INTEGRATED DESIGN LAB

Annual Report 2024–2025

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Cover Image: Renton High School Science Classrooms, Renton, WA. Architect: Side x Side. Photo credit: Sozinho Imagery
The UW IDL provided daylighting technical assistance on this project for Side x Side.

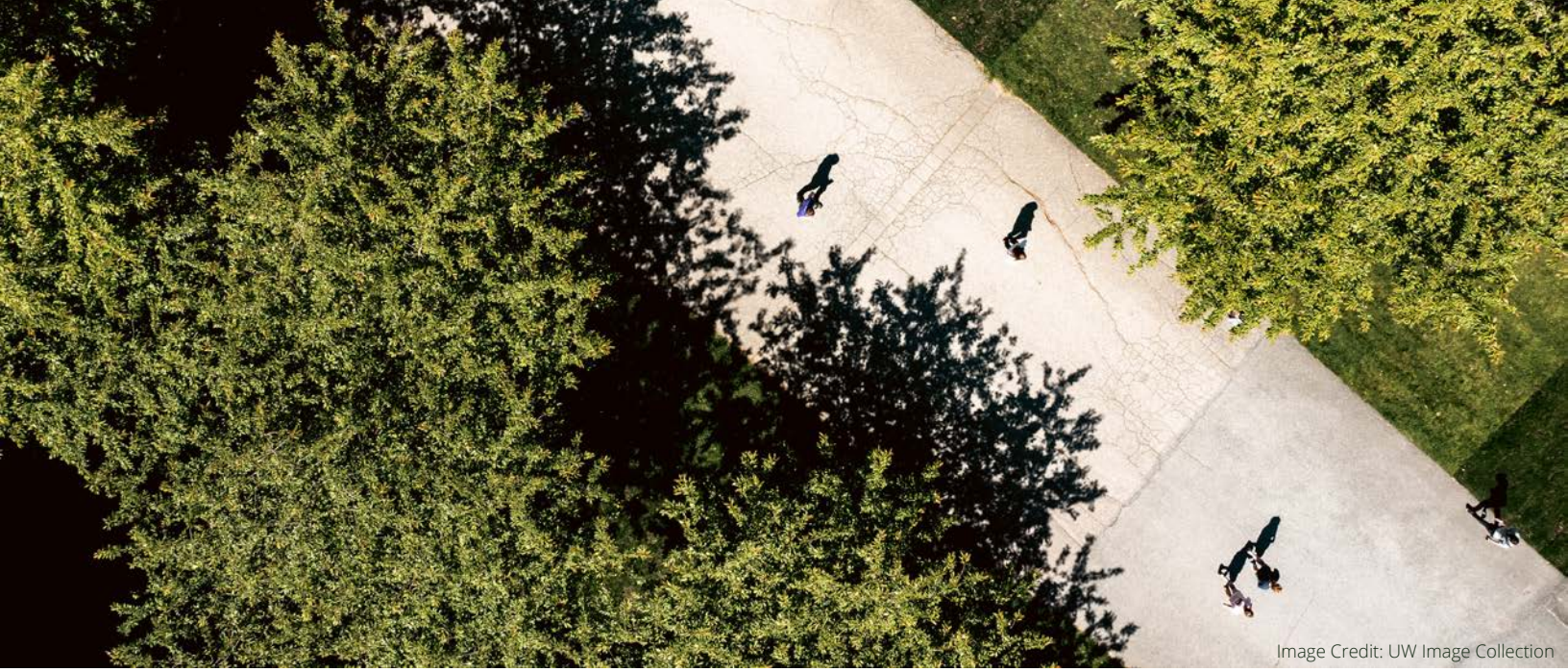


Image Credit: UW Image Collection

LETTER FROM THE DIRECTORS

Dear Friends and Supporters of the UW IDL,

Each year, as we share our annual report, we take the opportunity to reflect on our progress and highlight our successes. Those reading this are undoubtedly aware of the out-sized impact that buildings have on energy consumption and carbon emissions. This year, we focus on our efforts to transform the existing building stock into healthier, high-performing, energy-efficient assets—for the region and beyond. This work reflects a long-term, generational commitment to maximizing the value of the built environment.

Our cover features the remarkable renovation of Renton High School's science classrooms in Renton, WA—a 50-year-old Brutalist concrete building that was essential to the school's mission but overdue for upgrades. Designed by Seattle's Side x Side Architects, with IDL as daylighting and solar shading consultant, the building now offers improved comfort, natural light, energy performance, and—most importantly—a healthier, more productive learning environment.

To scale successes like Renton High School across the region, we recently partnered with the Northwest Energy Efficiency Alliance (NEEA) and Molly McCabe, a nationally recognized leader in finance and sustainability, on a new initiative to accelerate the speed and depth of energy retrofits. This work aligns with the growing adoption of Building Performance Standards (BPS) at both regional and national levels. These standards create a tailwind of opportunity, enabling the development of pathways that improve building performance while increasing asset value.

As part of this effort, and in partnership with NEEA, we are supporting a Whole Building Implementation program. It aims to develop clear, compelling strategies for implementing holistic energy improvements in the region's most common building typologies as part of routine capital planning. It also aims to create innovative tools that help identify and leverage funding and financing mechanisms, demonstrate strong return-on-investment potential, and equip building operators and real estate professionals with the tools they need to make the business case for whole-building efficiency—both internally and externally.

Aligned with this effort is our Department of Energy-funded Building Training and Assessment Center (BTAC). In partnership with the University of Washington, South Seattle College, and Northwest Indian College, the BTAC is training the next generation of professionals capable of meeting the requirements of building performance standards while raising the bar for how existing buildings are operated. Over the next two years, we expect to certify more than 60 students across all three institutions in these essential skills.

We remain deeply grateful to the organizations that make our work possible: the Northwest Energy Efficiency Alliance (NEEA), BetterBricks, our Puget Sound utility partners, the U.S. Department of Energy (DOE), ARPA-E, the American Institute of Architects (AIA), the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), the Illuminating Engineering Society (IESNA), and our Advisory Board for their ongoing guidance and support.

With Gratitude,

Christopher Meek
FAIA, IES
Professor
Director

Heather Burpee
AIA, EDAC
Research Professor
Director, Education and Outreach

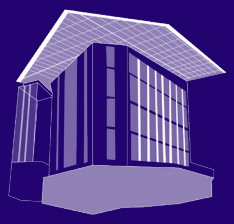
IDL at a GLANCE

WHO WE ARE

The IDL is operated by the **Department of Architecture** in the **College of Built Environments** at the **University of Washington** in the **Center for Integrated Design**. We are a self-sustaining organization of interdisciplinary faculty, staff, students, professional collaborators, and partner organizations working together to push the boundary on what's possible in sustainable building design. Our shared mission is to discover solutions that overcome the most difficult building performance barriers, and to meet the building industry's goals of moving towards radically higher performing buildings and healthy urban environments.

OUR WORK

The Integrated Design Lab's mission is underpinned by three service streams that work in tandem to promote an energy efficient, healthy built environment:



Knowledge Transfer through Education and Outreach – We share technical knowledge and lessons learned with our commercial clients and industry partners through professional education programs and public tours of the Bullitt Center.

Discovery through Research – We perform targeted research projects on high performance buildings in order to discover new technologies and strategies for healthy, energy efficient buildings.

Guidance through Technical Assistance – We apply our research findings by providing technical design assistance that translates new strategies and technologies to building project teams and industry partners.

The outcomes of our work intersect with people, policies, cities and buildings, and markets. Work examples are highlighted throughout this report. **In the past decade the Integrated Design Lab has produced:**

180 PAPERS PUBLISHED & JOURNAL ARTICLES, AND **500 CONFERENCE PRESENTATIONS**

DIRECT PROJECT INFLUENCE ON OVER **70,750,000 SQUARE FEET** OF COMMERCIAL BUILDINGS

OVER **98,000 HOURS** OF PAID GRADUATE STUDENT RESEARCH ENGAGEMENT AND **MENTORSHIP**

OVER **2,225 TOURS** SERVING OVER **42,000 PEOPLE VISITING** THE BULLITT CENTER

CONTACT

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Interested in collaborating with the IDL? Contact us to learn more, make a tax-deductible contribution to support the lab's mission, or to create student research internships.

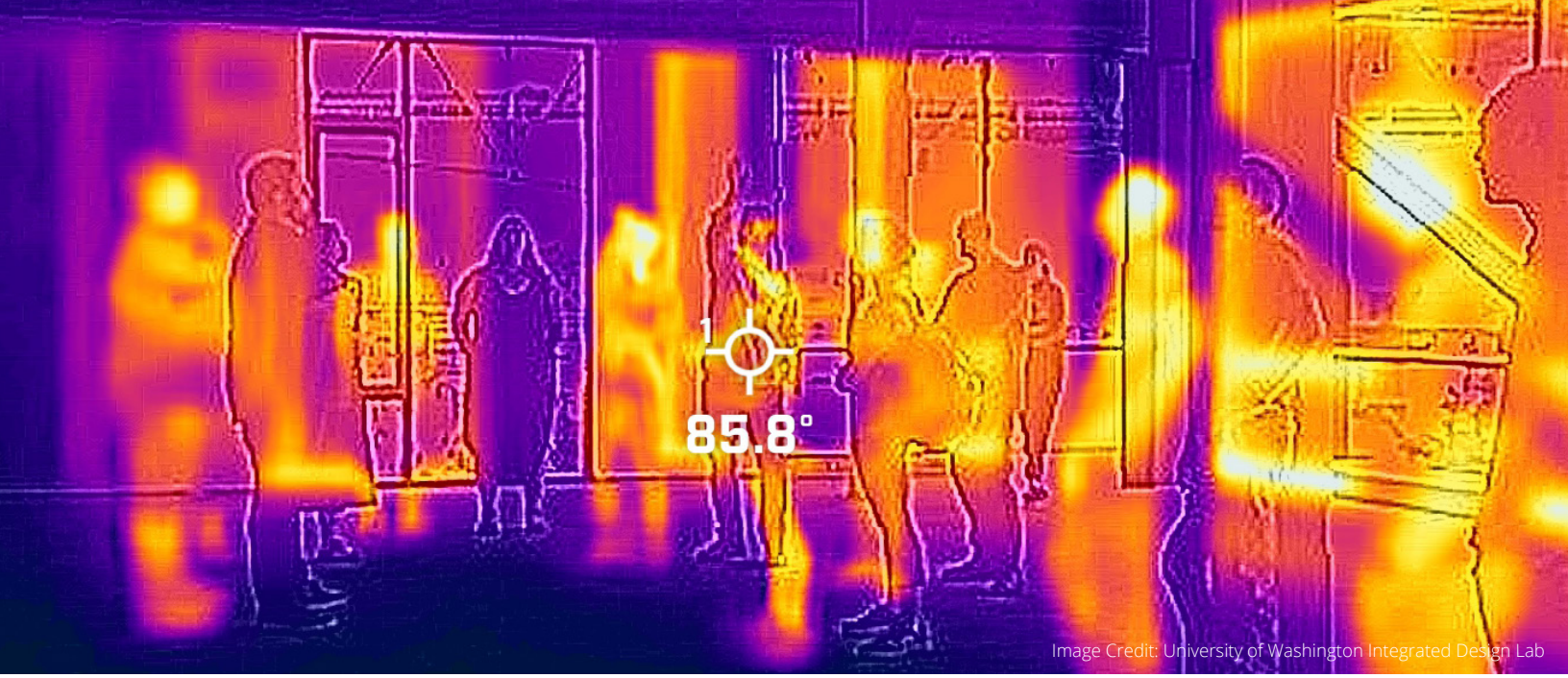

Image Credit: University of Washington Integrated Design Lab

OUTCOME I: THEORETICAL & APPLIED RESEARCH

Decreasing carbon emissions requires the building sector to reduce energy waste and embodied carbon. The UW IDL's work supports ambitious programs, evaluates new technologies, develops tools, roadmaps, and helps implement innovative projects deploying sustainable design strategies.

NEEA Whole Building Implementation

The UW IDL with Molly McCabe of HaydenTanner of Bigfork, MT have partnered with the Northwest Energy Efficiency Alliance (NEEA) to develop a new holistic "Whole Building" efficiency program that leverages building performance standards to accelerate and deepen energy efficiency in the existing building stock in Washington and Oregon – a generational opportunity that will pay dividends over the next several decades.

We aim to identify sound, strategic value cases for energy upgrades in the region's most common building types, ensuring they are integrated into routine capital planning. To support this, we are developing regional program concepts that will help building operators and real estate professionals be equipped with methods to effectively communicate the business case for whole-building efficiency to both internal and external stakeholders. In addition, we will coordinate educational offerings and financial incentive programs to increase awareness of NEEA's Whole Building resources—what they are, where to find them, and how to use them—while recognizing those who are leading the way through innovative approaches to existing building efficiency.

AIA UpJohn Award Collaboration [1]

In partnership with Olson Kundig, the UW IDL is developing a residential carbon emissions calculator. This open-source tool enables designers to select key project attributes, such as location, envelope, structural design, window-to-wall ratio, and HVAC system, and interactively calculate both embodied and operational carbon emissions. The no-cost tool allows users with little to no life cycle analysis technical knowledge to evaluate how different design decisions affect carbon emissions over the project's lifetime.

ARPA-E Parametric Open Data LCA [2]

The UW IDL continues working with the UW's Life Cycle Lab on a four-year, ARPA-E funded project to develop a comprehensive life cycle analysis (LCA) framework and package of tools that can be used in whole building LCA analysis. The UW IDL's contribution has been developing frameworks for projecting operating carbon impacts in buildings using a range of decarbonization and future weather scenarios. This program supports Harnessing Emissions into Structures Taking Inputs from the Atmosphere (HESTIA), which accelerates development of technologies that have net negative embodied emissions and store atmospheric carbon.

Population Health Initiative

IDL Prof. Christopher Meek is part of a team led by UW Assistant Professor Narjes Abbasabadi that was awarded a new Tier 3 Population Health Initiative (PHI) Climate "DecarbCityTwin 2.0: A Platform for Health-Driven and Equitable Decarbonization of the Built Environment." This grant will expand the team's work to advance urban modeling and machine learning techniques for improved indoor air quality, health, and energy efficiency in Seattle's Duwamish Valley and beyond.


Image Credit: UW Image Collection

OUTCOME II: EDUCATION & OUTREACH

The IDL forges partnerships to advance knowledge of high-performance buildings and overcome barriers for implementation. We develop and deliver educational programs for the professional design community, the University, and the public. These programs accelerate the realization of buildings that deliver exceptional environmental performance.

AIA Seattle Energy in Design Award [3]

Congratulations to LMN for their winning project, Founder's Hall at the UW Seattle campus, recipient of the 2024 AIA Seattle Energy in Design Award!

For the ninth year, the UW IDL has partnered with the AIA Seattle and the Honor Awards/ Committee on the Environment COTE Committee to provide technical support for the Energy in Design (EiD) Award. All award submitters are required to share energy performance data for their projects. The work aligns with the national-level development of the AIA "Common App." In 2024 approximately 20% of all submitted buildings met or exceeded the 2030 Challenge.

NEEA Luminaire Level Lighting Controls Market Intelligence

The UW IDL is developing case studies and gathering insights for the implementation of Luminaire Level Lighting Controls (LLLCs) with an emphasis on learning from market actors who have not previously incorporated LLLC technology in their projects. We are also partnering with the Northwest Energy Efficiency Alliance (NEEA) to identify case studies that showcase the innovate application of LLLC and lighting controls and design. This work supports the adoption of advanced lighting controls in the Pacific Northwest region.

Pacific Northwest Building Training Assessment Center (PNW BTAC) [4]

The UW IDL is leading a DOE-funded Building Training and Assessment Center with South Seattle College, Northwest Indian College, Pacific Northwest National Lab (PNNL), and the UW Industrial Assessment Center to provide hand-on workforce training in high-performance buildings operation.

Recent building assessment include the ACT Theater in downtown Seattle, The Africatown Benu Men's Shelter, El Centro de la Raza's historic building, and the University Presbyterian Church. At the completion of the first three years of the program the team anticipates certifying at least 60 students with industry-recognized certificates to up-skill participants in the area of benchmarking and strategic roadmaps for energy efficiency and decarbonization.

Bullitt Center Tour Program [5]

In the twelfth year of the Bullitt Center, we continue a robust in-person and virtual tour program. Visitors from around the world come to visit the innovations showcased in the building. Book a tour or check out our virtual tour on our website!

BetterBricks Very High Efficiency DOAS

Heather Burpee has provided several education and outreach opportunities highlighting BetterBricks and its Very High Efficiency DOAS program. This systems-based solution provides high air quality while reducing energy consumption, increasing overall indoor environmental quality for building occupants. Notable events included presentations for architecture firms, an online webinar highlighting technology and codes, and a detailed case study focus group.

Image Credit: UW Image Collection

OUTCOME III: TECHNICAL INFLUENCE ON DESIGN & CONSTRUCTION

The IDL's interdisciplinary faculty and students have influenced over 70 million square feet of new construction and major building renovation in the past decade. We provide technical assistance to architects, engineers, and building owners during early design phases through construction and operations with evidence-based strategies developed from research and targeted to deliver energy savings and reduced carbon emissions.

Renton High School Science Wing -- Side x Side Architects

SidexSide Architects recently completed the Renton High School Science Classroom retrofit to provide the next generation of students a contemporary and inspiring learning environment that blends transparency, natural light, and flexible design to support both lab work and informal collaboration while preserving the existing 1958 structure. The original building was re-imagined to integrate advanced daylighting strategies, including large expanses of glazing and carefully designed solar shading, to maximize natural light while minimizing glare and energy use. High-efficiency LED systems with smart controls complement daylight, ensuring optimal illumination for lab and classroom activities with reduced power demand. Sustainable material selections, upgraded mechanical systems, and improved thermal performance create a healthy, energy-efficient learning environment that aligns with the district's long-term sustainability goals. The IDL provided solar shading analysis and daylight design and simulation support.

> "Technical design assistance provided by the IDL helps shape the focus of our research and connects us with the design community in the collaborative effort to pursue a better built environment."

Building Stock Retrofit Post-Occupancy Evaluation -- Seattle Housing Authority

In partnership with the Seattle Housing Authority, the IDL is investigating new combined heat pump/heat recovery ventilation (HRV) units to facilitate improved indoor environmental quality and decarbonization in their existing building stock.

Seattle Space Needle

The UW IDL worked with the innovation team at Seattle's iconic Space Needle to envision implementation scenarios of a bifacial photovoltaic panel canopy for the Space Base entrance and visitor's center spase. The IDL created iterations on solar canopy geometry, calculated the annual electrical production capacity and analyzed the effects of solar panel shading on the highly glazed spiral base. Using parametric energy simulations, the IDL tested a range of exterior glazing scenarios and solar canopy shading options to advance sustainability and user experience at this landmark building.

Bellevue 600 -- NBBJ

The IDL continues its engagement with the Bellevue 600 design team. This 1,036,000 square foot 43-story, office tower in downtown Bellevue, WA designed by NBBJ. Its design incorporates extensive south-facing façades, narrow floor plates, and stepped massing that reduces self-shading, maximizing daylight. It uses light redirecting glazing and exterior shading and a natural ventilation strategy. These elements help lower reliance on electric lighting while managing daylight glare and solar heat gain. Post-occupancy analysis shows performance mirroring simulation results. The IDL is now consulting on the interior tenant improvements with Boulder Associates architects and Seneca Group.

Image Credit: UW Image Collection

SELECTED PRESENTATIONS & PUBLICATIONS

The IDL transfers its research findings through presentations and publications in diverse venues regionally, nationally, and internationally. These forums help to disseminate knowledge directly to design teams, professional partners, and others, bolstering the industry's technical capabilities and knowledge of high performance design.

> "Publications and presentations provide a conduit to share our research far beyond our region."

Clemson Symposium [6]

Heather Burpee presented and participated in Clemson University's inaugural Human-Centered Building Design Symposium where experts in the fields of architecture and construction science gathered to coalesce around emergent data-driven research in evidence-based design.

Perkins & Will Podcast [7]

Chris Meek and Heather Burpee spoke with Perkins & Will's "Net Zero in Focus" podcast led by Isha Mishra and Luis Matias Barajas Saldana. The focus was on how existing buildings and healthcare buildings can approach a net-zero energy and resilient future. The podcast was developed as part of an internal firm research grant with an aim to explore a future state built environment that consumes fewer resources and has a lower environmental impact.

GreenBuild [8]

Heather Burpee presented with Rachael Meyer (Weber Thompson) and Alexandra Ramsden (Brightworks) on "Regenerative Ecosystems, Resiliency & Human Wellbeing at the Greenbuild International Conference + Expo in Philadelphia. Her presentation was based on work from the Rosetta Stone: Translational Tool for Research-Informed Practice developed by the UW IDL's Firm Partnership Initiative.

Decarbonize Hospitals Guide [9]

Heather Burpee co-authored "Decarbonization of Hospital Buildings Design Guide" for the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and the American Society for Healthcare Engineering (ASHE) with Walt Vernon (Mazzetti), Mara Baum (Dialog), and Jim Crabb (Mazzetti). The guidebook provides a path forward for new hospital buildings to be fully decarbonized despite their high intensity.

Energy & Buildings Impact of Grid Mix [10]

Teresa Moroseos and Chris Meek from the UW Integrated Design Lab, along with Prof. Tomás Méndez Echenagucia from the UW Department of Architecture published a paper in Energy & Buildings that examines the influence of dynamic factors on operational carbon accounting across various building typologies and climate zones. In particular, future climate scenarios, electricity grid mix projections, and emission factor temporal resolution were assessed for their impact compared to using typical historical data. Incorporating future grid mix projections made the largest impact, underscoring the importance of incorporating this factor in Whole Building Life Cycle Assessment (WBLCA).

Society of Building Science Educators (SBSE) Quarterly Seminar

IDL Director Chris Meek along with Prof. Vivian Loftness, Paul Mellon Chair at Carnegie Mellon University, Prof. Mark DeKay at the University of Tennessee, and Moderator Omar Al-Hassawi, Associate Professor at Washington State University participated in the in Inaugural SBSE Quarterly Seminar. This panel discussed the definition and scope of building science and it's future in education, research, and the profession. Panelists shared aspects of their teaching, research, and service to society as part of a lively discussion with the audience on the importance of building science.

UW IDL STAFF

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PUBLICATION CITATIONS

1- AIA UpJohn Research Initiative, " Integrated Carbon Dashboard for Residential Architecture." With Olson Kundig. 2024 Awardee. **Web Link.**

2- Parametric Open Data for Life Cycle Assessment (POD | LCA) ARPA-E Award No. DE-AR0001624. Poster for ARPA-E Energy Innovation Summit 2023. **Web Link.**

3 - American Institute of Architects, Seattle Honor Awards. "Energy in Design Award." **Web Link.**

4- U.S. Dept. of Energy, Pacific Northwest Building Training Assessment Center (PNW BTAC). **Web Link.**

5- University of Washington's Integrated Design Lab, "Bullitt Center Tour Program. **Web Link.**

6- Clemson News, "Built Environment Experts Gather at Clemson for Symposium on Human-Centered Building Design." December 2024. **Web Link.**

7- Perkins & Will Net Zero in Focus Podcast, "Episode 1 with Heather Burpee," and "Episode 3 with Christopher Meek." Summer 2025. **Web Link.**

8- GreenBuild International Conference + Expo, "Regenerative Ecosystems, Resiliency & Human Wellbeing." Presentation with Alexandra Ramsden (Brightworks), and Rachael Meyer (Weber Thompson). Philadelphia, PA. 14 November 2024.

9- American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and American Society for Healthcare Engineering (ASHE) "Decarbonization of Hospital Buildings Design Guide." Burpee H, with Vernon, W. (Mazzetti), Jim Crabb (Mazzetti), and Baum, M. (DIALOG). August 2024. **Web Link.**

10- Moroseos, T., Echenagucia, T. M., & Meek, C. (2025). Impact of a dynamic grid mix and climate on operational carbon emissions modeling for different building typologies and climate zones. Energy and Buildings, 342, Article 115854. **Web Link.**

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