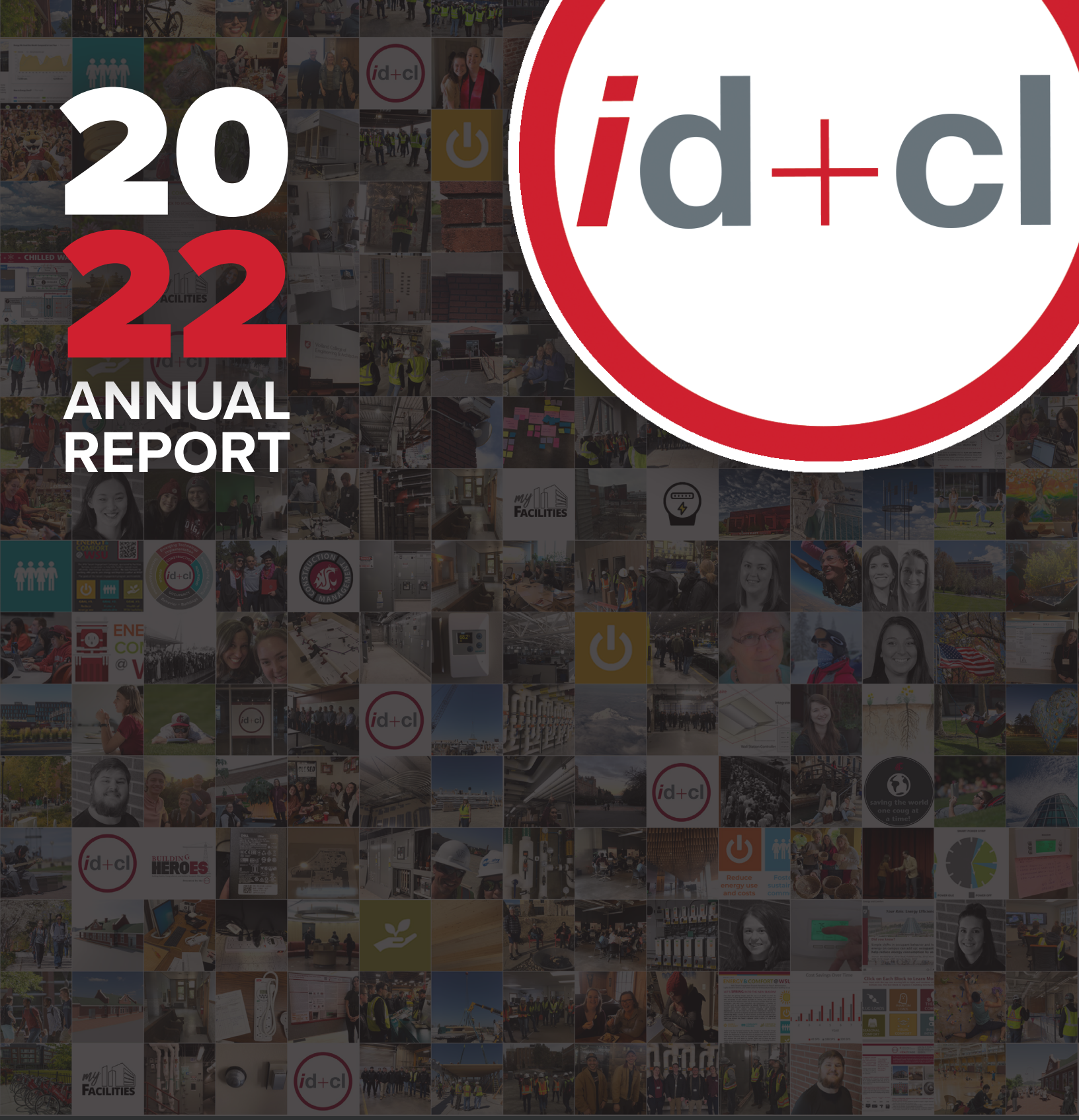

WSU Integrated Design + Construction Laboratory
2022 Annual Report

WASHINGTON STATE UNIVERSITY

idcl.wsu.edu
PACCAR Building, Room 107
2001 Grimes Way, PO Box 645815
Pullman, WA. 99164-5815

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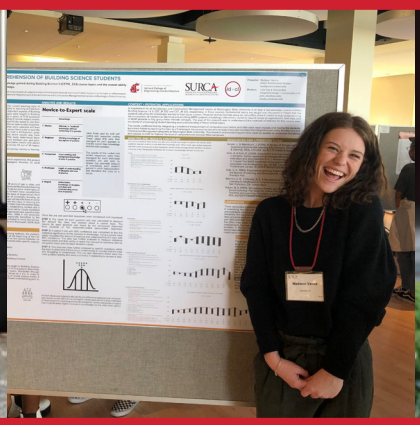



Story on page 12: We are pleased to highlight research outcomes and independent work of our research assistant team. Three undergraduate research assistants, Sierra, Maddy, and Ailee presented their research at the Showcase for Undergraduate Research and Creative Activities (SURCA), Ailee taking home an award for her presentation on LLLC market insights, Zach Colligan went to Singapore for an NSF-sponsored research abroad experience, and Sierra has returned from a semester abroad in Italy! We are so proud of our team!

LETTER FROM THE DIRECTOR

JULIA K. DAY, PHD.

Dear Friends of the Integrated Design + Construction Laboratory,

For me, it has been full of new beginnings, tremendous changes, and gratitude. As I reflect on 2022, I could not be prouder of our team at the ID+CL.

The first half of the year, I was mostly out, being a new mom to little Ella. I remember leaving the lab, on my way out for maternity leave on December 17th, 2021, and I was so sad to leave my first "baby", the ID+CL. I couldn't believe I wasn't going to work for a few months...how do people even do that? Well, after I downloaded my whole brain to Shelby, I stepped away. I started on my new venture of mom-ing, which has been the best thing in the world. And, guess what, the lab didn't implode. It kept on going and thriving without me. Shelby and the students stepped up and kept my ID+CL dream alive, and well. And for that, I am so grateful.

I am also grateful for everyone we have worked with this year who supported us. To Nancy Swanger and Darcie Bagott and the Granger Cobb Institute of Senior Living, thank you for believing in what we do and supporting us in our senior living study. To the Northwest Energy Efficiency Alliance (NEEA), thank you for helping me to rebuild and sustain the lab so that we can make a difference. To WSU Facilities Services for believing that we can help make a difference on campus. Thank you to all of the wonderful industry partners we work with who support us and our mission. Special thanks to Sequoyah Electric, University Mechanical Contractors (UMC), and Valley Electric for stepping in to take care of me after Ella was born by sending meals and love. To our support staff, Suzanne Hamada, Sarah Dossey, and Kate Barnes, we could not do what we do without you. To Jason Peschel and Rick Cherf for having my back and supporting me. To the students, we wouldn't even be here without you. To the SDC and CM Industry Advisory Boards, thank you for your support and for entertaining my crazy ideas. Thank you to my colleagues and Co-PI's along the way. And, Shelby Ruiz, I couldn't even function as a human without you.

The time away from work last year gave me a lot of time for reflection. I believe in what we are doing at the lab, I want to make a difference through the work we do. I want to help contribute to lofty goals such as meeting energy policy and climate change initiatives through energy savings in buildings, while also maintaining the health and well-being of the people who inhabit those buildings.

I want to express my deepest gratitude for you all. Thank you for your support, your guidance, and your friendship over the years. I cannot wait to see what we do next. Here's to a new year and new adventures.

Sincerely,

Director, Julia K. Day

Julia K. Day, PhD
Director | Integrated Design + Construction Lab
Associate Director | Composite Materials Engineering Center
Associate Professor | School of Design + Construction
Affiliated Faculty | Carson College of Business
Joint appointment at National Renewable Energy Laboratory (NREL)
e. julia_day@wsu.edu

ABOUT THE ID+CL AND CONTACT INFORMATION

Background

The WSU Integrated Design + Construction Lab (ID+CL) conducts sponsored design and construction research activities under WSU's Institute for Sustainable Design + Construction, the School of Design + Construction, and is administered under the WSU Composite Materials and Engineering Center. The ID+CL advances innovation in practice as part of an allied regional network of university labs (UO, UW, WSU, UI, MSU) that provides technical assistance and market diffusion services to AECO building teams. The network seeks to transform design, construction, and building operational practices to advance high-performance building designs that are more comfortable for people, require less carbon and energy to construct and maintain, and enhance the health and productivity of occupants.

Goals of the ID+CL

- employ students in research,
- work on projects that reflect the WSU grand challenges,
- advance energy savings and occupant comfort in high-performance buildings
- educate building occupants and building operators, and
- engage with the community and industry.

You can find us @ PACCAR

2001 Grimes Way, Room 107
PO Box 645815
Pullman, WA. 99164
509-335-8722 | www.idcl.wsu.edu

MEET OUR TEAM

Shelby Ruiz, M.A.
Research Project Manager
e. shelby.ruiz@wsu.edu

Zachary Colligan, B.S.
Graduate Research Assistant
M.A. in Architecture '24

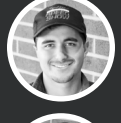
Emma Hageman, B.A.
Research Staff
B.S. in Psychology '22
Minor in Sociology

Anna Post
Graduate Research Assistant
M.A. in Architecture '23

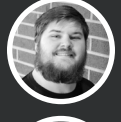
Sierra Rothlisberger
Research Assistant
B.A. in Interior Design '23

Ailee Simpson
Research Assistant
B.S. in Human Development '23

Anh Ngo, B.A.
UX Designer
B.S. in Architecture '23
B.A. in Digital Technology & Culture '21



Jacob Roibal
Research Assistant
B.S. in Architecture '23



Ethan Baum
Research Assistant
B.S. in Architecture '23'

Magnus Neil
Research Assistant
B.S. in Interior Design '22

What We Do:

The ID+CL welcomes projects related to high performance buildings, occupant comfort, occupant training and education, building system interfaces, BIM technical assistance, as well as occupant surveys and behavioral studies.

The School of Design + Construction has recognized the ID+CL as a key player in the school-wide research initiative for the following activities:

- engagement of building occupants, building operators, designers, and contractors through research opportunities, training and education;
- engagement of undergraduate & graduate students in research opportunities and scholarly activities through mentorship;
- dissemination of cutting edge research to the architecture, interior design, and construction communities;
- education and resource development for safe and efficient energy management; and
- facilitation of occupant-centric research in emerging tech, building case studies, innovative training for energy codes, standards and more

The ID+CL hires a team of diversely talented students in the disciplines of Construction Management, Architecture, Interior Design, Civil Engineering, and aspires to seek additional expertise by hiring students in the Mechanical Engineering, Electrical Engineering, Computer Sciences, Environmental Sciences and design fields in the coming year.

Maddy Vance, B.A.
Alumni Research Assistant
B.S. in Architecture '22
Minor in Construction Management
Minor in Business Administration

Robin Olson, M.A.
Alumni Research Scholar
M.A. in Interior Design '22

Grant Larson
Alumni Research Assistant
B.S. in Construction Management '23

2022 ALUMNI

Since 2017, the IDCL has hired 27 students

Diciplines employed:

- Architecture
- Interior Design
- Construction Management
- Civil Engineering
- BioEngineering
- Human Development
- Psychology

ENERGY & COMFORT @ WSU

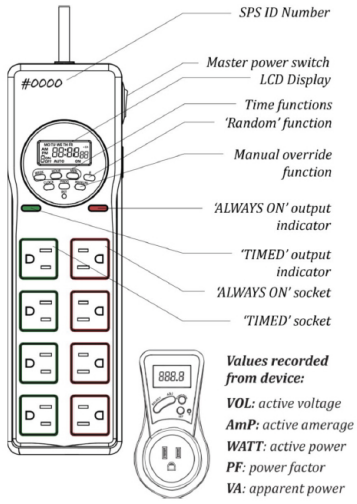
OUTCOME 1: DISCOVERY THROUGH RESEARCH + DEVELOPMENT

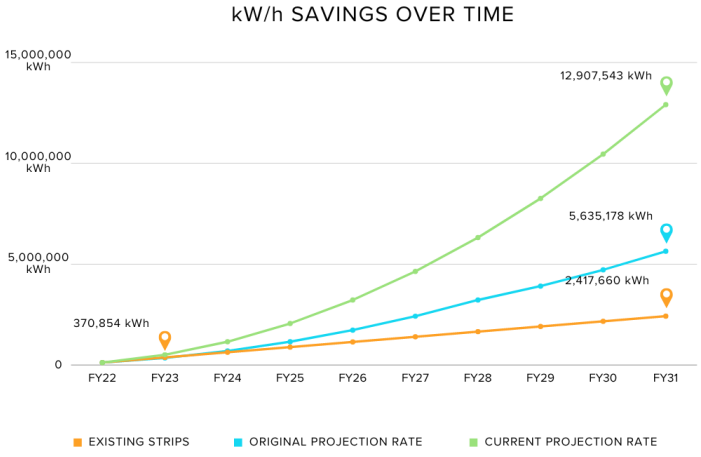
With support from WSU's Revolving Energy Fund (REF) and NEEA's BetterBricks Program, the ID+CL has continued the second phase of implementing a tenant engagement program designed to help to build occupants on the WSU Pullman campus manage their comfort while learning strategies to save energy while on campus. Tenant engagement (TE) activities are ongoing, and materials can be found on the Newsletters & Posters page of the ID+CL website. Many individuals have begun to recognize our staff, our materials, and our message, as we complete installations and continue to engage with staff and faculty in our target buildings. We have also recruited 35 departmental "Energy Champions," sent monthly (13 to date) energy and comfort newsletters to the targeted buildings, and we have installed 188 of 200 planned smart strips.

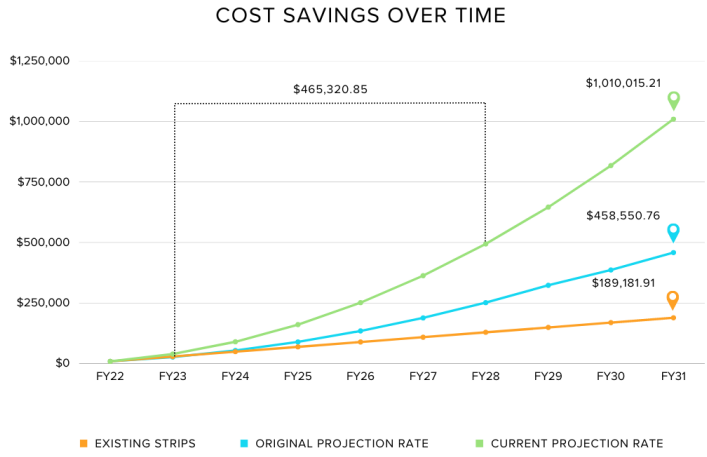
This report includes a summary of the Smart Surge Protectors (smart strips) plug-load reduction study that has been implemented these past 16 months (Aug 2021 – December 2022)

Key Results

The initial goals of this effort were to save an estimated annual electricity energy usage of 74,693 kWh, or $8,912 annually in Fiscal Year 2021 (FY21), which was met, with an estimated ~42% plug load energy savings. For Fiscal Year 2022 (FY22), the goal set from the previous year to estimate savings was based on FY21 data for 300 smart strips total by the end of June 2023. As shown below, based on the installation of the smart strips alone (not including tenant engagement) activities, we have surpassed our annual electricity energy savings goal (est. 318,340 kWh), and are in the progress to achieve significant savings as we install the remaining 112 strips committed for this fiscal year. The tenant engagement efforts are difficult to quantify, but we can assume the TE efforts accelerate these payback period assumptions due to smarter usage of equipment, energy use awareness, greater "off" or unplugged use, etc. These results exceed initial goals and demonstrate the program's effectiveness. Our efforts are also captured through surveys, email exchanges, and in-person feedback to inform us of challenges as we continue to conduct the study and improve our procedure.







Estimated electricity savings (kWh) and cost savings ($) over time comparing Fall 2022 and projected Spring 2023 installation numbers to the first batch of 43 installations.

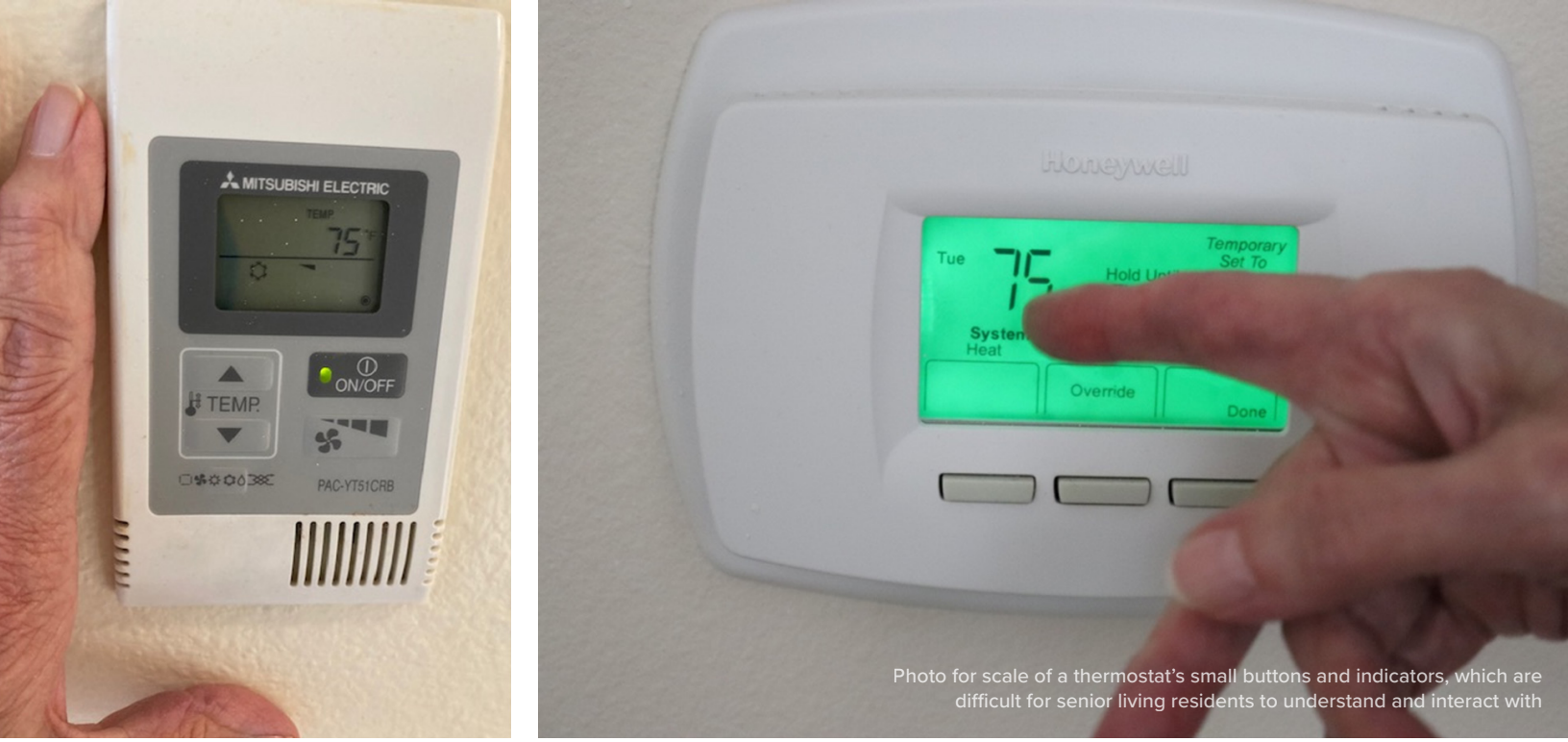


Photo for scale of a thermostat's small buttons and indicators, which are difficult for senior living residents to understand and interact with

OUTCOME 2: RESEARCH THAT TRANSCENDS ACADEMIA

Generational Resiliency: How can we Design Better Environments *with* and *for* Older Adults?

While it is important to consider living conditions for all age groups, it is especially important to conduct research for the ageing demographic, currently the world's fastest growing population. Nearly 40% of older adults have at least one disability or mobility issue, and as such, the senior care industry faces the challenge of meeting the needs of current and incoming residents. As if health-related concerns are not enough, seniors are also facing the loss of ability to control their interior environments as building technologies become more advanced without taking into consideration those with mobility or cognitive impairments.

Over the summer of 2021, our Research Project Manager, Shelby, was able to visit nine senior living communities in the greater Seattle area, to study personal comfort, safety, and overall wellbeing through the eyes of senior citizens as they experienced their environments. This study included forty one-on-one interviews, and five focus group conversations, in which participants had the opportunity to tell stories about their lives. Research data were analyzed in phases over the course of 2022, and results were disseminated through several avenues. The final reports for the Granger Cobb Institute for Senior Living and the two companies that allowed us to collect data within their communities were delivered in March, the first with all encompassing results of the entire study, and the latter with community and company specific results and recommendations. Next, focusing on the interface and comfort specific research questions of this study, we presented and published in the proceedings of ACEEE's Summer Study on Energy Efficiency in Buildings, igniting a thoughtful conversation about how senior comfort affects building efficiency and wellbeing of all. We also had the opportunity to present this work at the Behavior, Energy & Climate Change Conference virtually, which similarly allowed for meaningful discussion of the more personal factors of elderly wellbeing.

Experiences shared by participants tell stories of difficulties using essential spaces of their residences, such as their kitchens and bathrooms, expressed confusion or frustration trying to understand digital controls, like their thermostats and mobile devices, and further illustrated the importance of safe mobility in everyday settings. As we age, we know that our physical and social environments greatly impact our wellbeing, and the stories collected as a part of this research detail the daily realities of older adults.

"I met men and women, ranging from ages 65 to 105, all with different mobility, physical statures, health needs, mental and cognitive capacities, varying abilities to see, reach, smell, hear, and sense, as well as fluctuating interests in being a part of their community, society, and at times, their own bodies. Participants ranged as petite as 4' 6" to (at one point in their lives) 6' 7". They were secretaries, engineers, builders, scientists, writers, journalists, parents, spouses, grandparents (great, and great-great grandparents in many cases), gardeners, farmers, world-travelers, entrepreneurs, historians, military personnel, and so much more. While the data that resulted from this study is filled with important takeaways regarding the way that seniors interact with their built environment, it also tells the stories that capture their personhood and lived experiences within their living spaces."

-Shelby Ruiz

OUTCOME 2: EDUCATION THAT TRANSCENDS ACADEMIA

Building Operator Certification Logo seen above, which the course developed (BOGO) will act as an entry level training for high school and community college level students. This curriculum will catalyze the transition towards grid-interactive efficient buildings with an entry-level curriculum for building operators that teaches the fundamentals, builds intuition through hands-on simulations, and strengthens their ability to work with experts, leading to rewarding lifelong career advancement opportunities.

BUILDING OPERATORS: GRID AND OCCUPANT (BOGO) TRAINING

DOE's Office of Energy Efficiency and Renewable Energy (EERE) Buildings Energy Efficiency Frontiers & Innovation Technologies (BENEFIT) funding opportunity granted Northeastern University's Michael Kane, Washington State University's Julia Day, and the Northwest Energy Efficiency Council (NEEC) to work together on a workforce development education project. The goal of this DOE funded project is to develop, test, refine, and disseminate a robust education experience and training modules for entry-level building operators. As activities are developed for the modules in the first year, pieces will be tested at Madison Park Vocational Technical high school in Boston, MA. The project team is in the first year of developing Building Operator: Grid-Occupant (BOGO) training modules to expand the training of entry-level building operators beyond a focus on energy efficiency and peak demand reductions, to include energy flexibility. This course will serve as an entry point for young aspiring building operators in a workforce that faces vacancies growing 10% faster than the national labor job market. Targeting vocational technical (VoTech) high school students, the course combines classroom learning with hands-on simulators and exercises to give real technical and social skills to learners. This project team is developing, piloting, assessing, and disseminating the BOGO training modules in phases over the next three years to ensure they meet the needs of industry and are scalable across educational settings. The industry advisory board that oversees the development of this curriculum is composed of educators, technical specialists, building managers, and operational professionals from across the country.

Designated "BOGO" for Building Operators: Grid and Occupant Training, the grant project will study the effectiveness of a 14-hour supplemental curriculum to NEEC's Building Operator Certification (BOC) Fundamentals program. The Fundamentals of Energy Efficient Building Operations course provides the basic principles of energy efficiency awareness and practices in commercial buildings. It is designed for those looking to start a career in building operations and maintenance, existing facilities personnel who are looking for a solid foundational understanding of energy efficiency and building systems, and those whose work intersects with facilities and the built environment. The BOGO program is an entry point for pre-career students who will, one day, seek professional accreditation for their career as a building operator or facility manager. The course being currently developed, will begin with student trials in the Boston area with the intent to roll out nationally.

For this project, the ID+CL will provide technical support to Northeastern University and the other team members. The team will conduct both summative and formative evaluation to ascertain the most effective education methods and strategies, which may vary across the different target audiences. Washington State University intends to design the occupant centric curriculum, develop case studies, create virtual walkthroughs and innovative teaching tools, and perform graphic design support for the simulation environment. More will be published about this work as it is rolled out in the coming year!

BOGO LEARNING OBJECTIVES: By the end of this course, students will have the ability to...

U.S. DEPARTMENT OF ENERGY

1. Differentiate between units and measures of power versus energy, and explain how regular building operations and maintenance decisions affect a building's energy and power consumption and generation.
2. Identify benefits of common commercial building grid-interactive efficient building programs, and explain how regular building operation decisions affect the electric grid and building finances.
3. Identify properties of a building, the HVAC system, and the grid that can limit an operator's ability to provide indoor environmental quality.
4. Understand how occupant behaviors can impact the built environment and building energy performance: from occupant, to building, to grid scales.
5. Explain how a good relationship between building operators and occupants can help make buildings more efficient and effective GEBs
6. Understand potential strategies for using tenant engagement, communication, and education efforts to enhance occupant behaviors, comfort, and building energy use.

View from the northeast corner of the Depot property

OUTCOME 3: SUPPORT THE BUILT ENVIRONMENT THROUGH OUTREACH

Through industry sponsored research and other investigative activities, the ID+CL team has experience working in residential, commercial, educational, and institutional settings through in all phases of development, through construction and post-occupancy. Assisting our partners with technical innovations, equipment and design recommendations, market research, program design and post occupancy evaluations further supports our goals of advancing energy savings and occupant comfort in the built environment.

Pullman Depot Experience Project

The Pullman Depot Heritage Center worked with the ID+CL this last summer on creating digital models of the Pullman Depot that feature the historical elements of the original structure to use as an educational and fundraising tool. Through physical measurements, historic building plan comparisons, and meetings with the Pullman Depot Restoration Committee, an accurate current and planned parametric model was built. The ID+CL used this model and paired mixed-reality technologies to produce a package of renderings and marketing materials for the depot to use as they garner support for remodeling efforts. These models, videos, and renderings will highlight the craftsmanship of the original building, comparing modern elements to original features of the 1916 construction. The visualizations are to pave the way for the Pullman Depot's full restoration in the near future, and have been used to make decisions on materials, how to approach fundraising, and for advertisement purposes, drawing more foot traffic and media attention to the currently arranged museum. This work was featured during the Pullman Lentil Festival and Depot Days and can be seen on the Pullman Depot's Website.

2022 SEASON 2

NEEC AND BOC

In many ways, a building's efficiency relies heavily on the building operator. In this episode, we spend time with Melanie and Rebecca learning about the Northwest Energy Efficiency Council. They focus on improving the energy efficiency of buildings through training and resources for building operators in the PNW.

EXPLORING MYTH & REALITY: RESIDENTIAL ENERGY USE

Understanding how energy is used in the residential buildings we live in allows illumination of a host of misconceptions and simplifications. An honest appraisal of our home energy picture encourages us to explore what matters and matters most. We can learn what will best help our carbon footprint, and our energy costs while improving the vitality of our living environment. Best methods vary significantly by geography, local resources, and our changing climate.

COMMITMENT TO OUR CLIMATE

In this episode, we talk with Gus Simonds and Perry England from MacDonald Miller. Gus Simonds has been the CEO of Macdonald Miller since 1988 using his variety of skills to ensure that even the most complex building problems can be solved. Perry England has been with MacDonald Miller since 2005 and is proud to help buildings work better while taking care of the community and the environment.

THE FUTURE OF CITY BLOCKS

In this podcast, we speak with Hendrik Van Hemert, the Managing Director for Edo, and his involvement in the South Landing project, and what it means for the future of grid interactivity in the built environment.

Building HEROES Podcast season 2 episodes and speakers

BUILDING HEROES
Building Healthy, Energy-efficient, and Resilient Occupants: Educational Series
Presented by the id+cl

OUTCOME 3: SUPPORT THE BUILT ENVIRONMENT THROUGH OUTREACH

Connecting with Industry Members through the Building HEROES Podcast Series

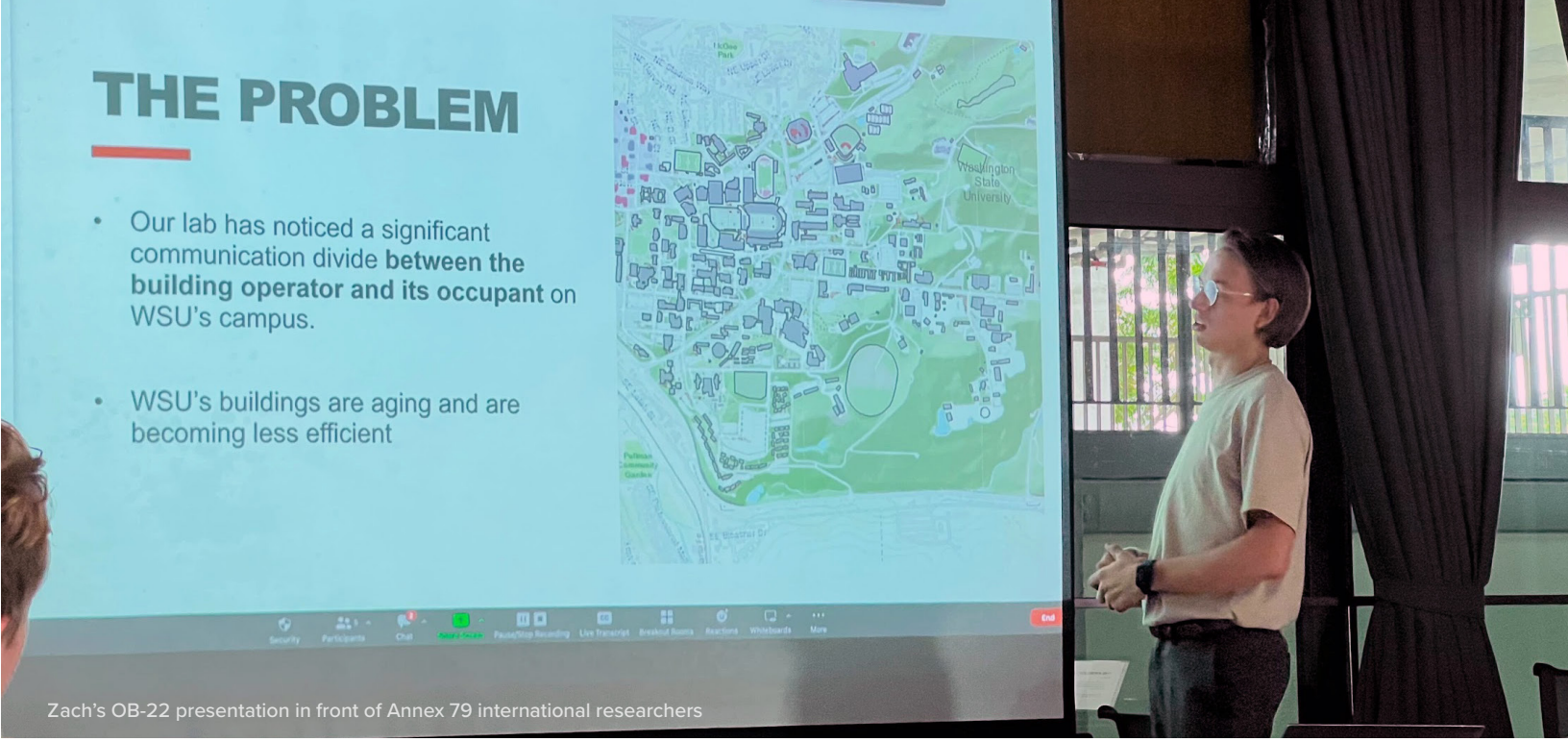
Through our partnership with the Northwest Energy Efficiency Alliance (NEEA) we have successfully completed our second season of our podcast, Building HEROes (Building Healthy, Energy-Efficient, and Resilient Occupants). In the first season, *Learning from the Greats*, we spoke with late-career building experts who spoke on industry and lifetime knowledge. In 2022, we spoke with facility management experts specifically, who shared various approaches to successful building operations.

After recording with industry speakers, designated students at the lab learn to edit the podcast, checking for clarity of both audio and information, then compiles supportive educational materials and resources into a podcast companion document which is available on our website. This mixture of technical skills such as audio mixing and graphic design, mixed with the ability to disseminate knowledge to the masses is an incredible quality to find in research assistants. Madison Vance, 2022 alumni of the ID+CL, helped us get this podcast off the ground when she first joined in 2021, and has been fundamental in its success over the last two years. Anna Post, a graduate research assistant for the lab, has spearheaded the production of the second half of his season.

In 2023, the third season of the Building HEROes Podcast will focus heavily on market transforming industry perspectives as well as up-and-coming, innovative companies, technologies, and professionals to provide a closer look at the emerging future of the built environment.

CREDIT WHERE CREDIT IS DUE, LET'S TALK ABOUT OUR STUDENTS!

Message from the project manager
It goes without saying that our undergraduate and graduate research assistants are the backbone of so much of our work. Our inspired and hardworking students help drive our projects, they bring new perspectives and methods, and they help us remain human in the work we do. Because our students are so wonderful, we also must highlight their accomplishments and highlights of 2022. Please enjoy this new feature of what our students have been up to!



Zach's OB-22 presentation in front of Annex 79 international researchers

ZACH'S SINGAPORE EXPERIENCE

Learn more about Zach's Experience

Zachary Colligan is an ID+CL Graduate Research Assistant pursuing his master's in architecture. As Zach began his master's degree journey, he was one of five nationwide students who were selected by the National Science Foundation's Center of Leadership Development in Built Environment Sustainability in partnership with Louisiana State University, the American Society of Thermal and Fluids Engineers, and the National University of Singapore for a four-week program to present his research proposal to researchers in Singapore. Zach traveled for a month in September to be a part of this wonderful opportunity.

This time away from the lab allowed Zach to explore an avenue of the ID+CL's Energy and Comfort at WSU Campaign that was not yet developed, seeking methods to collect real-time personal comfort assessments through wearable devices. His proposal and work on this project will be disseminated through conference abstracts, papers, and hopefully a first authored journal publication before Zach completes his graduate degree.

"While in Singapore I connected with students and faculty in the Building and Urban Data Science (BUDS) Lab to better refine my research proposal, prepare a six-month research plan, and to continue to learn and engage with the team to pursue the research independently upon my return to WSU. This experience opened my eyes to the global possibilities of my work and passions, traveling to conferences and engaging with international researchers. The balance and self-discipline required to succeed in this program was as equally exhausting as it was rewarding. The connections I have made with the students and faculty in Singapore as well as around the US will continue to impact the way I connect with others, and I hope other WSU students can be fortunate enough to have an opportunity such as this one." - Zach

THE BIG SOLUTION:
PROJECT COZIE

create a real-time tool for Facilities Services

Automatic localization to **remotely address the concern**

identify long-term patterns across seasons

Sierra pictured enjoying Italian fares in front of Florence's Duomo

BUONGIORNIO ITALY, SIERRA IS HOME!

Sierra Rothlisberger is pursuing her bachelor's degree in interior design. She and other classmates had the opportunity to spend four months abroad in Florence with a faculty member during fall semester of their senior year. During the experience abroad, designers immerse themselves in untouched culture right in the birthplace of the Renaissance, Florence, Italy. The purpose of the program is to help students return to original methods of art such as frescos or basketweaving, as well as learning how to bridge the gap between historical and modern architecture.

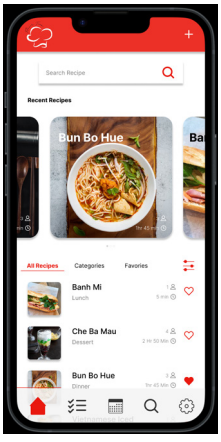
"My time in Italy last semester was incredibly rewarding and I wouldn't have traded it for any other experience. Being immersed in another culture broadened my design perspective to considering other cultures and points of view, design techniques, and overall connections will have a lasting impact on my academic and professional career. It's an opportunity no student should miss out on." – Sierra

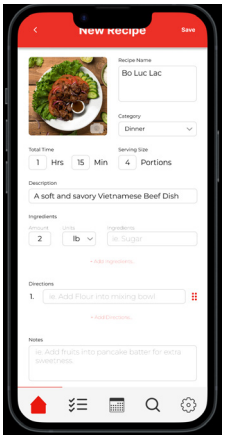
WELCOME TO WEB DESIGN AND UX DESIGNER ANH

At the beginning of Fall semester of 2021, ID+CL opened up a new position to help update our website and help out with graphics and our more technical projects. Anh Ngo joined the team with her expertise in User Experience (UX) Design, which is the process of designing a product, services, and experience with focus on optimizing usability, functionality, and satisfaction.

Anh is a senior in the architectural program and a digital design graduate. Growing up, she has always had a passion for design and technology. Anh believes that the products we use daily such as apps, could spark a similar enjoyment as when she sees an intricate building. Her goal after graduation is to pursue a career in UX design to create user-friendly spaces that elevate their experiences everyday.

View more of Anh's work





Jeremy Lessman, Director of Undergraduate Research announces Ailee's Gray Award, while she shakes the hands of Bill Davis, Mary Sánchez Lanier, and WSU Chancellor and Pullman Provost, Elizabeth Chilton.

SHOWCASING RESEARCH AT THE ID+CL

In the return of an in-person WSU Showcase week and Showcase for Undergraduate Research and Creative Activities (SURCA) event, three of our amazing research assistants submitted abstracts and created posters to compete in this exposition for undergraduate research. Ailee Simpson received the Gray Award in the category of Arts and Design for her work regarding Luminaire Level Lighting Controls (LLLCs). Congratulations Ailee!

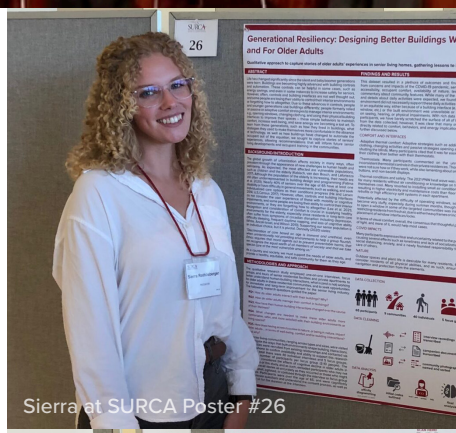
Sierra Rolthisberger and Madison Vance were also successful in their first SURCA experience submitting abstracts and posters in the Humanities and Social Sciences categories respectively. Sierra submitted her research regarding the Senior Living Project discussed below. Madison presented her research regarding learning comprehension in Building Science Courses sponsored by the Smith Teaching and Learning Grant.

Robin Olson, a graduate research scholar of the lab also presented at the faculty, staff, and graduate student showcase poster event, speaking with numerous members of the WSU and regional communities about her specific analysis strategies for the smart strips study. This poster presentation garnered many conversations about energy conservation on and off campus, and how individual impacts add up! Congrats to all of our presenters!

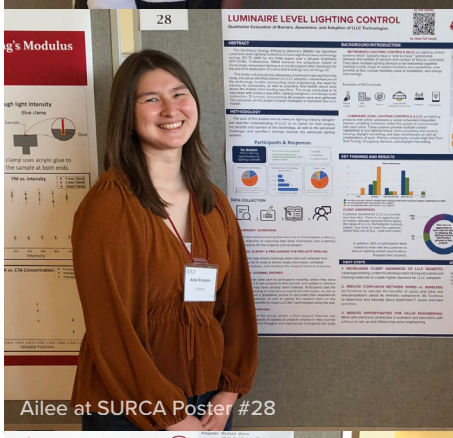
"The SURCA event was an exciting way to share our research with other WSU Alumni and students. I believe that Luminaire Level Lighting Control (LLLC) is an exciting technology that can be a great benefit to building tenants, especially as we find ourselves working indoors more often," - Ailee

"My poster was based on my involvement in our ongoing senior living project, in which 65 interviews were conducted to better understand health and comfort outcomes in the experience of older adults, sponsored by the Granger Cobb Institute for Senior Living and considered for an award at the SURCA showcase. While many of the conversations and details about daily activities were expected, we found that the built environment did not necessarily support those daily activities adequately or in an equitable way, either because of a building interface (e.g. thermostat, window, etc.) or the built environment was unavailable or usable based on seeing, hearing, or physical impairments." - Sierra

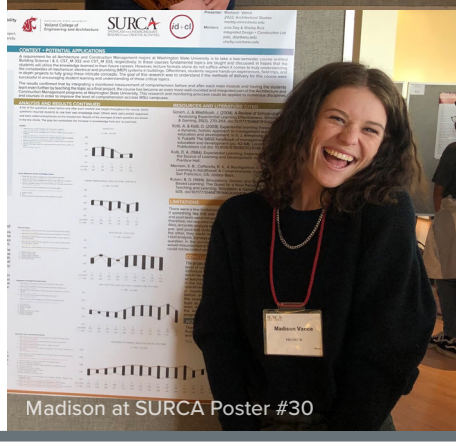
Learn more about each student's abstract



Sierra at SURCA Poster #26



Ailee at SURCA Poster #28



Madison at SURCA Poster #30

WHAT WE HAVE BEEN UP TO IN 2022?


ANNA SKIING


MADISON AND JULIA AT MADDY'S GRADUATION PARTY


AILEE IN SPAIN


ANH KAYAKING IN VIETNAM


SHELBY, MAHMOOD GHASSEMI (SEQUOYAH ELECTRIC), AND JASON PESCHEL AT THE MEP INDUSTRY DINNER AT MACDONALD MILLER'S SEATTLE OFFICE

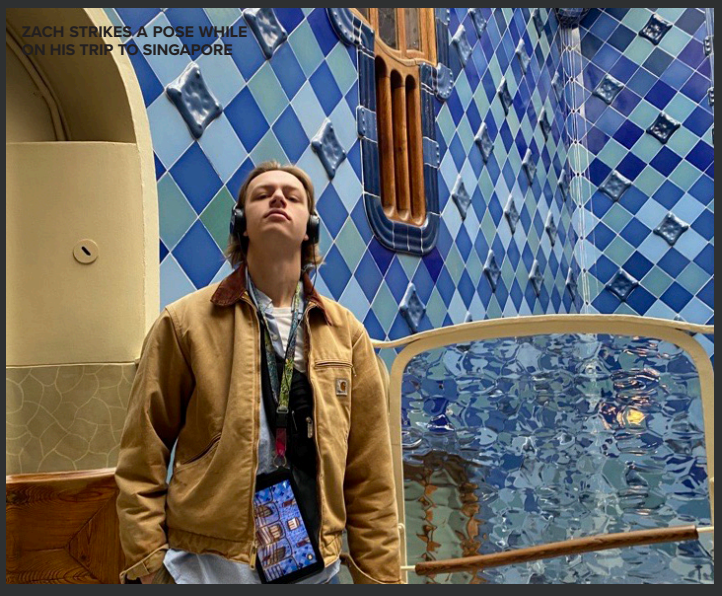

JACOB SKYDIVING


JACOB INSTALLING SPS


SHELBY, JULIA & MARCELLA ON THE BEACH AT ACEEE CONFERENCE


JULIA AND MARCELLA


SIERRA IN CINQUE TERRE, ITALY


ZACH STRIKES A POSE WHILE ON HIS TRIP TO SINGAPORE

SELECTED ID+CL PUBLICATIONS & CONFERENCE PROCEEDINGS

PEER-REVIEWED JOURNAL ARTICLES

Ruiz, S., Day, J. K., Govertsen, K., & Kane, M. (2022). Communication Breakdown: The Disconnect between Building Operators and Occupants. *Energy Research and Social Science,* 91. https://doi.org/10.1016/j.erss.2022.102719

PEER-REVIEWED CONFERENCE PROCEEDINGS / PAPERS

Ruiz, S. & Day, J., Rothlisberger, S. (2022). Re-thinking Building Interface Characteristics in Senior Living Facilities: Equity and Energy. *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings 2022*. Pacific Grove, CA.

Day, J., Ruiz, S., Wilson J.A., Simpson, A. (2022). Qualitative evaluation of barriers, awareness, and adoption of LLLC technologies. *Proceedings of the ACEEE Summer Study on Energy Efficiency in Buildings 2022.* Pacific Grove, CA.

PEER-REVIEWED CONFERENCE ABSTRACTS

Ruiz, S. & Day, J. (Accepted, presenting March 2023). The older I get: Implications of design choices on older adults in senior living communities. Interior Design Educators Council (IDEC) 2023 Annual Conference. Vancouver, British Colombia, Canada.

Ruiz, S. & Day, J. (2022). Capturing Energy Savings Through Tenant Engagement on a University Campus. September 15, 2022. BECC Virtual Webinar Series.

Ruiz, S. & Day, J. (2022). Designing Better Buildings with and For Older Adults: Building Interfaces and Safety in Senior Living Communities. Behavior, Energy & Climate Change Conference (BECC) 2022. Washington D.C. (Presented November 9, 2022)

OTHER LAB PROCEEDINGS/ABSTRACTS

Ruiz, S. (2022) Learning about buildings from older adults: A qualitative study. WSU Academic Showcase. Pullman, WA. (Presented March 24, 2022).

Day, J., Ruiz, S., Olson, R. (2022) Smart power strips feasibility: Testing applications of advanced power management at university office workstations. WSU Academic Showcase. Pullman, WA. (Presented March 24, 2022).

Vance, M. (2022) Measuring Comprehension of Building Science Students. WSU Showcase for Undergraduate Research and Creative Activities (SURCA). Pullman, WA. (Presented March 28, 2022).

Rothlisberger, S. (2022) Generational Resiliency: Designing Better Buildings With and For Older Adults. WSU Showcase for Undergraduate Research and Creative Activities (SURCA). Pullman, WA. (Presented March 28, 2022).

Simpson, A. (2022) Luminaire Level Lighting Control. WSU Showcase for Undergraduate Research and Creative Activities (SURCA). Pullman, WA. (Presented March 28, 2022).

TECHNICAL REPORTS

Colligan, Z., Ruiz, S., Day, J. (January 2023) WSU Energy and Comfort at WSU Fall 2022 Summary Report: Reducing Building Energy Use Through Tenant Engagement Pilot Study, Integrated Design + Construction Lab, Washington State University, Pullman, WA.

Ruiz, S., Day, J., Colligan, Z. (July 2022) Final Report on Year 2: Reducing Building Energy Use Through Tenant Engagement Pilot Study, Integrated Design + Construction Lab, Washington State University, Pullman, WA.

Ruiz, S., Rothlisberger, S., Day, J. (March 2022) Generational Resiliency: Learning from and Designing Better Buildings with and for Older Adults, Pilot study report prepared for the Granger Cobb Institute for Senior Living. Integrated Design + Construction Lab, Washington State University, Pullman, WA.

SUPPORT US

Are you or your company interested in sponsoring a study or pursuing new avenues of research?

Your support could help drive significant and timely change in the built environment. Our team targets cutting edge interdisciplinary research to advance building energy savings and occupant comfort through market transformation, education, and innovation.

To begin a partnership or discuss potential projects, please email the ID+CL Director at julia_day@wsu.edu.

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