

# **INTEGRATED DESIGN LAB**

# Annual Report 2021–2022

UW Center for Integrated Design 1501 E. Madison Street, Suite 200 Seattle, WA 98122

206-616-6566 https://idl.be.uw.edu/

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### LETTER FROM THE DIRECTORS

#### Dear Friends and Supporters of the UW IDL,

As we share our latest annual report with you, we reflect on the past year with gratitude. A highlight was our engagement with you – our firm partners, funders, utilities, clients, students, and other collaborators that provide us our deepest inspiration and meaning to our work. As the year turned from 2021 to 2022, we happily emerged back into the world for more in-person engagements, including conferences, working from the office several days of the week, and attending long-postponed community events and celebrations.

We would like to take a moment to thank those individuals and organizations that make our work possible including the Northwest Energy Efficiency Alliance (NEEA), our Puget Sound-regional utility partners, the Seattle Housing Authority (SHA), the City of Seattle, the American Institute of Architects, 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.

We completed our fifth year of engagement with our Partnership Initiative, collaborating with local firms to connect like-minded practitioners, bridge academic research and practice, and build shared research. The collective voice of our Strategic Advisory Board has provided an unparalleled sounding board for our organization. Outgrowths of the initiative inform our teaching, outreach, and research missions. Partners at each firm mentored students in Heather's "Topics in High

Performance Buildings" seminar this year, and firms provided sites for tours and visits with UW Architecture's Sustainable Design Case Studies course. Partner firms participated in a panel session at the AIA/ACSA's Intersections Research Conference discussing "Partnerships with Practice and Academia." The collective research that we are undertaking as a group has seen great success, with the American Association of Architects (AIA) providing additional support and engagement to expand the scope of the project.

In the coming academic year, we are excited to re-double our effort to engage with the people and communities that inspire our work. Often when presenting the Lab's work at conferences or in meetings away from our home in the Pacific Northwest, people remark on the innovative work that is happening in our region. All of this is possible through the support of the people that champion high-performance design in the Pacific Northwest. Our academic – practitioner partnerships set us apart from other peer institutions. We deeply value the trust relationships that we have developed over the last two decades, which provides the foundation for such collaborations.

With Best Regards,

Christopher Meek, FAIA, IES

Professor Director **Heather Burpee, M. Arch, EDAC** Research Associate Professor Director, Education and Outreach

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# 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:** 



**144 PAPERS** PUBLISHED & JOURNAL ARTICLES, AND **437 CONFERENCE PRESENTATIONS** 



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



OVER **94,830 HOURS** OF PAID GRADUATE STUDENT RESEARCH ENGAGEMENT AND MENTORSHIP



OVER **1,900 TOURS**SERVING OVER **36,500 PEOPLE VISITING** THE
BULLITT CENTER

### CONTACT

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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.

## 

#### **Embodied & Operational Carbon Tool**

The UW IDL, in collaboration with UW Architecture Professor Tomás Méndez Echenagucia, developed a web-based tool that allows users to assess the embodied and operational carbon tradeoffs of various building envelope conditions, such as: cladding material, amount and type of insulation, extent of glazing, type of glazing, etc. The tool also allows users to see how the tradeoffs change based on the climate, the carbon intensity of the project's location, and rate of de-carbonization of the electricity grid.

# **Building Retrofit Strategies for Low Income Multi-Family Buildings**

The UW IDL has been working with the Seattle Housing Authority on developing retrofit strategies that reduce energy use and improve indoor air quality and thermal comfort for the housing provider's existing building stock. The UW IDL is also developing a tool that leverages parametric energy modeling that allows the housing provider to assess energy savings and cost impacts of various retrofit strategies.

Translating new technologies and approaches to practice helps build capabilities of project teams, industry partners, and public agencies to address real-life challenges and raise the bar for high-performance design.

# Luminaire Level Lighting Controls Case Studies

The UW IDL developed three case studies of groundbreaking implementation of Luminaire Level Lighting Controls (LLLCs) for the Northwest Energy Efficiency Alliance. Projects included the Madrona Elementary School (Mahlum Architects), UW Founder's Hall (LMN Architects), and Star Lake Elementary/Totem Middle School (McGranahan Architects). The case studies highlighted learning and synthesis of best practices for individually controlled light fixtures in three key areas: design, construction, and operations.

#### **Very High Efficiency DOAS** <sup>1</sup>

The UW IDL partnered with NEEA to author a Very High Efficiency Dedicated Outdoor Air Systems (DOAS) Design Guide intended primarily for design engineers and contractors. The guide includes equipment and design requirements and best practices for optimal performance with design considerations, benefits, and applications.

#### Return on Investment of High Performance Design - Phase II<sup>2</sup>

The UW IDL partnered with the American Institute of Architects (AIA) to develop a resource of empirical research findings supporting the economic value case for high performance design – in this phase related to Hazard Mitigation, Climate Change Adaptation, and Designing for Reduced Carbon. 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" and provides practitioners research-based evidence and knowledge directly applicable to these important topics.



### **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

Chris Meek of the UW IDL moderated a series of webinars in regional and national venues on the potential of network lighting controls and Luminaire-Level Lighting Controls (LLLCs) to revolutionize the future of buildings and health. Along with substantial 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).

#### **CITY FOOD 2.0 Research Studio**

IDL Professor Chris Meek co-taught a research studio and seminar in the Department of Architecture at UW with Assoc. Professor Gundula Proksch aimed at speculative implementation of biologically-based and circular city principles spanning three distinct climatological and urban contexts: Tucson, AZ, Chicago, IL,

and Seattle, WA. It explored the Food-Water-Energy Nexus at multiple scales along with resource-efficient food production systems such as aquaponics, and their integration with other energy intensive processes, can be an effective sustainable direction for building integration and innovative design.

#### **AIA Seattle Energy in Design Award**

For the sixth year in a row, the UW IDL has partnered with the AIA Seattle and the Honor 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" and provides the design community with valuable feedback on its progress toward meeting the 2030 Challenge.

#### **UW CBE ARC Mentorship**

As part of the UW College of Built Environment's Applied Research Consortium, Heather mentored two students, Alondra

Garcia who researched Outdoor Learning Environments with DLR Group, and Gabe Rivas who is currently researching Effective Spaces for Respite in the Clinical Workplace with NBBJ.

#### **Bullitt Center Tour Program 3**

In 2022 we re-opened our in-person tour program offering public and private tours. We continue to share our tour program virtually through targeted presentations and a public video. Book a tour or check out our virtual tour on our website.

#### **Partnership Energy Workshop**

The UW IDL hosted a 5-part workshop series that introduced energy simulation methods to architects and designers with little to no energy simulation experience. The workshop series was a pilot program sponsored by Puget Sound Energy and was offered to the UW IDL's partnership firms. During the workshop, participants learned the fundamentals of creating and running energy models using Rhino and open source tools. The UW IDL plans to offer the workshop series to a wider audience in the upcoming year.



# OUTCOME III: TECHNICAL INFLUENCE ON DESIGN & CONSTRUCTION

The IDL's interdisciplinary faculty and students have influenced over 65 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.

#### St. Michael's Medical Center Silverdale, WA -- NBBJ

The UW IDL, in collaboration with NBBJ and SOLARC Energy Group, provided technical assistance on St. Michael's Medical Center, a new 144 bed (550,000 ft2) hospital in Silverdale, Washington, which opened in December 2020. With a stated goal of 135 kBtu/ft2 -yr in the RFP, its current energy performance is estimated to be 98 kBtu/ft2 -yr, saving over 5M kWh each year, and making this hospital one of the most energy efficient designs in the US today. The project has been approved for a Puget Sound Energy conservation rebate of over \$1,500,000. The UW IDL's scope included energy evaluation, goal setting, strategy development, energy modeling, WSEC compliance, and utility incentive modeling.

#### University of Washington's Behavioral Health Teaching Facility Seattle, WA -- 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 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.

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.

#### HSEB Campus Sustainability Seattle, WA -- UW & The Miller Hull Partnership

An interdisciplinary team led by graduate students Amber Wu, Brian (Ben-Hsin) Dow, and Connor Beck with support from the UW Campus Sustainability Fund (CSF) and the IDL, along with Julie Knorr of UW Capital Projects, designers from the Miller Hull Partnership, PAE Engineering and Lewis Builds, have provided an incentive for a significant installation of dynamic electrochromic self-tinting glass at the new UW Health Science Education Building (HSEB). Sponsored

by the UW Campus Sustainability Fund, the graduate students will now work to improve awareness of this new technology and incorporate key concepts in coursework offered the Department of Architecture

#### J. Burton Vasche Library Turlock, CA -- EHDD

The UW IDL performed a glare assessment for the newly renovated J. Burton Vasche Library on the Stanislaus State University campus in Turlock, California. A clerestory adjacent to the circulation desk was determined to be a potential source of glare for library staff, and the UW IDL worked with the design team to identify mitigation strategies, including strategically locating translucent glass in the clerestory and placing signage in a manner that shades and prevents glare from reaching stationary workstations.



### **SELECTED PRESENTATIONS & PUBLICATIONS**

#### **Decarbonizing Healthcare** 4

Heather Burpee moderated a panel session with Travis English (Kaiser Permanente), Robyn Rothman, (Healthcare Without Harm), and Amber Wirth (HKS), "Can Healthcare Reduce Its Carbon Footprint?" at the Paul Torrens Health Forum at UCLA's Fielding School of Public Health and Center for Healthcare Management.

# Energy in Design Award: Five Year Retrospective Analysis <sup>5</sup>

Christopher Meek, Heather Burpee, Teresa Moroseos, and Corey Squire with Dept. of Sustainability & Bora Architecture & Interiors published a paper and poster entitled "Energy in Design: A Case Study Toward Performance-Based Recognition in Architectural Design Awards" at the 2022 American Council for an Energy Efficient Economy (ACEEE) Buildings Summer Study. This paper describes AIA Seattle's Energy in Design Awards after six years of implementation, resulting in a culture and report card of energy performance in the context of design awards.

# Computational Carbon Research Studio Collaboration <sup>6</sup>

Teresa Moroseos and Chris Meek of the UW IDL, along with UW Architecture Professor Tomás Méndez Echenagucia, presented their experience teaching a UW Architecture graduate design studio at the 2022 annual conference of the Society of Building Science Educators. The talk focused on the development of the studio premise of investigating the tradeoffs between embodied and op-

erational carbon in building design, and how the students informed their design decisions with computational tools.

## Prioritizing Health in Design Education 7

Heather Burpee spoke at the Environmental Design and Research Association (EDRA), EDRA53. "Preparing the Next Generation in Design – How Can Health be Integrated and Prioritized in Design Education?" on a panel with Herminia Machry (SimTigrate Design Lab - Georgia Institute of Technology), David Allison, (Clemson University), Keith Diaz Moore, (University of Utah), Naomi A. Sachs, (University of Maryland), Dr. Neda Norouzi, (UTSA), and Craig Zimring (Georgia Institute of Technology).

## Partnerships with Academia and Practice <sup>8</sup>

UW IDL's Heather Burpee and Chris Meek moderated a Special Focus Session at the AIA/ACSA Intersections Research Conference, "Healthy Communities: Partnerships with Practice and Academia, transforming how we think about healthy buildings and communities" with panelists Anne Schopf (Mahlum), Vikram Sami (Olson Kundig), Kirsten Dotson (Miller Hull Partnership), Myer Herrell (Weber Thompson), and Pia Weston (SHKS).

## Rosetta Stone: A Translational Tool for Research-Informed Practice 9

Developed as a shared research endeavor of 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, we added content related to electric lighting and views to nature. The web-tool houses our latest findings and will continues to be expanded to house more content.

## Mitigation Strategies for Excessive Heat Events <sup>10</sup>

Excessive heat events are increasing in intensity and duration in the Pacific Northwest. The UW IDL presented and published a paper at the Architectural Research Center Consortium's (ARCC) Annual 2022 Conference that investigated the impact of projected weather conditions on interior temperatures of a typical apartment unit in Seattle. The paper also investigated the impact of passive design strategies for improving comfort during excessive heat events.

## Book Review: Visual Delight in Architecture <sup>11</sup>

IDL Professor, Chris Meek was invited to review Lisa Heschong's excellent new book Visual Delight in Architecture: Daylight, Vision and View for the journal Buildings and Cities. Her book blends peer-reviewed research with an accessible style, detailed personal anecdotes, and informed-speculation to tie together expansive themes of science, architecture, medicine, and the experience of being in buildings.



### **SELECTED RECOGNITION**

The UW IDL is involved in many projects through our applied research, education and outreach, and technical influence on design and construction . We are thrilled to share several projects and people that have been recognized throughout the year. The outcome of a great project or accomplishment is always a collective effort, and we congratulate those teams and individuals for these well-deserved achievements.

#### Architectural Research Centers Consortium (ARCC) Award

Teresa Moroseos of the UW IDL, with Heather Burpee and Chris Meek, were awarded the Architectural Research Center's Consortium 2022 Research Incentive Award to support their research on mitigation strategies for excessive heat events for low-income multi-family housing in Seattle. This award is only granted to two projects annually to faculty members of ARCC member schools. The UW IDL is currently working with a low-income housing provider on work related to this research project.

#### Louisiana Children's Museum, New Orleans, LA -- Mithun

Congratulations to the Mithun team for earning recognition for this project with a 2022 AIA COTE Top Ten Awards. IDL supported Mithun as a daylighting consultant for the project. The experience of light was core to the project: "The Reggio Emilia child development philosophy—a child-centered approach that emphasizes multisensory nature play—guided the design of experiential and haptic elements that cast changing shadows and inspire

Architectural awards are a critical and longstanding part of design culture -- they reveal the values of the design professions, confer legitimacy on projects and practitioners, and set future directions for industry.

interactive rainwater engagement while providing energy reductions and stormwater utility." The COTE Top-10 jury noted that "The design does everything: being a modern vernacular form that is spatially rich and meets the triple bottom line of social well-being, environmental health, and a just economy."

#### Lick-Wilmerding High School, San Francisco, CA -- EHDD

Congratulations to the EHDD team for being recognized with a 2022 AIA COTE Top Ten Award for Lick-Wilmerding High School Historic Renovation and Expansion. IDL supported EHDD as a daylighting consultant for the project. Jury Comment: "This project beautifully demonstrates how you can restore and renovate existing buildings, taking existing structures and flipping them to be extroverted and embracing street culture. Lick-Wilmerding shows how historic buildings can be net zero; [these two

things are] not mutually exclusive.

#### **UW Husky Green Award**

Lab Director Chris Meek was recognized with a 2021 Husky Green Award. The Husky Green Awards recognize individuals and groups across all University of Washington campuses who lead the way for sustainability at the University of Washington. They are given to students, faculty and staff from the Seattle, Bothell and Tacoma campuses who show initiative, leadership and dedication.

# Fellow of American Institute of Architects

Lab Director Chris Meek was elevated to Fellowship in the American Institute of Architects in 2021. Fellowship is bestowed on architects who have made significant contributions to the profession and society and who exemplify architectural excellence. Only 3% of AIA members have this distinction.

### **UWIDL STAFF**

#### **SENIOR STAFF**

Christopher Meek, FAIA, IES

Associate Professor and Director

Heather Burpee, M. Arch, EDAC

Research Associate Professor/Director, Education and Outreach

Teresa Moroseos, M. Arch

Postgraduate Research Analyst

**Deborah Sigler** 

Program Coordinator for Tours and Outreach

#### **STUDENTS**

Colin Veilleux 3-Year M. Arch. **Skyler Johnson** 2-Year M. Arch.

**Amber Wu** MS Design Technology

**Andrew Baltimore** 3-Year M. Arch.

**Connor Beck** 3-Year M. Arch.

**Judy Bowes** BE PhD Candidate

**Lindsay Johnson** 2-Year M. Arch.

**Preston Pape**MS Design Technology

### **PUBLICATION CITATIONS**

- **1-** "Very High Efficiency Dedicated Outdoor Air Systems Design Guide." The Northwest Energy Efficiency Alliance. Publication online forthcoming.
- 2- "ROI of High Performance Design." The American Institute of Architects. Accessed September 1, 2022. https://www.aia.org/resources/6409378-roi-of-high-performance-design
- 3- Bullitt Center Video: http://idlseattle.com/educational-outreach/tours/
- 4- The Paul Torrens Health Forum at UCLA's Fielding School of Public Health and Center for Healthcare Management. Can Healthcare Reduce Its Carbon Footprint? Moderated by H. Burpee with panelists T. English (Kaiser Permanente), R. Rothman, (Healthcare Without Harm), and A. Wirth (HKS). Virtual Presentation.
- **5-** Meek, C. (UW Architecture) Burpee, H., Moroseos, T. (UW Architecture), Squire, C. (Bora Architecture). American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. "Energy in Design: A Case Study Toward Performance-Based Recognition in Architectural Design Awards." Proceedings of the American Council for an Energy Efficient Economy (ACEEE) Summer Study on Energy Efficiency in Buildings. Asilomar CA. August 2022
- **6** Society of Building Science Educators (SBSE) Annual Retreat "The Computational Research Studio," with Mendez-Echenagucia, T. and Moroseos, T. (UW Architecture), Seattle, WA, 21 July 2022.
- 7- Environmental Design and Research Association (EDRA), EDRA53. "Preparing the Next Generation in Design How Can Health be Integrated and Prioritized in Design Education?" Panel Presentation & Discussion with Herminia Machry (SimTigrate Design Lab Georgia Institute of Technology), David Allison, (Clemson University), Keith Diaz Moore, (University of Utah), Naomi A. Sachs, (University of Maryland), Dr. Neda Norouzi, (UTSA), and Craig Zimring (Georgia Institute of Technology). Greenville, SC. June 2, 2022
- **8-** American Institute of Architects (AIA) and the Association of Collegiate Schools of Architecture (ASCA) Intersections Research Conference. "Healthy Communities Special Focus Session: Partnerships with Practice and Academia, transforming how we think about healthy buildings and communities." Chaired by H. Burpee & C. Meek with panelists: Anne Schopf (Mahlum), Vikram Sami (Olson Kundig), Kirsten Dotson (Miller Hull Partnership), Myer Herrell (Weber Thompson), Pia Weston (SHKS). September 29, 2021. Virtual Conference.

# INSTITUTIONAL PARTNERS

**Josh Pelham,** Market Channel Manager NEEA, Northwest Energy Efficiency Alliance

**John Jennings (Special Advisor),** Senior Product Manager, NEEA, Northwest Energy Efficiency Alliance

**Renée Cheng FAIA, DPACSA, NOMA,** Dean College of Built Environments, University of Washington

**Kate Simonen,** AIA, SE, Professor and Chair Department of Architecture, University of Washington

### **ADVISORY BOARD**

**Anne Schopf,** FAIA, Design Partner Mahlum

**Kristian Kicinski,** AIA, WELL AP, Associate Principal Bassetti Architects

**Duncan Griffin,** AIA, LEED AP, LEAN, Managing Principal HDR Architecture, Inc.

**Laura Maman,** AIA, Principal Miller Hayashi Architects

**Jim Hanford,** AIA, LEED AP BD+C, Principal Miller Hull

**Brendan Connolly,** AIA, LEED AP BD+C, Partner Mithun

**Pierce McVey,** AIA, EDAC, LEED AP, Principal SRG Partnership

Nick McDaniel, LEED AP, Senior Associate Lead Designer

Margaret Montgomery, FAIA, LEED AP, WELL, Principal NRRI

**Vikram Sami,** Director of Building Performance Olson Kundig

**Pia Westen,** AIA, LEED AP BD+C, Associate SHKS

**Myer Harrell,** AIA, LEED, Principal, Dir. of Sustainability Weber Thompson

**Neha Goel,** AIA, LEED, Associate Weber Thompson

**Matthew Zinski,** AIA, LEED AP, Principal Weinstein A+U

- **9-** "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/
- 10- Moroseos, T; Burpee, H; Meek, C (2022) "Efficacy of External Shading Devices and Natural Ventilation during Extreme Heat for a Seattle Multi-family Apartment Unit" Architectural Research Center Consortium Conference Proceedings
- 11- Meek, C., "Invited Book Review for Visual Delight in Architecture: Daylight, Vision and View by Lisa Heschong," Buildings and Cities Journal, 2 June 22. Accessed September 1, 2022. https://www.buildingsandcities.org/inner.php/insights/reviews/visual-delight-architecture-daylight.html [buildingsandcities.org]

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