio. He and the other “polymaths” will receive \$500,000 a year for up to five years to help support their research.

“I am beyond humbled and grateful for being selected to receive the Schmidt Science Polymaths Award. It truly is a career-defining honor,” Srubar said. “The award not only provides financial support for my work, but also enables me to approach it with an unencumbered, creative freedom to pursue high-risk, high-reward ideas. It’s such an incredible opportunity.”

- [Colorado built a park over I-70 to contain pollution. Is the air safe to breathe? \(CPR News\)](#)

“Asthma is a fact of life for Yadira Sanchez. The longtime north Denver resident shares the condition with her three children. The chronic ailment means the family starts every morning with nasal rinses and puffs from inhalers. It’s why sports and sledding were never an option when her kids were younger. And it’s the reason she now refuses to visit a new four-acre park just blocks from her home.

The gleaming greenspace is outfitted with playgrounds, a splash pad, a soccer field and an amphitheater. Sanchez thinks it’s an attractive addition to the neighborhood, but she hasn’t visited because it straddles Interstate 70, Colorado’s main east-west traffic artery.

The highway-spanning project, known as a “cap,” opened in late 2022 as the final piece of a \$1.2 billion project to nearly triple the width of the thoroughfare through Elyria-Swansea — a neighborhood with some of Denver’s highest asthma rates. One reason planners added the cover was to dampen noise and pollution from the freeway below.”

Addition information about air quality testing is available here: [How we measured air quality at the I-70 cover park in Denver’s Elyria-Swansea neighborhood.](#)

IAB Member News

- [Rheem Boosts Efficiency and Power a More Sustainable Future with Oracle Cloud \(Oracle\)](#)

“Rheem, a leading global manufacturer of HVAC equipment, water heaters, boilers and commercial refrigeration solutions, is expanding its investment with Oracle by selecting Oracle Fusion Cloud Applications Suite and Oracle Cloud Infrastructure (OCI) to scale its global operations and support its mission to engineer high-quality and sustainable solutions. With Oracle Cloud, Rheem will be able to manage its supply chain, customer service, HR, and finance processes on a single cloud platform.”

- [Rheem Opens Innovation Learning Center in Arkansas \(ACHR News\)](#)

“Rheem celebrated the grand opening of its Innovation Learning Center (ILC) in Fort Smith, Arkansas, on Oct. 12. The ribbon-cutting event included remarks by Rheem leadership, including Kevin Ruppelt, senior vice president and general manager of Rheem’s U.S. air conditioning division; Andrew Welch, Rheem’s director of operations; and Fort Smith Mayor George McGill. Those were followed by a tour of the facility and lab and company-wide picnic.”

- [New hybrid solar panel technology tested by Con Edison \(News12 Hudson Valley\)](#)

“New solar power technology is in the works and could soon be coming to Hudson Valley homes and business. Con Edison showcased hybrid solar panels at its Spring Valley offices, producing electricity and harnessing thermal energy for heating/cooling.

“The idea behind the technology is to provide all energy needs with one equipment. Utilizing the solar power and utilizing the waste heat recover under the solar power which makes solar panels 90% efficient compared to typical 20% efficiency for conversion on solar panels,” says Silvia Khurram, of Con Edison Research and Development.”

- [Ford commercial unit, Xcel Energy partner up to install 30,000 EV charging ports \(Reuters\)](#)

“Ford’s (F.N) commercial unit will collaborate with utility firm Xcel Energy (XEL.O) to install 30,000 electric vehicle (EV) charging ports across the U.S. by 2030, the companies said on Tuesday. The companies, which did not reveal any financial details on the partnership, said they would work together within Xcel’s broader Electric Vehicle Supply Infrastructure (EVS) program. Under the program, Xcel will install charging infrastructure for business customers that qualify for and enroll in an approved EVS program in the customer’s service location, with most upfront costs offset by the utility firm.”

- [City of Boulder Named Climate Action Leader on Carbon Disclosure Project 2023 A List \(City of Boulder\)](#)

“The City of Boulder has been recognized by the Carbon Disclosure Project (CDP) as one of 119 cities across the globe taking bold leadership on environmental action and transparency. CDP’s A List is designed to encourage and support cities to ramp up their climate action and ambition. A List cities build climate momentum, taking four times as many climate mitigation and adaptation measures as non-A Listers. Only 13% of 939 cities scored in 2023 received an A.”

- [Design Trends for the Post-COVID Office Environment \(Mead & Hunt\)](#)

“The concept of the office is less recent than we think. Clinical work was done in grand halls and courtyards as early as the 1700s. Even earlier in history, Renaissance-era scriptoriums depict work in pod-like stations. We have seen the office structure change over time, and it is no surprise that the modern office has changed in the past three years post-Covid. As contemporary employees and companies adjust to the “new normal,” what office design trends can we expect to emerge?”

- [Atelier Ten’s Roadmap to Absolute Zero Carbon \(Atelier Ten\)](#)

“Atelier Ten is developing creative solutions to push projects beyond “Net Zero Carbon” and toward “Absolute Zero Carbon“. The industry has used the concept of “net zero” for some time, and it’s a useful construct, but is limited scope and assumes the use of carbon offsets to balance (or “cancel-out”) building emissions. “Absolute Zero Carbon” buildings on the other hand removes offsets and pushes projects to achieve zero emissions from conception through operation. It means all emissions from building operations and materials, refrigerants, construction, infrastructure, and landscape will be zero. It means buildings will be zero carbon every minute of every day.”

- [Culturally Conscious Design at La Plaza Esperanza \(PAE Engineers\)](#)

“La Plaza Esperanza, which means “a place of hope,” is an 18,000 square feet community center that aims to serve a vibrant multigenerational community in Gresham, Oregon. The building design prioritizes community with a welcoming lobby, a single-class preschool and playground, a generous front porch, and multipurpose rooms.

Uniquely, the design team is made up of a majority Latinx architects, designers, engineers, and contractors, in the aim of reflecting the diversity of the community. The Latino Network, who will run the building, is a Latino-led education organization with a core belief in self-determination. They support local communities with an emphasis on culturally specific practices and services for youth and families.”

Building Industry News

- [DOE Study Stresses Need for Energy-Efficient Measures to Enhance Building Resilience \(USGNN\)](#)

“Over the past two decades, an increased frequency of extreme weather events has cost the U.S. more than \$1 billion in infrastructure damages. This prompted the U.S. Department of Energy (DOE) to commission research to assess how increased energy efficiency can improve building resilience under extreme temperatures.

The study, [Enhancing Resilience in Buildings Through Energy Efficiency](#), was prompted by DOE's Building Technologies Office. Three research laboratories were tasked with the project: the Pacific Northwest National Laboratory, the National Renewable Energy Laboratory and the Lawrence Berkeley National Laboratory."

- [Case Study: The Empire State Building \(Nexus Labs\)](#)

"Empire State Realty Trust (ESRT) has emerged as a trailblazer in the realm of deep energy retrofits and decarbonization. With a vast 10 million square foot portfolio, ESRT, led by Dana Schneider, the Director of Energy Sustainability and ESG, has dedicated over 15 years to the mission of achieving net-zero emissions. The approach taken by ESRT involves meticulous modernization of assets, infrastructure, and systems, ensuring enhanced resilience, efficiency, and reliability.

A key aspect of their methodology is the transparent sharing of knowledge. To that end, Schneider recently joined the Nexus Podcast with Etrit Demaj, co-founder of KODE Labs, to share ESRT's systematic approach to building retrofits and technology deployments, focusing on their transformative initiatives and the technical expertise that has propelled them to the forefront of the industry."

- [Accelerating Decarbonization in the United States \(National Academies\)](#)

"Addressing climate change by decarbonizing the U.S. energy system is essential and possible, with far-reaching benefits for public health and economic development. Recent legislation has put the nation on the path towards achieving net-zero greenhouse gas emissions by 2050, but many challenges remain. A new National Academies' report, [Accelerating Decarbonization in the United States](#), gives sector-by-sector recommendations to help policymakers successfully implement an equitable energy transition over the next decade and beyond."

- [Could Tougher Energy Codes Fix Climate Change? \(Scientific American\)](#)

"It seems almost too good to be true. But the Energy Department says one step by states would help the United States reduce future carbon emissions by nearly 2 billion metric tons and cut \$180 billion from the country's collective energy bill over 30 years. And the move needs no new technology, equipment, infrastructure or vehicles and would be the equivalent of removing 445 million gasoline-powered cars from the road over 30 years. What's required is for states to force new buildings to meet stronger energy standards that reduce consumption. The Energy Department is touting the benefits of this change in an unprecedented campaign that urges states to make buildings more climate-friendly by adopting new energy codes."

- [Countries asked to slash cooling emissions by 68% by 2050 \(Reuters\)](#)

"With climate warming leading to more air conditioning use worldwide, dozens of countries including China, India and the United States are being asked to commit to a global pledge that would require at least a 68% reduction in cooling-related emissions by 2050, sources told Reuters.

The Global Cooling Pledge – set to be announced at the upcoming United Nations climate summit, COP28 – represents a tough request given the cooling industry is only expected to grow."

- [Denver has a new climate boss. Here's her plan for an electrified and sustainable city — and how she's cutting her own carbon footprint \(CPR News\)](#)

"Denver is one of the few U.S. cities with an office dedicated to reducing greenhouse gas emissions and responding to the local effects of climate change. Denver's Office of Climate Action, Sustainability & Resiliency was funded through a local sales tax increase that Denver voters passed in 2020. Three years ago, Liz Babcock helped create the office. Now, Denver Mayor Mike Johnston has appointed her to lead it.

“I think the work of climate action has to engage everyone in our community,” Babcock said in an interview with Colorado Matters. “We are experiencing an affordability crisis in our community, and so pairing climate action and clean energy with programs that actually lower people’s energy costs is really important.””

- [Study aims to clear the air on the effects of air quality in school classrooms \(CO School of Public Health\)](#)

“Across Colorado, thousands of students filing into classrooms this school year are sharing their space with new companions. These nearly silent classmates don’t occupy desks or pore over textbooks. But they are as focused on gathering information and contributing to a positive class environment as the most dedicated student.

The new arrivals are thousands of classroom air quality monitors and portable air cleaners installed as part of a Centers for Disease Control and Prevention-funded study through the Colorado Department of Health and Environment and the University of Colorado Boulder.”

- [ASHRAE Releases Guide on the Role of Grid Interactivity in Decarbonization \(ASHRAE\)](#)

“The Grid-Interactive Buildings for Decarbonization: Design and Operation Resource Guide is the second in a series of guides developed by the ASHRAE Task Force For Building Decarbonization (TFBD) and provides information on maximizing carbon reduction through buildings’ interaction with the electric power grid.

“Grid-interactive buildings actively engage with the energy grid. They utilize smart technologies, renewable energy sources, and energy storage systems to optimize energy consumption and generation. This allows them to respond in real-time to grid signals, thereby reducing overall demand and GHG emissions,” said ASHRAE TFBD chair Kent Peterson P.E., Presidential Fellow. “Integrating buildings with the electrical grid is a critical component in the decarbonization process. It’s an emerging focus for building professionals, and ASHRAE is thrilled to provide new guidance as we collectively work towards a more sustainable, resilient, and energy-efficient built environment.””

- [Decarbonizing the Future \(ASHRAE\)](#)

“In October, HVAC&R industry stakeholders gathered for the 2023 Decarbonization Conference for the Built Environment where thought leaders, consulting engineers, architects and others met to discuss prospective, exciting opportunities in reducing the carbon footprint of buildings.

The subject of how to achieve decarbonization goals in an industry fraught with jockeying interests came up throughout the meeting. “How to succeed in an industry with so many disparate players? I think simplicity is going to be key,” said Laurie Kerr, principal climate advisor at U.S. Green Building Council (USGBC), during a Building Industry Decarbonization Collaboration panel. “We have to move away from overly complex requirements and formulas that really scare people away. We must move toward simpler directions that everybody in our industry can understand. Embrace simplicity and the big picture and let go of some of that perfectionism we love so much.””

- [Heat pumps are hot, but commercial retrofits face cold realities \(Utility Dive\)](#)

“Heat pumps are gaining recognition across many parts of the U.S. for their energy efficiency and reduced greenhouse gas emissions compared with other building heating and cooling options.

The U.S. Climate Alliance, a bipartisan coalition of 25 governors, recently pledged to increase heat pump installations across their states to reach 20 million by 2030. Currently, the U.S. has about 4.8 million heat pump installations, according to RMI, a clean energy think tank.

Adoption varies from state to state. In Massachusetts, concerns about initial expenses and the intricacies involved in selecting appropriate heat pump equipment have slowed adoption, putting the state behind

counterparts like Maine, which has already surpassed its 2025 target of 100,000 heat pumps. Maine Gov. Janet Mills, D, recently established a more ambitious target of reaching 175,000 heat pumps by 2027.”

- [This building was designed to withstand future heat waves \(wbur\)](#)

“Many of the people who died in Phoenix during a record-breaking heat wave in July lived outdoors without shelter. But according to the Maricopa County Health Department, at least 81 people succumbed to heat injuries inside a building — victims of a broken or unused air-conditioning unit.

It makes you wonder: What if this desert city was better designed to protect against the deadly heat that is inevitably coming with climate change?”

- [Hotel Marcel New Haven becomes first certified Passive House hotel in US \(Hotel Management\)](#)

“When architect and developer Bruce Redman Becker envisioned the opportunity to create Hotel Marcel New Haven, Tapestry Collection by Hilton (Conn.), which opened in May 2022, he wanted to create a hotel that operated fully on renewable energy, without any use of fossil fuels.

That vision is now a reality as Hotel Marcel has become the first Passive House-certified hotel in the country. The Passive House certification, managed by Passive House Institute, is the only internationally recognized performance standard for air tightness and energy consumption, verified with field-tested energy modeling. Worldwide, 5,629 buildings have been certified by Passive House Institute. Only 140 are in the United States and Hotel Marcel is the first hotel with more than 100 rooms to be certified in the world.”

Upcoming Conferences & Meetings

- [ASHRAE 2024 Winter Conference](#), Chicago, IL, Jan 20-24, 2024

Nick Clements will be attending both technical committee meetings (EHC, SGPC10, HWBE PD) and the AHR Expo for networking with prospective IAB members.

- [2024 ASHRAE International Conference on Building Decarbonization](#), Madrid, Spain, Apr 17-19, 2024

“This 3rd ASHRAE topical conference provides a unique opportunity for professionals to share information, exchange ideas and collaborate on the design, construction, ownership and operation of facilities that have a minimal or neutral impact on the environment in terms of carbon footprint. Our primary objective is to enrich the knowledge base while fostering global collaborations in decarbonization efforts, ultimately leading to a sustainable future for our planet. Join us at this groundbreaking event and be a part of the solution towards a greener, more sustainable built environment.”

- [IBPSA-USA SimBuild 2024](#), Denver, CO, May 21-23, 2024

“SimBuild 2024 marks the 20th anniversary of the first SimBuild conference, held in 2004. The theme of the conference is “Celebrating Two Decades of SimBuild.” Join us as we commemorate IBPSA-USA’s contributions to sustainability and building performance simulation and look toward the future. The program will highlight the work of IBPSA-USA and its members and provide a platform to envision the future of simulation, as we explore emerging technologies, trends, and strategies that will continue to drive building performance excellence in the years ahead.”

- [2024 ASHRAE Annual Conference](#), Indianapolis, IN, June 22-26, 2024

“Legislative initiatives, electrification, artificial intelligence and other technological and social forces are impacting ASHARE members across all aspects the built environment,” said technical conference chair Brian Fronk. “The program tracks for the 2024 ASHRAE Annual Conference in Indianapolis seek to explore the challenges and opportunities in responding to these changes, while continuing to focus on core HVAC&R fundamentals, equipment and research and development.”

Important Dates: 3/15/2023: Final conference papers due

- Indoor Air 2024, Honolulu, HI, July 7-11, 2024

“The world has seen unprecedented interest in improving indoor air quality due to the COVID-19 pandemic. The importance of our indoor environment on human health and well-being has never been more pronounced. Changes implemented in indoor spaces to reduce viral transmission have also had other benefits to our indoor spaces, and it is critical that we work globally to sustain these improvements. One of the biggest challenges to the indoor air community is to leverage the current circumstances to Sustain the Indoor Air Revolution. Thus, the theme of this conference will center around continued improvements in indoor air science and implementation in our buildings.”

Important Dates: 12/15/2023: Abstract submission deadline

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