INTEGRATED DESIGN LAB

Annual Report 2019–2020

UW Center for Integrated Design
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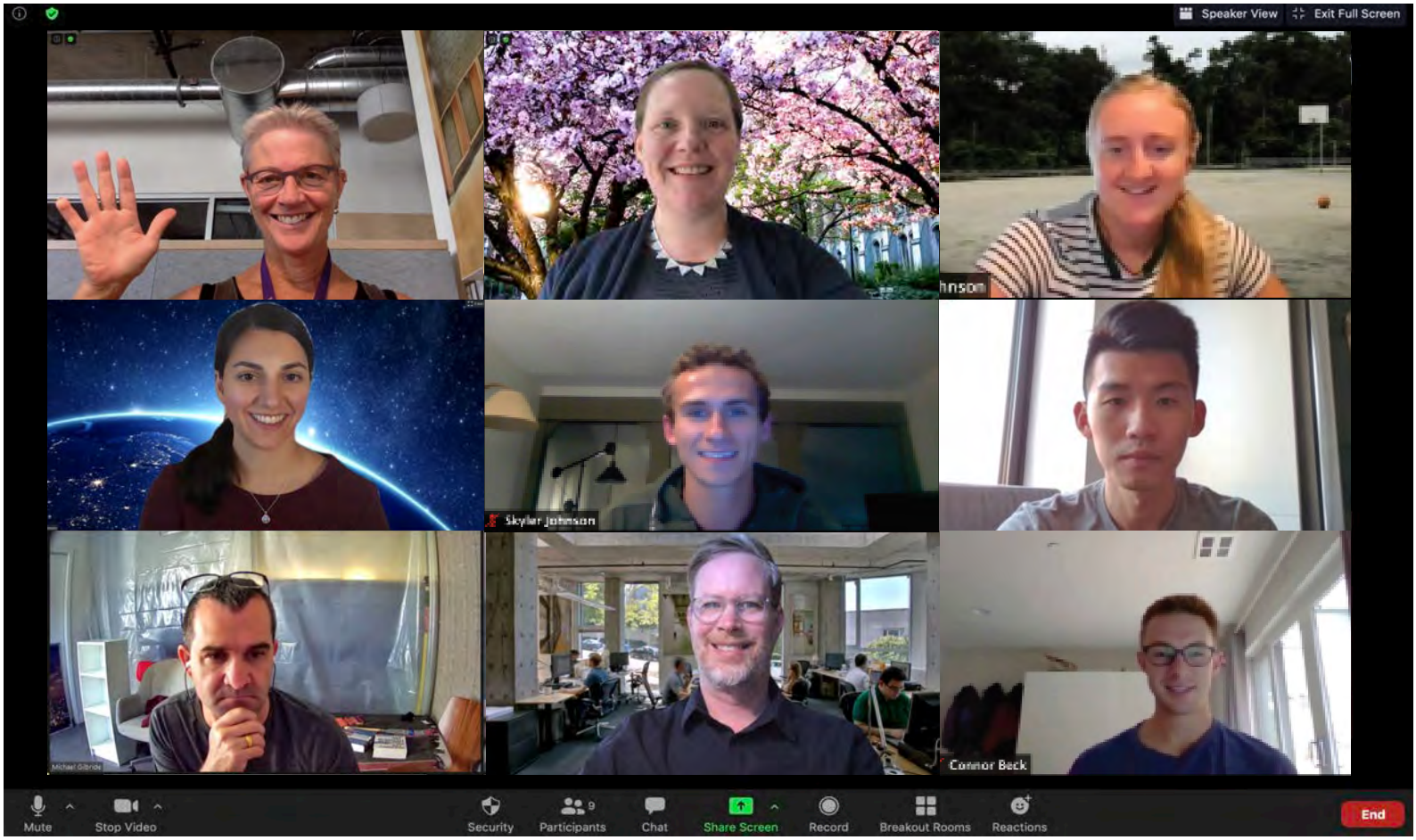
Cover Image: Norse Wildfire with Prof. Harvey Group
Inspired from the convergence of events in 2020.



LETTER FROM THE DIRECTORS

2020 has been a tumultuous year to say the least. As we face a global pandemic and resulting health crisis and recession, wildfires rage among increasingly visible evidence of climate change and environmental degradation. We are called to renewed action for civil rights stemming from persistent social injustice and unprecedented stress on our systems of democracy. The pandemic has exposed many of the fissures in our society – yet it has also revealed the strength and resilience of our communities.

For this, we want to express sincere gratitude for the unwavering commitment of all of our partners. Including the utility support we receive from the Northwest Energy Efficiency Alliance (NEEA) and from individual utilities in the Puget Sound region. And, the staff at UW who helped us transition to new ways of distance working in what now feels like the blink of an eye. We also want to extend our deepest gratitude to the staff, faculty, and students of the lab who have gone above and beyond to maintain continuity of our programs and projects while taking on increasing burdens outside of the "office."

With your support, and despite the challenges that have arisen, we have had an incredibly productive year and are especially excited about our strengthened connections with our collaborators, clients and colleagues.

Particularly exciting is our work with the City of Seattle Office of Sustainability and Environment (OSE) on improving the performance of existing buildings. In seeking to develop technical and financial pathways for meeting the new State Clean Buildings standard, we are training our lens toward partnering with community-serving organizations and finding ways to bring efficiency resources to historically underserved stakeholders.

Our Partnership Initiative has entered its fourth year. The collective voice of the thirteen-firm Strategic Advisory Board has provided an unparalleled sounding board for our organization. The collective research that we are undertaking as a group has also seen great success, with the American Association of Architects (AIA) providing additional direct funding to expand the scope of the project.

We are also thrilled to have welcomed Teresa Moroseos as a full time professional staff member in March.

We look forward to the next year, with more kindness, more equitable distribution of opportunity, and with hope that we can come together with evidence-based approaches to the challenges we share as we work toward a healthier, more productive, and sustainable future.

Christopher Meek, FAIA, IES
Associate Professor
Director

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

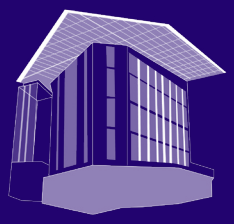
IDL at a GLANCE

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:**

93 PUBLISHED PAPERS & JOURNAL ARTICLES, AND 335 CONFERENCE PRESENTATIONS

DIRECT PROJECT INFLUENCE ON OVER 60,000,000 SQUARE FEET OF COMMERCIAL BUILDINGS

OVER 91,000 HOURS OF PAID GRADUATE STUDENT RESEARCH ENGAGEMENT AND MENTORSHIP

OVER 1,800 TOURS SERVING OVER 33,000 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.

Very High Efficiency (VHE) DOAS[1]

The UW IDL partnered with NEEA to author a VHE DOAS Design Guide for NEEA intended primarily for design engineers and contractors. The guide includes system benefits, system design requirements, as well as lessons learned from pilot installations. A link to the guide can be found on pg. 7 of this report.

Seattle Building Tune-Up Accelerator

The City of Seattle Office of Sustainability & Environment (OSE) in partnership with the UW IDL, Smart Buildings Center (SBC), Seattle City Light (SCL), and Pacific Northwest National Labs (PNNL) is engaging building owners, managers and vendors to develop market expertise and accelerate the voluntary implementation of energy efficiency improvements in Seattle's medium-rise commercial building stock. The UW IDL engaged owners with three levels of technical analysis from initial tests using NEEA's SPARK tool, to deep energy analysis outlining phased energy retrofit guidance achieving at least 20% energy savings. This work is funded by the US Dept. of Energy with matching funds from NEEA.

> "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."

Rosetta Stone a Translational Tool for Research-Informed Practice in High Performance Design

Developed as a shared research endeavor for the UW IDL Partnership Initiative, the Rosetta Stone seeks to bridge academic research and design practice with a translational tool that consolidates 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. The UW IDL launched a web-tool that houses its latest findings.

The UW IDL also partnered with NEEA and the AIA to develop additional targeted content for each organization. For NEEA, the benefits of their VHE DOAS technology, and for AIA the economic case for high performance design.

Luminaire-Level Lighting Controls & Commercial Window Attachment Programs

The UW IDL is working with NEEA to provide market intelligence, outreach, stakeholder engagement, and technical guidance to accelerate adoption of several technologies including luminaire level lighting controls (LLLC) and secondary window attachments. Our efforts have focused on building awareness and market intelligence to share information for better technology uptake. The UW IDL is working to leverage research and documentation of existing installations to reduce the risk to building owners by understanding, documenting, and addressing the technological and operational challenges associated with the widespread adoption of these systems.

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.

Partnership Initiative

We are in our fourth year of the Partnership Initiative - a formalized mechanism uniting leading design and construction firms around a shared vision of advancing research-informed practice. Thirteen firms comprise the Partnership, working to advance three goals: 1) establishing an Advisory Board to help guide the IDL's strategic direction, 2) coalescing around opportunities for research-informed practice, and 3) developing the shared research project, "Rosetta Stone: a Translational Tool for Research-Informed Practice in High Performance Design."

Total System Performance Ratio (TSPR) Professional Training[2]

With support from NEEA, we 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.

> "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."

Performance-Based Design Studio

UW IDL faculty led a seminar and studio in 2019 with Perkins&Will focused on designing a mixed-use building on the Seattle waterfront that would meet the Living Building Pilot Ordinance, and the Housing and Livability Agenda (HALA). Students explored evidence- and performance-based design processes underpinned by research and case studies, with workshops on energy-efficiency, parametric modeling, facade design, building economics, water and renewables.

AIA Seattle Energy in Design Award

The UW IDL has partnered with the AIA Seattle's Committee on the Environment (COTE) providing technical support for the Energy in Design Award. This award requires energy performance data for all project submissions. This program is being examined by the American Institute of Architects (AIA) as a national model. The UW IDL UW IDL has incorporated the AIA Committee on the Environment (COTE) "Common App"with the EiD Award to expand view of sustainability building design.

Bullitt Center Tour Program[3]

In its seventh year, the Bullitt Center remains one of the greenest buildings in the world and serves as a precedent for sustainable building design. In 2019/20, the UW IDL hosted over 200 tours, promoting awareness of the building's design to over 3,000 visitors. With the abrupt move to remote realities in March 2020, we paused our in-person tour program. This opened the opportunity to create alternative content, providing remote educational opportunities. An overview video and click-through virtual tour can be found on our website.

Image: Lick Wilmerding School, San Francisco, CA
Credit: EHDD Architecture

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.

Lick Wilmerding School San Francisco – EHDD

The AIA California Council has honored Lick Wilmerding School with a 2020 Merit Award. This 55,000 sf project includes a three-story classroom building, a new one-story administration building, and renovation of existing spaces. The project is committed to zero net energy operations with a predicted net EUI of zero kBtu/ft²-yr. The UW IDL partnered with the team at EHDD to use daylight to amplify the indoor-outdoor connection and taught glass façade in harmony with the existing historic mid-century San Francisco facility and to illuminate the teaching and learning spaces while reducing contrast between interior surfaces and the views to the exterior, saving energy, and controlling envelope loads.

Austin Central Library wins National AIA COTE Top-Ten Green Building Award - Lake Flato

The Austin Central Library was recognized with an AIA National Committee on the Environment (COTE) Award, the highest recognition for green building design in the US. The library is a building shaped by light and designed to respond to the specific context of its place. In writing about the Austin Central Library in Texas Architect, Aaron Seward noted that "the atrium, the whole building in fact, has a dreamlike quality. The silvery sparkle and dynamic fluctuation of the well-diffused daylight has an almost material presence, as though it were calibrated by James Turrell." The UW IDL worked in close partnership with the design team to achieve the "best daylight Library in the nation." This is the ninth AIA COTE Top-Ten Building Award project where IDL has had a significant technical and design influence in daylighting and energy efficiency.

UW Health Science Education Building – Campus Sustainability Fund (CSF) Grant

UW IDL graduate student researchers Ben-Hsin (Brian) Dow and Connor Beck were awarded a three-year $64,000 grant to evaluate the energy, experience, and lifecycle impacts of adding electrochromic windows to the new UW Health Science Education Building (HSEB) on the Seattle campus. This design approach is estimated to reduce the peak cooling load on the affected spaces by 30%. Funded with support from the UW Campus Sustainability Fund (CSF), this student-led project will engage with designers at the Miller Hull Partnership and PAE Engineers to implement the project, supporting evaluation, a portion of the incremental capital cost and post-occupancy evaluation and communication about this innovative new campus building.

Harrison and Overlake Medical Centers - NBBJ

The UW IDL, in collaboration with NBBJ and SOLARC Energy Group, provided technical assistance on both Harrison Medical Center, a new 144 bed (550,000 ft²) hospital in Silverdale, Washington and Overlake Medical Center, a new 239,000 ft² patient-bed tower at the existing hospital in Bellevue, Washington. Both have exemplary modeled energy performance, and are highlighted case studies in the "Toward Net Zero Energy Hospitals" guide co-authored by Burpee. The UW IDL's scope included energy evaluation, goal setting, strategy development, energy modeling, WSEC compliance, and utility incentive modeling.

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.

EDRA 2020 Presentation[4]

Lab Co-Director Heather Burpee presented at the Environmental Design Research Association's (EDRA) virtual conference in April 2020 on the University/Practice partnership, the Rosetta Stone research project, and stories from practice about the value of the Partnership and the Rosetta Stone Tool.

LLLC MythBusters

Seeking to dispel misinformation about luminaire-level lighting controls technology (LLLC), lab Director Christopher Meek and Chris Wolgamott of the Northwest Energy Efficiency Alliance (NEEA) hosted three virtual MythBusters-inspired events in WA and OR, moderated by Angela Pilant of Evergreen Consulting. LLLC technology can deliver significant business benefits, the high quality lighting for occupants, and energy savings up to 75%.

REHVA/ASHRAE Guidebook Toward Zero Energy Hospital Buildings[5]

Heather Burpee is collaborating with an international team of experts on low energy hospitals. The aim is to provide a framework for hospitals to reduce energy consumption in order to help meet international carbon emission goals. The guidebook is sponsored by the Federation of European Heating, Ventilation, and Air Conditioning Associations (REHVA) in collaboration with the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) and is due to be published in early 2021.

NSF Research Presentation

Lab Director, Christopher Meek gave an invited lecture at the University of Southern California (USC) Workshop on Architectural Faculty in Environmental Sustainability Research. Sponsored by the National Science Foundation and USC, this two-day workshop had multiple aims including promoting an architectural research framework, identifying challenges that affect the career success of faculty researchers in Architecture and environmental sustainability. Prof. Meek discussed the lab's approach to integrating research, technical assistance, and education.

ACEEE Presentations & Publications[6,7]

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 Bulidings 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.

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.

ACSA Publication[8]

Lab Director, Christopher Meek co-authored a publication for the Assocaition of Collegiate Schools of Architecture (ACSA) with lead author Elham Soltani-Dehnavi (former UW Master of Science, Design Computing student and current architect at Perkins&Will) on the development of a multi-criteria environmental design tool that incorporates multiple comfort factors in office buildings and can give designers an overall and broader perspective on space planning.

UW IDL STAFF

SENIOR STAFF

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PUBLICATION CITATIONS

1- VHE DOAS Guide: https://betterbricks.com/resources/vhedoas-comprehensive-design-guide

2- TSPR Training: https://waenergycodes.com/online_training

3- Bullitt Center Video: http://idlseattle.com/educational-outreach/tours/

4- Burpee, H., "Rosetta Stone for Research-Informed Practice." Envronmental Design Research Association: EDRA51 Virtual Conference, April 2020.

5- Maasen, W. (Royal HaskoningDHV and TU/e, NL), Mills, F. (Low Carbon Design Consultants, UK), English, T. (Kaiser Permanente), Burpee, H. (UW IDL), Vernon, W. (Mazzetti), Salabasheva, M. (Kaiser Permanente), Khankari, K (AnSight LLC), Zeiler, W (TU/e, NL), Kilkis, B. (Baskent University, TR), "ASHRAE-REHVA Guidebook Towards Zero Energy Hospital Buildings," American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and Federation of European Heating, Ventilation, and Air Conditioning Associations (REHVA) . In Development and Review.

6- 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.

7- 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 Efficincy 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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Weinstein A|U

8- Soltani-Dehnavi, Elham (UW M.S. Design Computing), Meek, C., " X-Maps: A Computational Method for Space Planning Using Multi-Variate Occupant Comfort,” Proceedings of the 108th Association of Collegiate Schools of Architecture Annual Meeting. Virtual Conference, 6 May 2020.

THANK YOU TO OUR SPONSORS:

FOUNDATIONAL SUPPORT

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PROGRAM GRANTS

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