INTEGRATED DESIGN LAB

Annual Report 2018–2019

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Cover Image: Coastal Biology Building, Santa Cruz, CA, EHDD Architects
Project: IDL daylighting technical assistance (2018)
Photo Credit: Michael David Rose

LETTER FROM THE DIRECTORS

The UW Integrated Design Lab (IDL) is situated within in the Center for Integrated Design (CID), an officially recognized research entity within the Department of Architecture and College of Built Environments at the University of Washington. The CID promotes a healthy, energy efficient built environment through research, education and outreach initiatives. Located at the Bullitt Center in Seattle, WA, the CID serves as a hub for interdisciplinary research teams to collaborate, share resources and improve knowledge on high performance building design.

We have had a fruitful year and are especially excited about our strengthened connections with our collaborators, clients and colleagues. Our three-part mission of research, technical assistance, and education and outreach connects us with a diverse range of stakeholders, including private parties, local, regional, and federal funding agencies, cities, utilities, trade associations, practitioners of architecture and engineering, building owners, educators, students, and the public. Our extensive reach gives us perspective on the collective culture of inquiry in our region and deepens our nuanced understanding of the market.

This year, our largest funder, the Northwest Energy Efficiency Alliance (NEEA), adopted a new five-year strategic plan. We are pleased to be part of their future vision and look forward to the next era of funding through the agency. We have also strengthened our relationships with local utilities, working directly with Seattle City Light, Puget Sound Energy, Snohomish County Public Utilities District, and Tacoma Power.

Our Partnership Initiative has entered its third 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 have worked with numerous partners in the design and construction of buildings through technical assistance including daylighting support, energy master planning expertise, utility incentive modeling, and building performance goal setting.

The IDL serves as a bridge between academia and the building industry, a mutually supportive role that promotes sustainable energy-efficient design and building. As a self-sustaining group in the University of Washington's College of Built Environments, the Integrated Design Lab (IDL) accelerates long-term market transformation with interconnected research, advocacy, and education, while shaping tomorrow's design leaders and helping our stakeholders break new ground in sustainable-design practice. In stride with the collective movement that is working to reduce carbon emissions and the impact of buildings on the environment, we drive toward forward-thinking solutions with our partners.

We look forward to the next year, entering a new decade of collaboration and innovation and an enriched built-environment for our region.

- Christopher Meek and Heather Burpee

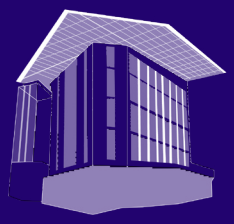
IDL at a GLANCE

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:**

75 PUBLISHED PAPERS & JOURNAL ARTICLES, AND 305 CONFERENCE PRESENTATIONS

DIRECT PROJECT INFLUENCE ON OVER 50,000,000 SQUARE FEET OF COMMERCIAL BUILDINGS

OVER 85,000 HOURS OF PAID GRADUATE STUDENT RESEARCH ENGAGEMENT AND MENTORSHIP

OVER 1,600 TOURS SERVING OVER 30,000 PEOPLE VISITING THE BULLITT CENTER

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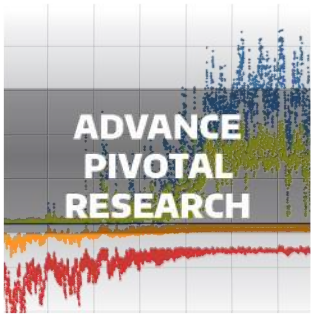
Interested in collaborating with the IDL? Contact us to learn more, make a tax-deductible contribution to support the lab's mission, or to create student research internships.



OUTCOME II: APPLIED RESEARCH

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

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.

Very High Efficiency (VHE) DOAS

The UW IDL implemented a web-based remote energy monitoring protocol and equipment deployment/data collection strategy for documenting pre- and post-energy consumption for a rooftop HVAC unit upgrade to a VHE DOAS system. These data will supplement case studies that NEEA is developing using this technology. The UW IDL is authoring a VHE DOAS Design Guide aimed primarily at design engineers and contractors that includes system benefits, system design requirements, as well as lessons learned from pilot installations.

> "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 & 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 existing installations and reduce the risk to building owners by understanding, documenting, and addressing the technological and operational challenges associated with the widespread adoption of these systems.

Rosetta Stone 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.

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 third year of the Partnership Initiative - a formalized mechanism uniting leading design and construction firms around a shared vision of advancing research-informed practice. All eleven founding firms have continued their commitment to the Partnership, and we added two additional firms this year. Partners have worked toward 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 for Research-Informed Practice in High Performance Design."

Bullitt Center Tour Program

Now open for six years, the Bullitt Center is still one of the greenest buildings in the world and serves as a precedent for sustainable building design. The Bullitt Center opened In 2013 and became the first large-scale 'living' commercial building. In 2019, the UW IDL hosted over 250 tours, promoting awareness of the building's design to over 5,000 visitors.

> "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."

UW IDL Tools & Methods

We delivered a four-part education series focused on the technical analysis of high-performance buildings, "Integrated Design Tools & Methods" was composed of four half-day sessions where participants learned hands-on methods for analyzing high performance design. This series was sponsored by Seattle City Light. Participants included professionals from the utility and professional design community.

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 is providing technical guidance to the AIA National Committee for the development of their "super spreadsheet" that aims to provide data-driven performance metrics for architects nationally.

Rendering: Overlake Medical Center New East Tower, Image: Courtesy of 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.

Harrison Medical Center – NBBJ

The UW IDL, in collaboration with NBBJ and SOLARC Energy Group, provided technical assistance on Harrison Medical Center, a new 144 bed (550,000 ft^2) hospital in Silverdale, Washington. With a stated goal of 135 kBtu/ft^2-yr in the RFP, its current energy performance is estimated to be 98 kBtu/ft^2-yr, saving over 5M kWh/year. The project is undergoing PSE incentive evaluation, with an anticipated 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.

Austin Central Library – Lake Flato Architects

The award-winning Austin Central Library is a building shaped by light and designed to respond to the specific context of its place. The heart of the building is the six-story atrium, which provides daylight for more than 80% of regularly occupied spaces. The UW IDL worked in close partnership with the design team to achieve the "best daylight Library in the nation." Using a range of qualitative and quantitative analyses, the UW IDL assisted on aspects of the building volume, apertures, and shading systems.

> "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."

UC Santa Cruz Coastal Biology –EHDD

This new 40,000 sf building is part of the world-class marine and ocean health research, education and public service facility at the University of California-Santa Cruz Wells Fargo Coastal Science Research Center. The UW IDL partnered with the team at EHDD to use daylight to amplify the indoor-outdoor connection on this beach front site and illuminate the interior spaces of the building while reducing contrast between interior surfaces and the views to the exterior.

Panorama City Sustainability Master Plan – Rice Fergus Miller

In collaboration with SOLARC Energy Group, the UW IDL led a sustainability-workshop comprised of presentations and facilitated discussions, which led to the development of a sustainability master plan for the campus. Topics including energy, water, waste, materials, and community were explored and tangible goals were established for the future development of the community.

Overlake Medical Center –NBBJ

The UW IDL, in collaboration with NBBJ and SOLARC Energy Group, provided technical-design assistance on Overlake Medical Center, a new 239,000 ft^2 patient-bed tower at the existing hospital in Bellevue, Washington. The current energy performance of the new facility is estimated to be 75 kBtu/ft^2-yr, which represents a savings of over 1.3M kWh/year. The project is undergoing an incentive evaluation through Puget Sound Energy, with anticipated conservation rebates of about $300,000.

Image: University of Washington Aerial, Photo: Mark Stone/UW

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.

Partnership & Rosetta Stone[1]

The IDL co-presented with Anne Schopf (Mahlum) and Myer Herrell (Weber Thompson) at the AIA's 2019 National Convention in Las Vegas, NV in June 2019. They presented 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.

Bullitt Center Infographics[2]

The IDL updated all building-system infographics used throughout the Bullitt Center. The placards serve as visual education tools throughout the building and on the Bullitt Foundation's website.

Tune Up Accelerator and Building Renewal[3]

Presented at the 2019 International Conference on Climate Resilient Cities: Energy Efficiency and Renewables in the Digital Era (CISBAT) hosted by the Ecole Polytechnic Federal Lausanne (EPFL) in Switzerland in September 2019, this paper details initial implementation of a building-owner engagement process aimed at accelerating voluntary deep energy retrofits as part of a new mandatory building tune-up requirement. Highlighting the use of energy disclosure data and a suite of freely-available energy simulation tools, this paper describes an approach to developing a scalable for deep-energy retrofits that drive carbon-neutral operations in existing buildings.

Bullitt Center Energy Performance Posters[4]

After a three year process of reconciling circuit-level energy monitoring and whole-building energy at the Bullitt Center, the UW IDL analyzed and graphically represented two years of actual energy consumption. The results of these analyses were presented as a series of posters at a symposium hosted by the Lawrence Berkeley National Laboratory in Berkeley, CA in April 2019.

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

The UW IDL is collaborating with an international team of experts on low energy hospitals to create a new design guidebook for engineers and of hospital owners. 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 2020.

Performance-Based Tools for Exploring High Performance Decision-Making[6]

This paper elucidates an industry-academic collaboration between Perkins+Will and UW Architecture. Parametric-based modeling was used as a decision-making structure for developing high-rise schemes in the architectural studio environment, supported by an introductory seminar course. The UW IDL led this collaboration where students used the Living Building Challenge and Seattle's Living Building Ordinance as a framework, and explored maximizing designs based on ecology, economy, and economics.

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PUBLICATION CITATIONS

1- AIA Conference on Architecture 2019, Discovering the Rosetta Stone: Translating Research for Design Decision-Making; Burpee, H., Heerwagen, J., Harrell, M., Schopf, A., Meek, C. - Session Organizer, 7 June 2019, Las Vegas, NV

2- http://www.bullittcenter.org/building/building-features/

3- Meek, C., Gustin, A., Ballinger, "Development and Dissemination of Deep-Energy Retrofit Strategies through a Mandatory Municipal Building Tune-Up Ordinance in Seattle, Washington, USA," Proceedings of the 2019 International Conference on Climate Resilient Cities, Energy, and Renewables in the Digital Era (CISBAT). Lausanne, Switzerland. September 2019

4- Rosenfeld Symposium at the University of California Berkeley, Poster Presentation: Weather and Occupancy-driven Energy Consumption at the Bullitt Center; Gustin, A., Torres, I., Davis, D., Meek, C., Burpee, H., Gilbride, M., April 2019, Berkeley, CA.

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- Haymaker, J., Meek, C., Kleiner, D., Pena, R., Burpee, H., Norwood, W., "Constructing Performance-Based Tools and Practitioners for Exploring Living, Mixed-Use, High-Rise Building Design Spaces," Perkins+Will Research Journal. 2019

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