



INTEGRATED DESIGN LAB

Annual Report 2020-2021

UW Center for Integrated Design
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LETTER FROM THE DIRECTORS

Dear Friends and Supporters of the UW IDL,

We are pleased to have this opportunity to share our Annual Report with you, highlighting our most significant outcomes of our 2020-2021 year. Before looking ahead, we would like to express sincere gratitude for the unwavering commitment of our partners: the utility support we receive from the Northwest Energy Efficiency Alliance (NEEA), from individual utilities in the Puget Sound region, municipalities, and allied organizations, creative practitioners who invite us into their projects, and the students, staff, and faculty who make the Lab possible.

Our work has come into sharp focus this year - the devastating climate projections of the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report released in August coinciding with once-unimaginable heat in the Pacific Northwest emphasizes the importance and urgency of the Lab's mission to increase resource efficiency and help eliminate greenhouse gas emissions.

The waypoints on our journey in the coming year offer a bounty of opportunity:

- Developing cost effective energy-efficiency and decarbonization resources with communities and building owners that have been historically underserved by our programs

- Identifying technical approaches for retrofit strategies that improve the quality and energy performance for buildings that serve the most vulnerable in our communities.
- Sharing innovative use of Luminaire Level Lighting Controls (LLCs) in new construction to improve the visual experience while saving up to 70% of electricity use compared to conventional lighting systems.
- Advancing new research-based teaching methods and tools to better quantify lifecycle embodied and operational carbon emissions in buildings.
- Building a new professional education program that will bring low- and no- cost simulation tool capabilities to practitioners and firms regardless of size or scale.

We look forward to the next year with confidence that we can come together with evidence-based approaches to the challenges we face as we work toward shared prosperity and a healthier, more productive, and sustainable future.

With Best Regards,

Christopher Meek, FAIA, IES
Associate Professor
Director

Heather Burpee, M. Arch, EDAC
Research Associate 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:**



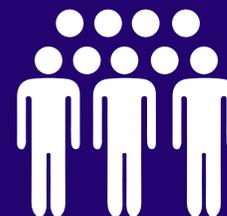
**128 PUBLISHED PAPERS
& JOURNAL ARTICLES,
AND 402 CONFERENCE
PRESENTATIONS**



**DIRECT PROJECT
INFLUENCE ON OVER
65,000,000 SQUARE
FEET OF COMMERCIAL
BUILDINGS**



**OVER 93,400 HOURS
OF PAID GRADUATE
STUDENT RESEARCH
ENGAGEMENT AND
MENTORSHIP**



**OVER 1,830 TOURS
SERVING OVER 35,000
PEOPLE VISITING THE
BULLITT CENTER**

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SPONSORSHIP

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.



OUTCOME I: APPLIED RESEARCH

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

Return on Investment of High Performance Design ¹

The UW IDL partnered with AIA National to develop a body of empirical research findings supporting the economic value case for high performance design. The outcome of this work can be found on the [AIA's website](#). This project was an outgrowth of the UW IDL's "Rosetta Stone: A Translational Tool for Research-Informed Practice."

Retrofit Accelerator Pilot & HUB

The UW IDL, with NEEA support, has increased its investment in developing energy efficiency and decarbonization for existing buildings in Seattle and Washington State. This includes several pilot projects with private owners and the Seattle Housing Authority (SHA) and in close partnership with the City of Seattle Office of Sustainability (OSE). We have also been part of a visioning team for a Retrofit Accelerator Hub. OSE has envisioned the Retrofit Accelerator Hub as most critically serving building owners with limited capacity, such as non-profits, class B/C office and affordable housing, and especially those that serve BIPOC and other vulnerable communities. With our current work with the Retrofit



Accelerator pilot, UW IDL is a key partner for such a concept. We see ourselves as part of the program development (technical approaches, costing, informing policy decisions, and direct building engagement where appropriate).

Non-Energy Benefits of VHE DOAS ²

The UW IDL partnered with NEEA to translate empirical research supporting the [benefits of Very High Efficiency Dedicated Outdoor Air Systems \(VHE DOAS\)](#). These include Indoor Air Quality, Thermal Comfort, Operational Cost, and Space Efficiency.

HVAC Education & Training Scan and Market Intelligence

The UW IDL partnered with NEEA and the MSU IDL to develop an HVAC Training Inventory where professional training programs in heating, cooling, and ventilation were documented and opportunities for efficiency interventions may be possible.

Improving Lighting User Interface Controls ³

The UW IDL partnered with the Lighting Design Lab, Washington State University,

and the Northwest Energy Efficiency Alliance to identify key barriers to network lighting control adoption. The research team developed a web-based wall-station user survey for commercial building occupants and operators in the office, education, and healthcare submarkets. Findings offer important insights for lighting designers and decision makers surrounding the preference for certain wall station types, both of which can impact the user experience and energy efficiency outcomes.

Rosetta Stone: A Translational Tool for Research-Informed Practice ⁴

Developed as a shared research endeavor for the UW IDL Partnership Initiative, this project bridges academic research and design practice with a translational tool that synthesizes research from various sources and is based on a range of high performance design elements and value cases. It presents evidence that practitioners can use to inform mindful design decisions. This year, [the UW IDL launched a web-tool](#) that houses its latest findings and will be expanded to house more content.



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.

Luminaire Level Lighting Controls (LLLC) Webinar Series

Chris Meek of the UW IDL moderated a national webinar on the potential of network lighting controls and Luminaire-Level Lighting Controls (LLLCs) to revolutionize the future of buildings and health. Along with big energy savings, these systems can be used in a wide variety of monitoring and response applications ranging from asset tracking and ventilation to security and safety. Participants included panelists from the University of Oregon, Evergreen Consulting and the Northwest Energy Efficiency Alliance (NEEA).

UW Graduate Research Studio on Embodied and Operational Carbon Emissions

Chris Meek and Teresa Moroseos with the UW IDL and new Assistant Professor Tomás Méndez Echenagucia developed and delivered a graduate Research Studio in the UW Department of Architecture to investigate the potential of mass-timber buildings to reduce both embodied and operational CO2 emissions with the help and computational structural design tools such as

“The UW IDL’s education & outreach activities bridge research and technical assistance efforts, providing timely access to knowledge and current practices to design and construction professionals, building owners, students, and the public.”

Grashopper iterative simulations through Energy Plus and custom Python scripts that calculate operational and embodied carbon for various early-stage building designs. The studio is part of ongoing research being developed by the involved faculty and includes the development of a parametric building performance simulation tool to co-optimize embodied and operational carbon emissions.

AIA Seattle Energy in Design Award

For the fifth year in a row, the UW IDL has partnered with the AIA Seattle and the Awards Committee to provide technical support for the Energy in Design (EiD) Award. This award requires energy performance data for all project submissions. This work aligns with the national-level development of the AIA Committee on the Environment (COTE) "Common App."

Total System Performance Ratio (TSPR) Professional Training ⁵

With support from NEEA, Heather Burpee developed and delivered a Washington State Energy Code Training program focused on a new code pathway in the 2018 Washington State Energy Code called Total System Performance Ratio, or TSPR. Participants included professionals from the utility and professional design community, among others. An asynchronous version of this training is available on the [Washington State Energy Code Education website](#).

Bullitt Center Tour Program ⁶

With the closure of in-person activities during COVID-19, we took our tour program virtual through targeted presentations and a public video. [Check out our virtual tour on our website here](#).



Image: Montage Health Ohana Center, Monterey, CA
Credit: NBBJ

OUTCOME III: TECHNICAL INFLUENCE ON DESIGN & CONSTRUCTION

The IDL's interdisciplinary faculty and students have influenced over 50 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.

Ranier Beach Clinic, Seattle WA (Mahlum)

Congratulations to the Mahlum team for earning recognition for this project with an AIA COTE Top Ten and AIA Academy of Architecture for Health (AAH) Design Awards. The project team referenced the work of the UW IDL's Partnership Initiative tool, "Rosetta Stone: A Translational Tool for Research-Informed Practice," guiding the application of biophilic design principles that are integral to the project's concept and success.

Bellevue 600 Highrise, Bellevue WA (NBBJ)

The UW IDL provided daylighting consulting for a new 30-story office tower building in Bellevue, WA designed by NBBJ. The IDL assessed various façade schemes for daylighting performance throughout the design process.

Ohana Center, Monterey, CA (NBBJ)

The UW IDL was the daylighting consultant for the Ohana project, a new mental health facility in Monterey, CA designed by NBBJ. The IDL performed daylighting assessments to advise the design team on maximizing illumination while minimizing undesirable glare in gathering and

“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.”

staff spaces. The IDL also studied effects of converging reflected sunlight adjacent to complex concave façade elements. This project was featured recently in [The New York Times](#).

NODE Eco Prefab ADU Energy Tool

The UW IDL worked with NODE, a pre-fab housing company, to develop a parametric tool for predesign energy analysis of residential homes. The intent of the tool is to optimize building geometries and assemblies to make net-zero energy homes viable in the housing market.

University of Washington's Behavioral Health Teaching Facility (UW & SRG Partnership)

The UW IDL, in collaboration with UW, SRG Partnership, and SOLARC Energy Group, provided technical assistance on the UW's new Behavioral Health Hospital, located at Northwest Hospital - a 150 bed teaching facility with behavioral health and other medical patient beds.

UW IDL's scope includes energy evaluation, health & energy-related goal setting, strategy development, energy modeling, Seattle Energy Code compliance, and utility incentive modeling.

Energy Research on Low Income Housing: Stuart Manor

The UW IDL partnered with the City of Seattle and Solarc Energy Group to develop a technical roadmap for energy retrofits for Stuart Manor, an existing, low-income public housing apartment. The team assessed energy savings and cost implications for different retrofit interventions, demonstrating a path for compliance with the WA Clean Buildings Act and the City of Seattle's emission reduction targets. The team will disseminate the findings from this project in a case study to inform building owners and other stakeholders the energy retrofit opportunities for similar building typologies.



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.

AIA Conference on Architecture, A'21 Panel Presentation

UW IDL's Heather Burpee led a panel discussion, with panelists Chris Meek (UW IDL), Monica Landreneau (HOK), and Amy Leedham (Atelier 10), "Building a Case for High-Performance Design." This panel was based on the research UW IDL conducted for AIA, "The ROI of High Performance Design," and the experience the panelists have in sharing the benefits of HP design with clients.

Architectural Research Centers Consortium: (ARCC) ⁷

IDL researcher Teresa Moroseos co-authored a paper with Danish researcher Toke Haunstrup Christensen (Aalborg University, Copenhagen) that describes energy use in three Danish Ecovillages. The paper assesses the built environment and social norms of Danish Ecovillages to understand the reduction in consumption compared with similar Danish Homes.

ASHRAE Annual Conference

Heather Burpee co-presented at the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) 2020 Annual conference with

Travis English of Kaiser Permanente: "Zero-Net Energy Hospitals: Is this a Myth? Toward Net-Zero Energy Hospital Buildings; an the 'Impossible;' Become Possible."

Illuminating Engineering Society (IES) National Conference, New Orleans

Chris Meek of the UW IDL with Armando Berdiel and Shaun Darragh from the Lighting Design Lab, and Julia Day with Washington State University presented "Lighting Con troll User Interfaces: The Good, The Bad, and Where We Might Go From Here" at the Illuminating Engineering Society (IES) national conference and Armando. It covered results from a research project to query end users on their lighting wall station experiences and preferences.

ACEEE Presentations & Publications^{8,9}

Christopher Meek and Andrew Gustin, with Sandra Mallory and Nicole Ballinger with the City of Seattle Office of Sustainability and Environment (OSE) published a paper entitled "Seattle Building Tune Up Accelerator - Deep Energy Retrofit Path" at the 2020 ACEEE Buildings Summer Study. This paper describes the implementation methods and results of a

U.S. Department of Energy funded building-owner engagement and technical assistance process aimed at accelerating voluntary deep energy retrofits.

UW IDL's Heather Burpee co-authored a second ACEEE paper on Total System Performance Ratio (TSPR) with co-authors Bing Liu, Neil Grigsby, Supriya Goel, Michael Rosenberg, and Duane Jonlin.

GoGreen Seattle Conference

Heather Burpee led a panel discussion on Best Practices for Decarbonizing Buildings with panel including Brad Liljequist (McKinstry), Brett Philips (Unico), Duane Jonlin (City of Seattle), and David Heslam (Earth Advantage).

Women In Healthcare Webinar

Heather Burpee spoke with Travis English (Kaiser) and Rick Maniktala (BranchPattern) in the Women in Healthcare's webinar series, "Achieving Net Zero Energy Goals in Hospitals Post COVID-19," where they explored how hospitals use energy, how to significantly reduce that energy use on the path to decarbonization, and the implications of ventilation on energy and indoor air quality.

UW IDL STAFF

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PUBLICATION CITATIONS

- 1- "ROI of High Performance Design." The American Institute of Architects. Accessed September 10, 2021. <https://www.aia.org/resources/6409378-roi-of-high-performance-design>.
- 2- "Literature Review of Non-Energy Benefits Associated with Dedicated..." BetterBricks. Accessed September 10, 2021. <https://betterbricks.com/resources/literature-review-of-non-energy-benefits-associated-with-dedicated-outside-air-systems-doas>.
- 3- Wilson, J. (Lighting Design Lab), Meek, C., Day, J. (Washington State University), Berdiel, A. (Lighting Design Lab), Darragh, S. (Lighting Design Lab), Burpee, H. (UW Architecture), Ruiz, S. (Washington State University), Baltimore, A. (UW M. Arch Candidate), "The Networked Lighting Controls (NLC) User-Experience Survey and Findings Report." Published by Lighting Design Lab, a Division of Seattle City Light, 15 December 2020.
- 4- "Rosetta Stone." Rosetta Stone: A Translational Tool for Research-Informed Practice. University of Washington Center for Integrated Design, October 14, 2020. <https://rosetta.be.uw.edu/>.
- 5- "TSPR Training Videos." Online training. Accessed September 10, 2021. https://waenergycodes.com/online_training.
- 6- Bullitt Center Video: <http://idlseattle.com/educational-outreach/tours/>
- 7- Moroseos, Teresa, Christensen, Toke Haunstrup. (2021). Can Danish Ecovillages demonstrate a path to reduce domestic energy use?. ARCC Conference Repository, 1(1).
- 8- Meek, C., Ballinger, N. (City of Seattle), Mallory, S. (City of Seattle), "Tune-Up Accelerator: Deep Energy Retrofit Path," Proceedings of the American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. Asilomar CA, August 2020.
- 9- Liu, B. (NEEA), Grigsby, N. (NEEA), Goel, S. (PNNL), Rosenberg, M. (PNNL), Burpee, H., Jonlin, D. (City of Seattle). "A New Goldmine? Achieving HVAC Energy Efficiency Through a System Metric," Proceedings of the American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. Asilomar CA, August 2020.

INSTITUTIONAL PARTNERS

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