INTEGRATED DESIGN LAB

Annual Report 2023–2024

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Cover Image: Montage Health Ohana Center for Child and Adolescent Behavioral Health. Photo Credit: © Ty Cole/OTTO
The UW IDL provided daylighting technical assistance on this project for NBBJ.

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 over the past several years. A highlight has been the ongoing diversification of our research and areas of technical expertise. Through collaboration with our colleagues within the University, external organizations, our partner firms, and our funders we have expanded the lab's horizons and impact.

Building upon a decade of healthcare efficiency innovation, the IDL authored the ASHRAE/ASHE Guide to Decarbonizing Hospital Buildings. Through a partnership with the Urban Land Institute and Kohn Pederson Fox Architects (KPF), the IDL and Associate Professor Tomas Mendez Echenagucia developed new approaches for evaluating carbon for facades in new contexts. In partnership with Professor Kate Simonen and the UW Lifecycle Lab, we have contributed to new open-source parametric life cycle assessment (POD LCA) methods for buildings and products. We have established new relationships with South Seattle College and Northwest Indian College to help train the next generation of building energy assessors and operators. We have joined with new UW faculty member, Narjes Abbasabadi, on a Population Health Initiative seed grant to use digital twins for building retrofits and healthy indoor air. These projects and collaborations offer us exciting new areas of impact, while continuing our core work in energy efficiency with our long-time partners.

We have opened a new chapter in the life of IDL with our move to the Roosevelt Commons building in the University District, closer to our home bases of Architecture and Gould Hall (and next to the U-District Light Rail Station if you want to visit us!). We retain our long-term commitment to the Bullitt Center, continuing to operate the tour program and to learn from the building's exceptional performance. We also celebrate Heather Burpee's promotion to full Research Professor within the Department of Architecture – the highest rank in the professoriate.

As always, we would like to take a moment to thank the organizations that make our work possible including the Northwest Energy Efficiency Alliance (NEEA), BetterBricks, our Puget Sound regional utility partners, The U.S. Dept. of Energy (DOE), the U.S. Advanced Research Projects Agency-Energy (ARPA-E), the American Society of Heating Refrigerating and Engineers (ASHRAE), the Illuminating Engineering Society (IESNA), the AEC teams that bring us into their process, and our Advisory Board, which is helping us expand beyond our traditional boundaries. We look forward to a bright future of expanded collaboration, innovation, and an ever-better built environment for our region.

With Best Regards,

Christopher Meek
FAIA, IES
Professor
Director

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

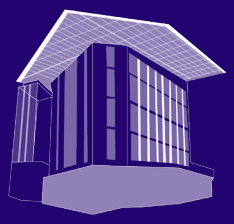
IDL at a GLANCE

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:**

170 PAPERS PUBLISHED & JOURNAL ARTICLES, AND **480 CONFERENCE PRESENTATIONS**

DIRECT PROJECT INFLUENCE ON OVER **69,250,000 SQUARE FEET** OF COMMERCIAL BUILDINGS

OVER **96,900 HOURS** OF PAID GRADUATE STUDENT RESEARCH ENGAGEMENT AND **MENTORSHIP**

OVER **2,130 TOURS** SERVING OVER **40,000 PEOPLE VISITING** THE BULLITT CENTER

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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.

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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.

IDL Members Awarded A. Eugene Kohn Fellowship

Prof. Christopher Meek, Research Engineer Teresa Moroseos, and UW Associate Prof. Tomás Mendez Echenagucia were selected for an A. Eugene Kohn/KPF Fellowship which was recently established through a gift to the Urban Land Institute's (ULI) Randall Lewis Center for Sustainability in Real Estate. The fellowship promotes innovation in sustainable design in the commercial real-estate industry and has created opportunities for UW IDL to collaborate with the New York office of Kohn Pederson Fox (KPF) and global real estate leaders to advance the area of low-carbon building design and operations.

Luminaire Level Lighting Controls Market Intelligence

The UW IDL is developing case studies and gathering market knowledge for the implementation of Luminaire Level Lighting Controls (LLLCs) with an emphasis on operations, commissioning, and innovative design approaches through interviews with leading market actors in the lighting controls and building operations industry. Documented sites include an office building, an academic building, and a new landmark library in addition to a number of prospective healthcare designs. This market intelligence will help inform the Northwest Energy Efficiency Alliance's LLLC initiative.

NEEA Webinar

Heather Burpee led a webinar sharing recent insights and research on Energy Code, Building Performance Standards, Energy Efficient Technologies, and Utility Incentives in collaboration with NEEA, Mike Hatten and Eric Knowles of Solarc Energy Group, and Taylor Pitts from PSE.

ARPA-E Parametric Open Data LCA [1]

The UW IDL continued 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 (PHI)

IDL Prof. Christopher Meek is part of a team led by UW Assistant Professor Narjes Abbasabadi that was awarded a Population Health Initiative (PHI) Climate Change Pilot Grant that includes faculty from UW Architecture, Construction Management, Electrical and Computer Engineering and faculty from the Southern Illinois University Architecture Program. The project, DecarbCityTwin: A Platform for Equitable Decarbonization of the Built Environment, is developing a digital platform to facilitate decarbonization by addressing interconnected challenges related to energy and health while considering exposure to ambient air pollution.

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.

Pacific Northwest Building Training Assessment Center (PNW BTAC)

The UW IDL was awarded a grant through the Bipartisan Infrastructure Law and the US Department of Energy in their Industrial Assessment Center (IAC) and Building Training and Assessment Centers (BTAC) Program to establish a new Pacific Northwest BTAC. It aims to fill two gaps in building performance improvements: a trained workforce, and access to benchmarking and strategic roadmaps for energy efficiency and decarbonization, especially in disadvantaged communities. The PNW BTAC will leverage partnerships with South Seattle College, Northwest Indian College, Pacific Northwest National Lab (PNNL), and Washington State Department of Commerce. The PNW BTAC will provide services to Washington, Oregon, and California.

AIA Seattle Energy in Design Award

For the ninth year, the UW IDL has partnered with the AIA Seattle and the Honor Committee to provide technical support for the Energy in Design (EiD) Award. This award requires submitters to share energy performance data for all projects. The work aligns with the national-level development of the AIA Committee on the Environment (COTE) "Common App" and provides the design community with valuable feedback on its progress towards meeting the 2030 Challenge while furthering energy efficient design in the region.

Bullitt Center Tour Program [2]

We continued our in-person and virtual tour program this year offering public and private tours. We continue to have robust demand from visitors from around the world. Book a tour or check out our virtual tour on our website!

Energy Modeling for Architects

Teresa Moroseos led the second iteration of ARCH 598: Energy Modeling for Architects, a new, parametric building energy modeling course offered by the UW's Department of Architecture in Winter 2024. Students in the course were introduced to the fundamentals of setting up and running building energy models as part of the design process. Graduate architecture students were tasked with providing a technical roadmap for their design projects to maximize energy performance and climate responsive design opportunities using design components including building envelope, shading devices, massing and glazing, internal loads, thermal setpoints, and basic HVAC systems.

NEEA Very High Efficiency DOAS

Heather Burpee has provided education and outreach to design firms to share NEEA's Very High Efficiency DOAS technology and program. This systems-based solution provides high air quality while reducing energy consumption, increasing overall indoor environmental quality for building occupants.

Building Healthy Podcast [3]

Heather Burpee was interviewed by Oxygen8 as part of their "Building Healthy" series. The podcast episode focuses on designing decoupled systems and the application of systems at the Bullitt Center. Additional video content is available on the podcast website.

Nick McDaniel, Architect with NBBJ, inspects a section of unitized curtain wall at the new Bellevue 600 Tower in Bellevue, WA. Photo Credit: Christopher Meek/UW IDL

OUTCOME III: TECHNICAL INFLUENCE ON DESIGN & CONSTRUCTION

> "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."

UW's Center for Behavioral Health and Learning -- SRG + CannonDesign

The UW IDL, in collaboration with SRG + CannonDesign and SOLARC Energy Group, provided energy-focused technical assistance on the UW's Center for Behavioral Health and Learning, which opened its doors in May 2024. It is a 150 bed facility on the UWMC-Northwest campus and is modeled to perform better than Seattle Energy Code, one of the most aggressive energy codes in the nation, leading as an exemplar in hospital energy efficiency. UW IDL's scope includes energy evaluation, strategy development, energy modeling, and LEED evaluation and compliance.

Montage Health Ohana Center for Child and Adolescent Behavioral Health -- NBBJ

UW IDL partnered with NBBJ's Los Angeles, CA office to provide daylighting, glare control, and solar reflection analysis for the Ohana Center for Child and Adolescent Behavioral Health in Monterey, CA. Created to provide a facility to support children suffering from mental health issues, the 55,600 ft² building provides an inclusive, healing environment for pediatric patients, families, and caregivers based on current neuroscience research. Constructed with cross-laminated timber (CLT), the building, according to NBBJ, "accentuates the site's natural landscape, emphasizes treatment through medicine and the building itself, and serves as a prototype for future behavioral health facilities." The building has been widely recognized including articles in the New York Times, Bloomberg, and the Wall Street Journal, with an emphasis on how evidence-based design and daylight effects can support heath and healing.

Building Stock Retrofits -- Seattle Housing Authority

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

Aki Kurose Middle School Renovation and Expansion -- Integrus

In partnership with Integrus Architecture, Hargis Engineers, and Seattle Public Schools, the IDL is providing early stage building performance modeling including envelope thermal analysis, internal comfort and daylighting/glare simulation for an existing 1950's-era building renovation and expansion of Aki Kurose Middle School. This iconic Rainier Valley school aims to be zero-carbon, targeting an energy use intensity (EUI) of 18 kBTU/ft²-yr while positioning it to meet the academic needs of students for the next century.

Tukwila Public Works Daylighting Design -- Miller Hayashi

In partnership with Miller Hayashi Architects and Tukwila Public Works, IDL Research Engineer Teresa Moroseos and student Sara Moghadasipour provided daylighting design support for a new, high-performance public building. Tukwila Public Works Maintenance and Engineering Building is a new approximately 35,000 ft² three-story building and a Tool Storage/Drive-Through Covered Loading facility to support Tukwila Public Works. IDL provided daylighting design guidance and shading system analysis to ensure comfortable and high-quality views out to the Duwamish River from this waterfront site.

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.”

ULI Carbon Sweet Spot [4]

The UW IDL led the development of a new co-authored a report with the Urban Land Institute (ULI) and the New York office of Kohn Pederson Fox Architects, "The Carbon Sweet Spot: Design Tradeoffs for Embodied and Operational Carbon in New Buildings." With increasing emphasis on decarbonization, building owners and developers face myriad choices as they try to balance cost and value and meet carbon emissions reduction goals. Based on the results of three project analyses and discussions with leading developers and industry experts, this report highlights the critical design decisions that impact the building facade and offers frameworks for considering total carbon emissions over the life of a building investment. Ultimately, it suggests a process by which decision-makers can identify the whole life-cycle carbon “sweet spots” for their buildings.

EDRA Exterior Blinds Presentation [5]

IDL Research Engineer, Teresa Moroseos, presented "Impact of Office Building Exterior Venetian Blinds on Energy and Daylighting Performance During Current and Future Weather in Seven US Cities" at The Environmental Design Research Association (EDRA) 55th annual national conference in Portland, OR. Based on an IDL technical report completed for Draper, Inc., this research and analysis outlined the impact of automated exterior venetian blinds that lower when direct sunlight is present to minimize glare and heat gains, and tilt to maximize views to the outside, demonstrating peak load reduction (mechanical system downsizing), glare control, thermal comfort, and daylight performance.

Smart Buildings Exchange (SBX) [6]

Christopher Meek led a panel discussion on IAQ at the 2024 Smart Buildings Exchange. The panel featured Prof. Vivian Loftness (Carnegie Mellon University), Seema Bhangar (US Green Building Council), and Dr. Stephanie Taylor (Building-s4Health, Inc.). The discussion highlighted the importance of healthy indoor environments, creating and maintaining indoor air quality with evidence from the field.

Decarbonize Hospitals Guide [7]

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).

Decarbonize Guide Conferences [8]

Heather Burpee spoke at several national conferences sharing the outcome of the recently published “Decarbonization of Hospital Buildings Design Guide” including the American Society for Healthcare Engineering 2024 International Summit & Exhibition on Health Facility Planning, Design & Construction (ASHE PDC), Environmental Design Research Association (EDRA), and ASHE’s Health Care Facilities Innovation Conference.

IBPSA Carbon Assessment [9]

Teresa Moroseos presented current work related to assessing operational and embodied carbon of façade design at the International Building Performance Simulation Association’s (IBPSA) Seattle Chapter’s July meeting. She outlined parametric methodologies used to calculate embodied and operational carbon, along with data sources, model assumptions, and key findings of her work to date.

UW IDL STAFF

SENIOR STAFF

Christopher Meek, FAIA, IES
Professor and Director

Heather Burpee, Assoc. AIA, EDAC
Research Professor, Co-Director

Teresa Moroseos, AIA
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STUDENTS

Sara Moghadasipour
2-Year M. Arch.

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3-Year M. Arch.

PUBLICATION CITATIONS

1- https://carbonleadershipforum.org/podlca-project/

2- https://idl.be.uw.edu/educational-outreach/tours/

3- Oxygen8's Building Healthy Podcast, "Designing Decoupled Systems with Heather Burpee." April 2024. Web Link.

4- Meek, C, Moroseos, T. (UW Architecture), Méndez Echenagucia, T. (UW Architecture), Schantz, M. (ULI), Williams-Eynon, A., "The Carbon Sweet Spot: Design Tradeoffs for Embodied and Operational Carbon in New Buildings," Publication of the Urban Land Institute Randal Lewis Center for Sustainability in Real Estate, May 2024. Web Link.

5- Environmental Design and Research Association (EDRA), EDRA55. "Impact of Office Building Exterior Venetian Blinds on Energy and Daylighting Performance during Current and Future Weather in Seven US Cities." Portland, OR. June 2024. Web Link.

6- SBX Smart Buildings Exchange, "Indoor Environmental Quality: Results from the Field" with Bhangar, Seema (U.S. Green Building Council), Vivian Loftness (Carnegie Mellon University), and Dr. Stephanie Taylor (Building4Health). Invited Panel Discussion, Seattle, WA, August 2023.

7- 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.

8a- American Society for Healthcare Engineering 2023 International Summit & Exhibition on Health Facility Planning, Design & Construction (ASHE PDC): "ASHE/ASHRAE Decarbonization Design Guide for Hospitals." Presentation with Kara Brooks (ASHE), Walt Vernon (Mazzetti), and Mara Baum (DIALOG). National Healthcare Conference. San Diego, CA. March 2023.

8b- Environmental Design and Research Association (EDRA), EDRA55. "Decarbonization of Healthcare Buildings" Panel Presentation & Discussion with Mara Baum (DIALOG). Portland, OR. June 2024. Web Link.

8c- American Society for Healthcare Engineering 2024 Health Care Facilities Innovation Conference, "Design Guide for Decarbonized Healthcare." Presentation with Walt Vernon (Mazzetti) and Mara Baum (DIALOG). National Healthcare Conference. Anaheim, CA. July 2024. Web Link.

9- International Building Performance Simulation Association Seattle Chapter Meeting, "Tradeoffs between Embodied and Operational Carbon in Building Envelope Design". Invited Presentation, Seattle, WA, July 2024.

INSTITUTIONAL PARTNERS

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