



**CLEAN ENERGY  
INSTITUTE**

UNIVERSITY *of* WASHINGTON



# **Annual Report**

**July 1, 2022 –  
June 30, 2023**

# Letter from CEI's Director

Dear friends of CEI,

I'm proud to report that the Clean Energy Institute continues to grow its impact in research, education, community engagement, and innovation to advance solutions for climate change.

This year, we welcomed new member and affiliate faculty from the College of Built Environments and the College of the Environment. CEI faculty currently contribute to six federal research centers with a total of \$148.7 million in funding from the U.S. Department of Energy (DOE) and the National Science Foundation (NSF).

New state funding enabled CEI to award a record 39 Graduate Fellowships and recruit four distinguished postdoctoral researchers from leading U.S. research universities and national labs. CEI education staff and Graduate Fellows were also able to engage more K-14 students this year than ever before.

This new state funding also enabled CEI to establish its Community Engagement Testbed to meet the energy resiliency, economic, and sovereignty needs of energy-burdened communities.

Recent federal and state policies are funding clean energy deployments at unprecedented levels, and while 35 to 40% of these investments are earmarked for disadvantaged communities, pursuing and executing infrastructure grants requires science and engineering expertise.

As a third party to communities and government with that expertise, CEI is uniquely positioned to support community clean energy research and deployment projects across Washington state.

CEI's first Community Engagement Testbed projects were executed in 2023:

- UW Engineering seniors worked with the Jamestown S'Klallam Tribe, Jefferson County Emergency Management, and the Clallam County Sheriff's Office to explore and develop tailored energy resilience designs.

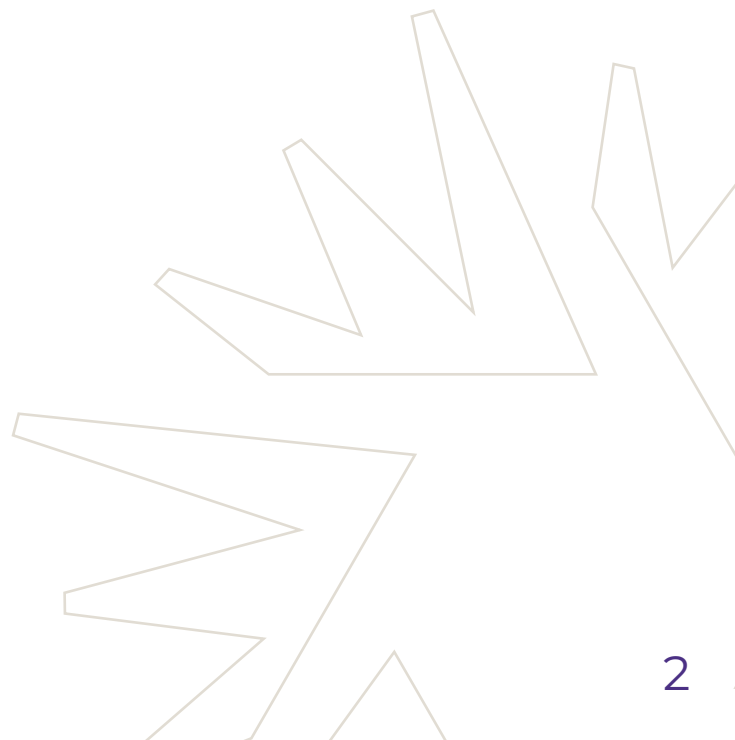


- Washington Clean Energy Testbeds staff scientists analyzed solar-storage microgrid design options with the Yakama Nation Housing Authority.
- CEI supported co-designed research by Front and Centered, a statewide coalition of communities of color-led groups, and UW civil engineers to understand air quality and health impacts on communities burdened by traditional energy.

I am deeply inspired by the enthusiasm of UW students, faculty, and staff for these opportunities to serve. They recognize what state and federal governments have now written into law: that there is an inextricable link between developing climate technologies and achieving climate justice. This intersection is where the Community Engagement Testbed operates, and I'm eager to strengthen our campus partnerships in pursuit of holistic, thoughtful solutions for Washington and the world.

Thank you for your continued support,

Daniel T. Schwartz





# TABLE OF CONTENTS

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ABOUT CEI.....4

RESEARCH.....8

EDUCATION.....17

COMMUNITY ENGAGEMENT.....26

FACILITIES.....29

EXPENDITURES.....34

APPENDIX.....35





# ABOUT CEI

## MISSION

The University of Washington (UW) [Clean Energy Institute's](#) (CEI) mission is to accelerate the adoption of a scalable and equitable clean energy future that will improve the health and economy of our state, nation, and world. To accomplish this, CEI supports the advancement of next-generation solar energy and battery materials and devices, as well as their integration with systems and the grid. CEI creates the ideas and educates the people needed to generate these innovations, while facilitating the pathways to bring them to market.

CEI supports students, faculty, and partners through [basic and translational research support](#), [education and community engagement programs](#), and access to [world-class facilities](#).

## LEADERSHIP & MANAGEMENT

Established in 2013 with support from the state of Washington, CEI is led by director [Daniel T. Schwartz](#), Boeing-Sutter Professor of Chemical Engineering, chief scientist [David Ginger](#), B. Seymour Rabinovitch Endowed Chair in Chemistry, and administrator Amanda McCracken-Roberts.

In 2017, CEI launched the [Washington Clean Energy Testbeds](#), an open-access facility for prototyping, testing, and scaling climate technologies. Testbeds operations are overseen by Testbeds technical director [J. Devin MacKenzie](#), Washington Research Foundation Associate Professor of Clean Energy, Mechanical Engineering and Materials Science & Engineering, and Testbeds managing director Michael B. Pomfret, Ph.D.

CEI is advised by a UW Trainee and Faculty Advisory Board (TFAB), including two Trainee Advisory Representatives and nine faculty; and an external Technical Advisory Council (TAC) of prominent members of the Pacific Northwest clean energy community.

CEI staff, facilities, and finances are managed by the Collaboration Core, a shared services unit in the College of Engineering.

# FACULTY & STUDENTS

CEI's 37 Member Faculty are the core scholars who help define and implement the Institute's energy science and engineering research and educational programs. CEI Member Faculty status is conferred by vote of the TFAB. CEI also has 30 Affiliate Member Faculty who broaden and enrich the institute's research and educational programs. UW faculty interested in joining CEI as an Affiliate Member are invited to apply through the CEI website, with applications reviewed on an as-received basis.

CEI programs support approximately 100 UW graduate students each year, including funding doctoral research, training students in the interdisciplinary Energy Materials, Devices, and Systems lab course, and supporting opportunities to work alongside K-12 schools, investors, and public policy stakeholders. CEI programs are open to all UW students that meet requirements specified in each program, not just those whose advisors are CEI Member Faculty or Affiliate Member Faculty.

CEI-affiliated academic personnel and students are formally managed through their appointing department.

## FACULTY RECOGNITION



**Kai-Mei Fu**

Virginia and Prentice  
Bloedel Professorship



**Xiaosong Li**

Larry R. Dalton Endowed  
Chair in Chemistry



**Dianne Xiao**

Klaus and Mary Ann  
Saegebarth Endowed  
Professorship

## Professional Societies & Journals

- Kai-Mei Fu: [Optica Fellow](#)
- David Ginger: [Materials Research Society Fellow](#)
- Daniel Kirschen: [Editor in chief of new IEEE journal, "Transactions on Energy Markets, Policy and Regulation"](#)
- Xiaosong Li: [Washington State Academy of Sciences](#)
- Lilo Pozzo: [Neutron Scattering Society of America Anne Mayes Award](#)
- Alexandra Velian: [AAAS Marion Milligan Mason Award, Chemical & Engineering News Talented 12](#)
- Dianne Xiao: [Packard Fellow](#)
- Jihui Yang: [Washington State Academy of Sciences](#)

## 2023 Scientific Achievement Award

Each year, CEI recognizes a graduate student who has demonstrated extraordinary productivity in clean energy research and scholarship and contributed meaningfully to the scientific community.



**John Cenker** (Physics, advised by Xiaodong Xu), a 2021-22 CEI Graduate Fellow, received a 2023 Clean Energy Scientific Achievement Award for his work to advance 2D materials, including the invention of a new technique using mechanical tension to manipulate magnetic phases in 2D semiconductors. After completing his Ph.D., Cenker will continue his research as a postdoc at Columbia University and its U.S. DOE Center for Programmable Quantum Materials (Pro-QM), which includes the UW as a partner with Professor Xu leading the UW thrust.



**Margherita Taddei** (Chemistry, advised by David Ginger), a 2020-21 CEI Graduate Fellow, received a 2023 Clean Energy Scientific Achievement Award for advancing thin-film halide perovskite materials suitable for tandem solar photovoltaic (PV) cells. Taddei demonstrated a method of homogenizing and stabilizing perovskite materials by adding a common industrial precursor, ethylenediamine. Her “recipe” achieved a record open-circuit voltage for tandem-suitable perovskites and was stable for over 100 days, a critical barrier to commercializing perovskite PV.

## 2023 Outreach & Service Award

Each year, CEI recognizes a graduate student who has demonstrated dedication and creativity when communicating STEM to a variety of audiences.



**Leo Zasada** (Chemistry, advised by Dianne Xiao) received the 2023 Clean Energy Outreach & Service Award for his development of the Science Outreach & Policy for Adults (SOPA) program. As a 2020-21 CEI Graduate Fellow, he noticed that STEM outreach often excluded older audiences. With help from UW graduate student volunteers, Zasada developed educational content related to CEI research and delivered the first series of seminars at Seattle-area senior and community centers. Seminar topics included: solar energy and solar panels; electric vehicles and battery science; light-emitting technologies and optoelectronics; and plastics, microplastics, and pollution.

# TRAINEE RECOGNITION

## National Science Foundation Graduate Research Fellowship

Rachel Tenney (Chemistry, advised by Daniel Gamelin)

## UW CoMotion Postdoctoral Entrepreneur

Dr. Sarah Pristash — Apex Solar Conversions

(Ph.D. Chemistry '22, advised by Cody Schlenker; '20-21 Torrance Science Policy Analyst)

## UW CoMotion Innovation Gap Fund Award

Dr. Oliver Nakano-Baker — Odo Labs

(Ph.D. MSE '22, advised by Devin MacKenzie; '19-20 CEI Graduate Fellow)

## UW Husky 100

Tharindu Fernando (Physics, advised by Ting Cao; 21-22 CEI Graduate Fellow)

Rahoul Banerjee Ghosh '24 (Chemistry; research with David Ginger and Xiaosong Li)

## UW Mary Gates Research Scholarship

Rahoul Banerjee Ghosh

## Renewable Energy Scholarship Foundation Award

William Heins '24 (ChemE; worked at Testbeds, now Group14)

Rahoul Banerjee Ghosh

Anthony Gironda (MSE, advised by Jerry Seidler; '22-23 CEI Graduate Fellow)

Alexis Glaudin (Chemistry, advised by Cody Schlenker)

Seancarlos Gonzalez (ChemE, advised by David Bergsman; '22-23 CEI Graduate Fellow)

Ashe Kamin (Chemistry, advised by Dianne Xiao; '21-22 CEI Graduate Fellow)

Eden Tzanetopolous (Chemistry, advised by Daniel Gamelin; '21-22 CEI Graduate Fellow)

Sophia Votava '23 (ECE; senior capstone via Community Engagement Testbed)

*Honorable mention:* Andrei Draguicevic

(Chemistry, advised by Alexandra Velian; '22-23 CEI Graduate Fellow)

## Washington Research Foundation Postdoctoral Fellow

Dr. Richard Lee (Ph.D. MSE '22, advised by Devin MacKenzie)

Dr. Sarah Pristash



# RESEARCH

## OVERVIEW

CEI scientists and engineers are discovering new materials for more efficient, more easily-manufactured solar cells; designing new batteries that can safely power all forms of transportation or back up the electrical grid; and modernizing electrical grids with sophisticated information technology to accommodate new sources of power. Broadly, CEI research can be categorized within solar energy, energy storage, smart grids and systems integration, and advanced materials and basic science.

As an interdisciplinary institute, CEI enables UW faculty in several departments to leverage a range of research expertise, educational programs, and open-access, low-cost user facilities to attract federal grant support. CEI also serves as an experimental platform for UW faculty to develop new educational methods and facilities that support CEI's goals in education and training.

In 2022-23, CEI faculty led federal research centers and consortia with a total of \$148.7 million in federal funding. The Molecular Engineering Materials Center (MEM-C) was renewed by the National Science Foundation for \$18M over six years, while the Center for Science of Synthesis across Scales (CSSAS) and Center for Programmable Quantum Materials (Pro-QM) each received \$12.6M, four-year extensions from the U.S. Department of Energy.

CEI also launched the Distinguished Postdoctoral Fellowship in 2023, recruiting four recent Ph.D. graduates from leading U.S. research universities and national labs to advance CEI's mission in clean energy research and community engagement.



UW students investigate clean energy across disciplines in the Research Training Testbed.

# RESEARCH CENTERS

Led by CEI Member Faculty, these federally-funded research centers support a range of interdisciplinary activities under a major, cross-cutting research goal. These multi-institutional collaboratives typically include multiple R1 universities, startups and major corporations, and national laboratories.

## Battery500 Consortium

### The Innovation Center for Battery500 Consortium

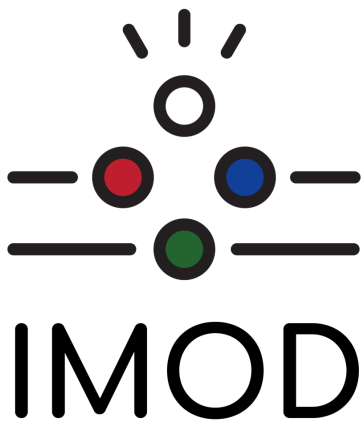
(Battery500) was established in 2016 by the U.S.

Department of Energy (DOE) Vehicle Technologies Office (VTO) with an initial \$50M grant over five years, and extended in 2021 with another \$75M over five years. Led by PNNL, Battery500 includes battery

experts from UW, three additional national labs, and

four universities, with IBM as an advisory board member. Battery500 aims to develop next-generation electric vehicle batteries with a target energy density of 500 watt-hours per kilogram, a lifetime of 1,000 cycles, and a cost of less than \$100 per kilowatt.

Battery500 director Jun Liu joined UW in 2019, and is now a CEI Member Faculty, the Washington Research Foundation Innovation Chair in Clean Energy, the Campbell Chair Professor of Materials Science & Engineering, and a professor of chemical engineering at UW while maintaining a Battelle Fellowship at PNNL.



## Center for Integration of Modern Optoelectronic Materials on Demand

The Center for Integration of Modern Optoelectronic Materials on Demand (IMOD) was established in September 2021 under a five-year, \$25 million Science and Technology Center (STC) grant from the National Science Foundation (NSF). The 11-university research collaborative is led by UW and directed by CEI chief scientist David Ginger. IMOD research centers on new semiconductor materials and scalable manufacturing processes for new optoelectronic devices. Applications of IMOD research range from displays and sensors to a technological revolution, under development today, that is based on harnessing the principles of quantum mechanics.

## Molecular Engineering Materials Center

[The UW Molecular Engineering Materials Center](#) (MEM-C), an NSF Materials Research Science and Engineering Center (MRSEC), is led by chemistry professor [Daniel Gamelin](#). MEM-C was established in September 2017 with an initial \$15.6M in funding over six years and was renewed by NSF in 2022 with \$18M over another six years. MEM-C coordinates materials research between two colleges and five departments at UW and PNNL to address major trans-disciplinary challenges in materials research. Interdisciplinary research groups explore engineering defects in nanostructures for information processing, sensing, energy, and research tools, and the quantum properties of atomically layered materials.



## U.S. Manufacturing of Advanced Perovskites Consortium



The [U.S. Manufacturing of Advanced Perovskites Consortium](#) (US-MAP) includes UW and its [Washington Clean Energy Testbeds](#) (see "Facilities"), the University of North Carolina at Chapel Hill, the

University of Toledo, the National Renewable Energy Laboratory (NREL), UW Chemistry spinout BlueDot Photonics, and other leading domestic solar companies. US-MAP was established [in May 2020](#) with the aim of accelerating the domestic commercialization of perovskite technologies. As a founding organizer, UW and the Testbeds serve on the US-MAP executive board and oversee delivery of projects. In April 2021, DOE's Solar Energy Technologies Office (SETO) [awarded \\$7.5M to two US-MAP projects](#) that leveraged the Testbeds in their proposals: \$2.5M to First Solar to develop a cost-competitive, high-yield, high-throughput manufacturing process for a 3,600 cm<sup>2</sup> solar cell with 22% power conversion efficiency (comparable to conventional silicon-based PV); and \$5M to a consortium that includes UW and NREL to establish the Center for Heuristic Evaluation of Emerging Technology Advancement (CHEETA), part of a joint perovskite bankability center led by Sandia National Laboratories.

## Center for Programmable Quantum Materials

The [Center for Programmable Quantum Materials](#) (Pro-QM) is a U.S. DOE Energy Frontiers Research Center (EFRC) housed at Columbia University in partnership with the UW. Pro-QM aims to advance quantum technologies that could one day revolutionize information transfer, processing, sensing, and other currently unimagined functions.



Pro-QM research is organized across two scientific “thrusts” and two fabrication and characterization “themes.” UW physics and MSE professor Xiaodong Xu leads the thrust on programmable topology while assistant professor of chemistry Alexandra Velian leads the material design and heterostructure engineering Theme. Pro-QM also includes UW professors Jiun-Haw Chu, David Cobden, Di Xiao, and Matt Yankowitz, along with partners at the Brookhaven National Laboratory.

In August 2022, [Pro-QM was renewed by DOE with an additional four-year, \\$12.6M grant.](#)

## Northwest Institute for Materials Physics, Chemistry, and Technology



The [Northwest Institute for Materials Physics, Chemistry, and Technology](#) (NW IMPACT) is a joint UW-PNNL research initiative aiming to advance research within the Pacific Northwest region in the science of making materials, and to educate the next generation of chemists, physicists, and engineers in materials science.

This year, it successfully renewed its Center for the Science of Synthesis Across Scales (CSSAS), a DOE EFRC housed at the UW and led by ChemE professor François Baneyx and PNNL’s Dr. Jim De Yoreo, a CEI Member Faculty who holds UW affiliate professorships in chemistry and MSE. [CSSAS received a \\$12.6M, four-year extension from DOE](#) in August 2022.



## DISTINGUISHED POSTDOCTORAL FELLOWS

In order to support innovation to accelerate a carbon-neutral economy and to promote the equitable deployment of clean energy solutions, CEI established the Distinguished Postdoctoral Fellowship in 2023 with support from the state of Washington.



**Zixiao Ma** joined the UW after completing his Ph.D. in electrical & computer engineering at Iowa State University. His research focuses on the development of machine learning-based, safety-critical controls for renewable energy-dominated microgrids. At the UW, Ma works with ECE professor Baosen Zhang, whose group focuses on control theory, machine learning, and power systems.



**Chris Torres** earned his Ph.D. in chemical & biochemical engineering from the University of Illinois Urbana-Champaign. He is an Alfred P. Sloan Scholar and an NSF Graduate Research Fellow. At the UW, he works with ChemE assistant professor Julie Rorrer, continuing his research into sustainable catalysis while also developing self-sustainable community outreach programs to advance under-represented Black, Hispanic, and Indigenous (BHI) populations.



**Rebecca Vincent** earned her Ph.D. in Materials at the University of California-Santa Barbara, where she was an NSF Graduate Research Fellow. At the UW, she is co-advised by CEI director and ChemE professor Dan Schwartz and ChemE professor Lilo Pozzo as she develops non-destructive diagnostics for EV batteries and grid storage systems. She also collaborates closely with Dr. Jie Xiao, the leader of PNNL's Advanced Battery Fabrication National Lab and a major contributor to Battery500.



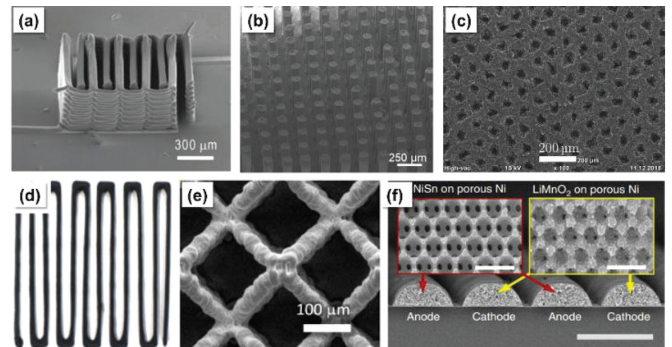
**Rachel Woods-Robinson** joined the UW after conducting postdoctoral research at the Lawrence Berkeley National Lab. She received her Ph.D. in Applied Science & Technology with a focus on Materials Physics from the University of California-Berkeley on a Chancellor's Research Fellowship and an NSF Graduate Research Fellowship. At the UW, she researches life cycle assessments of emerging PV technologies, co-advised by CEI chief scientist and chemistry professor David Ginger; Testbeds technical director and associate professor of MSE and ME J. Devin Mackenzie, and Alberta "Birdie" Carpenter, who leads strategic analysis efforts at the National Renewable Energy Lab. She works closely with partners in the US-MAP Consortium.

# RESEARCH HIGHLIGHTS

## Are Three-Dimensional Batteries Beneficial? Analyzing Historical Data to Elucidate Performance Advantages | ACS Energy Letters

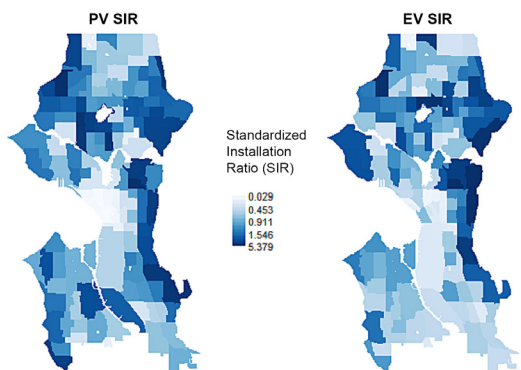
Conventional lithium-ion batteries are composed of stacks of anodes, cathodes, and separators, all immersed in electrolyte and sandwiched between current collectors. Increasing the thickness of the electrodes increases storage capacity but slows down charging and discharging, so battery engineers are exploring 3-dimensional architectures to add more material and more surface area. In *ACS Energy Letters*, CEI Graduate Fellow [Chih-Hsuan Hung](#) (mechanical engineering),

Phong Huynh, Katrina Teo, and WRF Innovation Professor of Clean Energy [Corie L. Cobb](#) computationally analyze experimental publications on Li-ion batteries with 3-dimensional electrode architecture over the past 20 years. The authors find that 3D Li-ion batteries exhibit better rate capabilities down to micron-scale feature sizes, confirming their expected performance benefit. The authors excluded batteries with nanoscale 3D architectures as the increased surface area makes them more susceptible to side reactions. The authors state that 3D Li-ion batteries are suitable for a range of applications including electric vehicles, and that devices based on similar principles to batteries such as hydrogen fuel cells could benefit from this insight.



Experimental images of 3D Li-ion batteries with various architectures, analyzed by Hung et. al.

## Clean energy justice: Different adoption characteristics of underserved communities in rooftop solar and electric vehicle chargers in Seattle | Energy Research & Social Science



Seattle census tracts with higher rates of single-family home ownership adopt distributed energy resources more frequently.

In *Energy Research & Social Science*, CEI Graduate Fellow [Yohan Min](#) analyzes rooftop solar and EV charger installation permit records from the City of Seattle's open data portal from 2003 to 2019. Min and coauthors find that rooftop solar and EVs are concentrated in particular communities, with housing and economic variables most strongly associated with adoption rates. The study suggests that housing-related support may increase the adoption of both technologies, and that distributed energy resource policy should be tailored to local community characteristics.

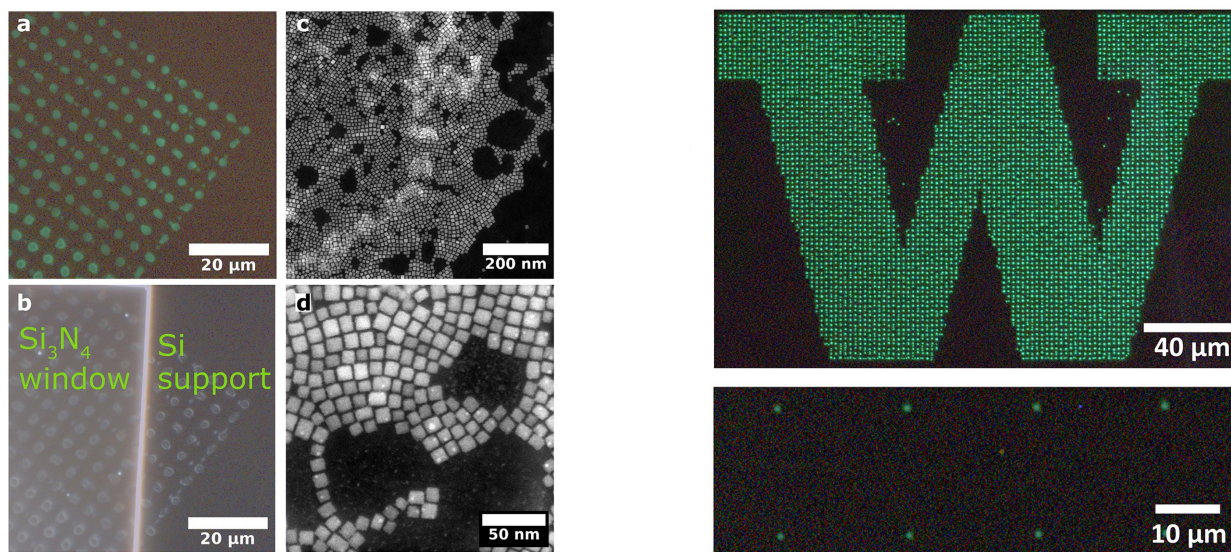


## Design Rules for Obtaining Narrow Luminescence from Semiconductors Made in Solution | Chemical Reviews

Solution-processed semiconductors are in demand for present and next-generation optoelectronic technologies because of their scalability and ease of integration into devices with diverse form factors. In *Chemical Reviews*, researchers from the NSF [Center for Integrating Modern Optoelectronics on Demand](#) (IMOD) led by CEI faculty member and chemistry professor [Brandi Cossairt](#) elucidate guidelines for synthesizing solution-processed semiconductors. The IMOD team first examines requirements for colloidal emitters in devices including displays and light-emitting diodes, photodetectors, lasers, and quantum information. The researchers then compare the current state of the art across different classes of colloidal emitters: quantum dots, perovskite nanocrystals, 2D structures, and organic molecules. The review concludes by suggesting directions for future research, including techniques to homogenize crystal growth, select for size after synthesis, control the interfacial chemistry between solution and nanoparticle, and to fine-tune photonic properties of perovskites by swapping out organic molecules that determine the spacing of the crystal structure.

## Direct Patterning of Perovskite Nanocrystals on Nanophotonic Cavities with Electrohydrodynamic Inkjet Printing | Nano Letters

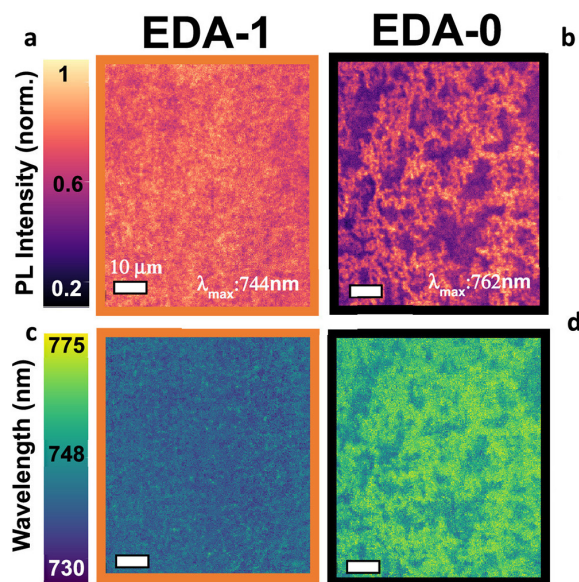
Inkjet printing has been adapted for advanced materials and devices: it is a rapid, additive method of placing droplets of a material into any arbitrary pattern with almost no material waste. However, resolutions are limited to tens of micrometers, which is less precise than is needed for photonic devices. Smaller printed features can be generated with electrohydrodynamic (EHD) inkjet printing, controlling the droplets with an electric field applied from the print nozzle. In this paper in *Nano Letters*, CEI Graduate Fellow [Ted Cohen](#) (Molecular Engineering) and coauthors demonstrate EHD inkjet printing of luminescent nanomaterials with sub-micrometer precision.



Microscope images of inkjet-printed CsPbBr<sub>3</sub> nanoparticles.

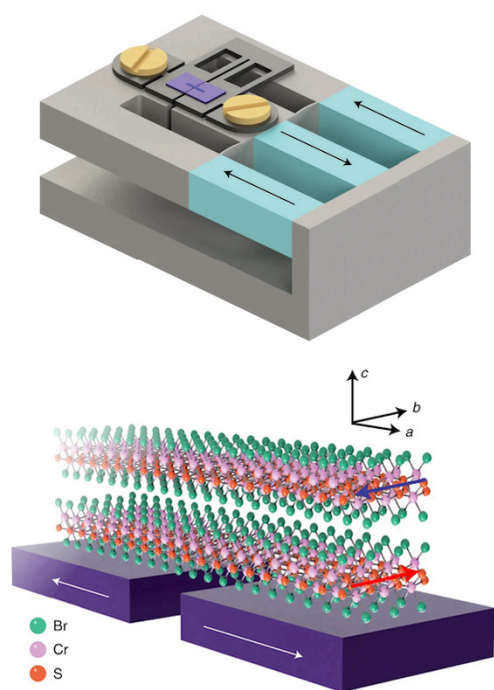
## Ethylenediamine Addition Improves Performance and Suppresses Phase Instabilities in Mixed-Halide Perovskites | ACS Energy Letters

Authored by CEI Graduate Fellow and chemistry Ph.D. candidate [Margherita Taddei](#), this *ACS Energy Letters* paper describes a new “recipe” for mixed-halide perovskites. With versatile opto-electronic and physical properties and inexpensive manufacturing costs, perovskites have the potential to revolutionize solar photovoltaics with flexible cells or thin-film coatings to boost efficiencies. Perovskite PV conversion efficiencies are gradually approaching those of conventional silicon, but long-term stability remains a barrier to widespread commercialization. By introducing ethylenediamine, a common chemical often used as a precursor in industrial synthesis, Taddei achieved a record open-circuit voltage for perovskites suitable for silicon-tandem cells, and stability over 100 days.



Photoluminescence of mixed-halide perovskites is more homogenous when ethylenediamine is added (a,c).

## Generation of large strains in 2D van der Waals materials at cryogenic temperatures | Nature Reviews Physics



Schematic of Cenker's device for applying strain to 2D materials.

This single-author paper in *Nature Reviews Physics* by [John Cenker](#), a Ph.D. candidate in physics and a CEI Graduate Fellow, describes the invention of a mechanical strain device for 2D materials. The 2D material chromium sulfide bromide (CrSBr) is an antiferromagnet, a type of magnetic material with the spins of its electrons aligned opposite to those of their neighbors, producing a net zero effect. But when Cenker applied physical tension to the CrSBr, he observed that the spins of the electrons within the material aligned to produce the familiar ferromagnetism — and reverted back when the tension was eased. Harnessing full control of the spins of electrons within semiconductors would mean information could be represented without having to move charge-carrying particles through physical features on a chip, a fundamental concept underpinning modern electrical and computer engineering.



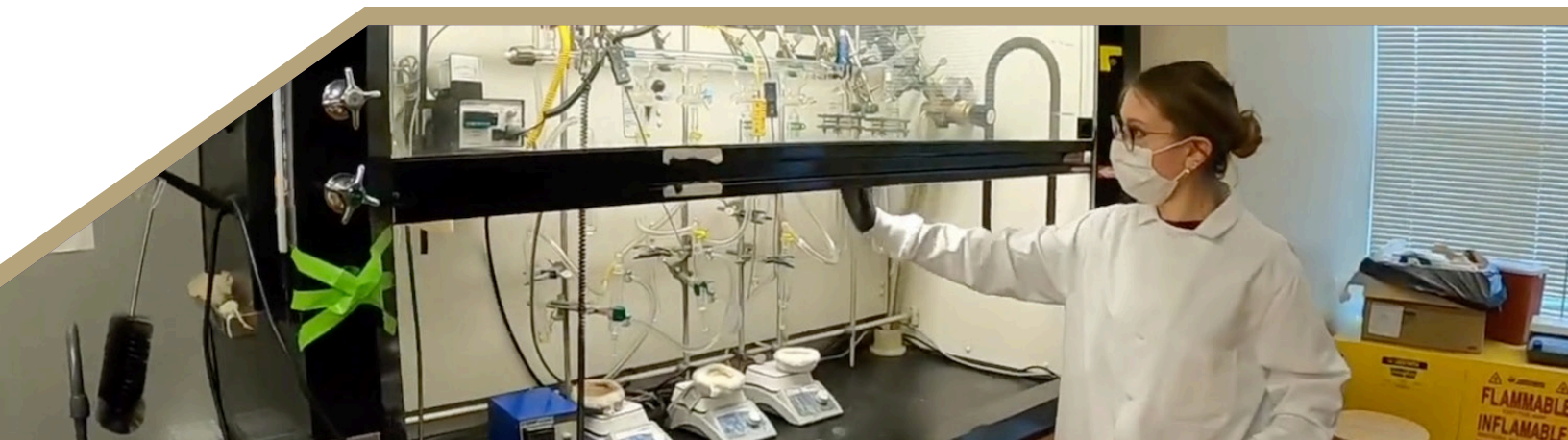
# EDUCATION

## OVERVIEW

Education is at the core of CEI's mission. CEI helps inspire, recruit, train, and support the next generation of clean energy leaders and innovators through unique education, outreach, and research training programs. These programs serve graduate, undergraduate and K-12 students, K-12 and community college teachers, and the general public. CEI's programs seek to expand participation in STEM by making STEM study and STEM careers more attractive and more attainable for a broader cross-section of the US population.

CEI's signature program for UW graduate students, the CEI Graduate Fellowship, directly funds UW Ph.D. students to explore new directions in clean energy research, while providing opportunities for career development and community engagement. Additional programs for UW graduate and undergraduate students provide interdisciplinary clean energy training as well as specialized opportunities in K-12 STEM education, public policy, and climate tech innovation.

CEI also provides undergraduate students from other universities as well as local community, tribal, and technical college instructors with opportunities to perform clean energy research in a UW lab over the summer. Several of these summer undergraduate researchers have later transferred to UW to complete their bachelor's degree or have been accepted to UW graduate programs.



Taddei showing off wet lab synthesis in the Ginger research group.

“ I came to the UW to apply my background in photochemistry and nanomaterials to solutions for climate change, and I am grateful for CEI's support for my research and opportunities for career development. But moreover, I'm motivated by this community of clean energy scholars! ”

-- 2021-22 CEI Graduate Fellow Margherita Taddei,  
a Fulbright Scholar from Italy pursuing her Ph.D. in chemistry

# CEI GRADUATE FELLOWSHIP

The [CEI Graduate Fellowship](#) funds up to two quarters of clean energy research for 20-30 UW doctoral students each academic year, while providing interdisciplinary training via research seminars, science communication projects, K-12 outreach activities, climate tech networking events, industry field trips, and lab tours. CEI has awarded over 200 Fellowships since 2013. After earning Ph.D.s at the UW, CEI Graduate Fellows have pursued careers in the climate tech industry, U.S. universities, think tanks and other nonprofits, and federally-funded research labs.

## 2022 - 2023 CEI Graduate Fellows

### *Chemical Engineering*

- Yuri Choe
- Seancarlos Gonzalez
- Yuefan Ji
- Nisarg Joshi
- Rose Lee
- Maria Politi
- Sage Scheiwiller
- Zachery Wylie

### *Chemistry*

- Tyson Carr
- Matthew Chang
- Hannah Contreras
- Andrei Draguicevic
- Mercie Hodges
- Phuong Le
- Adelaide Levenson
- Ben Link
- Xiaolin Liu
- Ben Mitchell
- Hao Nguyen
- Emily Nishiwaki
- Meredith Pomfret
- Michael Riehs
- Gillian Shen
- Thom Snoeren
- Rachel Tenney

### *Electrical & Computer Engineering (ECE)*

- Aaron Gehrke
- Rose Johnson
- Dan Strum

### *Materials Science & Engineering (MSE)*

- Anthony Gironda
- Xuetao Ma

### *Mechanical Engineering (ME)*

- Kristina Gill
- Zachary Lewandowski

### *Molecular Engineering*

- Yangwei Shi

### *Physics*

- Jared Abramson
- Jonathan DeStefano
- Eric Lester
- Heonjoon Park
- Chun-Chih Tseng
- Jiayi Zhu

“ As an undergrad, I was curious about new materials for energy applications, and it’s not uncommon for graduate students to lose sight of that when immersed in their research. The Graduate Fellowship reminded me of the big picture, and inspired me to think outside the box. It was also gratifying to engage young students with science! ”

-- John Cenker, 2021-22 CEI Graduate Fellow

## EDUCATION & TRAINING FELLOWSHIP

CEI [Education & Training Fellows](#) (ETFs) work closely with CEI’s education staff for two to four academic quarters to develop outreach activities, displays, and curricula for K-12 classrooms. They also arrange logistics and recruit CEI student volunteers for school outreach visits and other educational events.

### 2022 - 2023 Education & Training Fellows



**Jacob Finney**

Chemistry



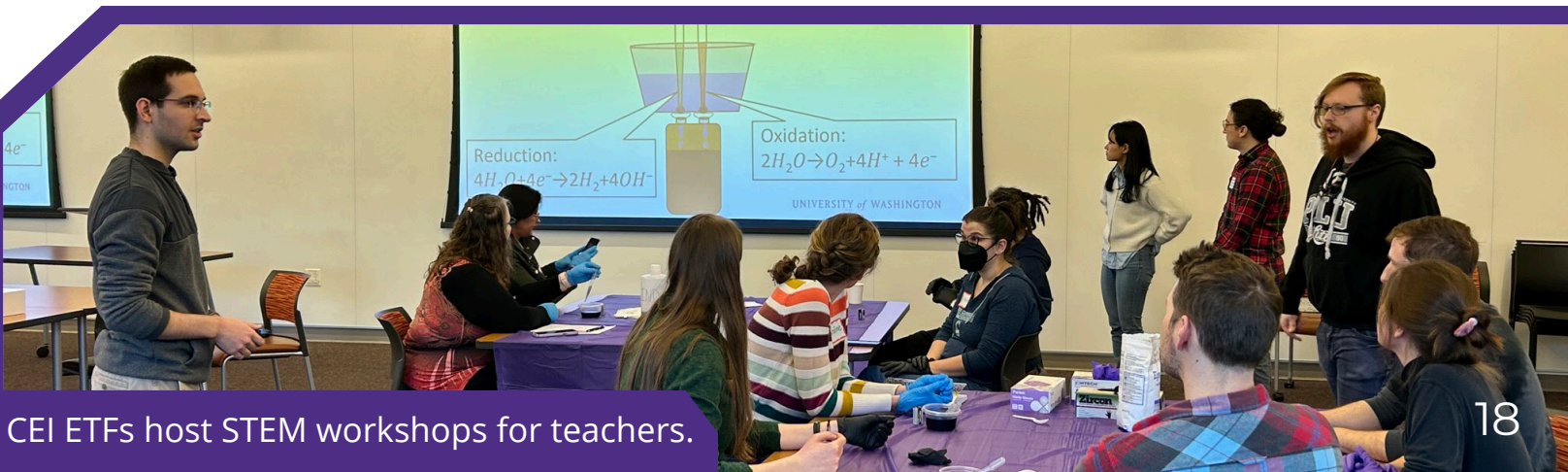
**Miguel González**

Civil & Environmental Engineering  
2021-22 CEI Graduate Fellow



**Ricardo Rivera-Maldonado**

Chemistry  
2021-22 CEI Graduate Fellow



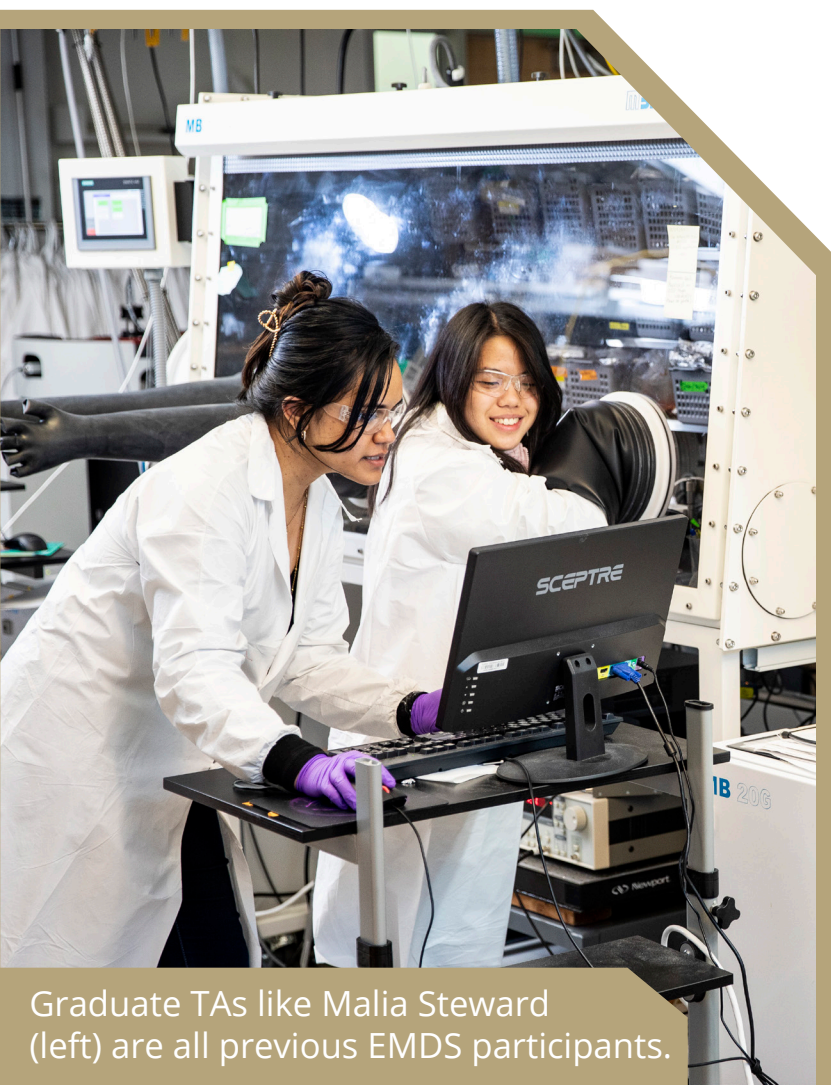
CEI ETFs host STEM workshops for teachers.



# INTERDISCIPLINARY ENERGY LAB COURSE

Each year, the Energy Materials, Devices & Systems (EMDS) course provides 30 upper-division undergraduates and graduate students with project-based training on materials for energy generation and storage, and the integration of renewables into energy systems. EMDS is cross-listed in Chemistry, Chemical Engineering, and Materials Science & Engineering, but the course educates students from across the College of Arts & Sciences and College of Engineering. EMDS students learn a wide breadth of energy research techniques including:

- Nanoparticle synthesis and characterization (CdSe quantum dots)
- Solar photochemistry – hydrogen fuel production
- Batteries – fabrication and testing of Li-ion coin cell with carbon electrodes
- Photovoltaics – third generation solar cell fabrication and characterization (organic-PVs and perovskites)
- Semiconductor properties – 2D material fabrication and testing
- Grid simulation



“It’s exciting to see how the students react to their first exposure to measuring a solar cell after they fabricate them by hand. Because the students are from various disciplines, they ask questions based on their understanding and knowledge upon analyzing the data. I respond in a way to answer their questions that makes sense to them, and our collaboration also helps me to look at my own research from a different perspective.”

— *EMDS TA Malia Steward,  
a Ph.D. student in  
mechanical engineering*

Graduate TAs like Malia Steward (left) are all previous EMDS participants.



# ADVANCED EXPERIENCE PROGRAM

The [Advanced Experience Program in Clean Energy](#) (AXP), created through the generous support of the [Mark Torrance Foundation](#), provides opportunities for UW doctoral students in STEM to apply their knowledge to support decision makers in clean energy investing and science policy. AXP is designed to be a flexible, 20-hour time commitment to complement each student's Ph.D. training and longer-term professional development. Torrance Tech Due Diligence analysts evaluate emerging climate technologies for the Seattle-area angel investing group E8; while Torrance Science Policy analysts prepare science and engineering briefs for policymakers with the Washington State Academy of Sciences. AXP has supported 55 Tech Due Diligence trainees since the 2017-18 academic year, along with 21 Science Policy Analysis trainees since 2020-21.

## Trainee Testimonials

"[The Tech Due Diligence track] was a good opportunity to learn from both sides—how to perform due diligence and also how to pitch as a startup."

"Because of this fellowship, I heard about a policy conference happening on the Olympic Peninsula that I had the opportunity to attend. This intensely improved my professional development because I was able to meet and converse face-to-face to a variety of working professionals in technical and policy fields. Not only did I feel that the project I explored through the fellowship was validated through this experience, but I also learned about various career paths speaking to the science-focused attendees."



2022-23 Torrance Science Policy Analysts Rose Johnson, Anthony Gironda, Justin Pothoof, and Trey Pichon (left to right) with CEI director Dan Schwartz (2nd from left) and WSAS executive director Donna Riordan (far right).

## TRAVEL GRANTS

CEI Travel Grants cover up to \$1,500 in expenses for UW students conducting research in CEI-related areas to present their work at conferences — an ideal opportunity to apply science communication and networking skills. CEI made 29 travel grants in 2022-23 for a total of 229 since the program was established, averaging roughly 31 in years where travel was not restricted by COVID-19.

# SUMMER RESEARCH EXPERIENCES FOR UNDERGRADUATES & TEACHERS

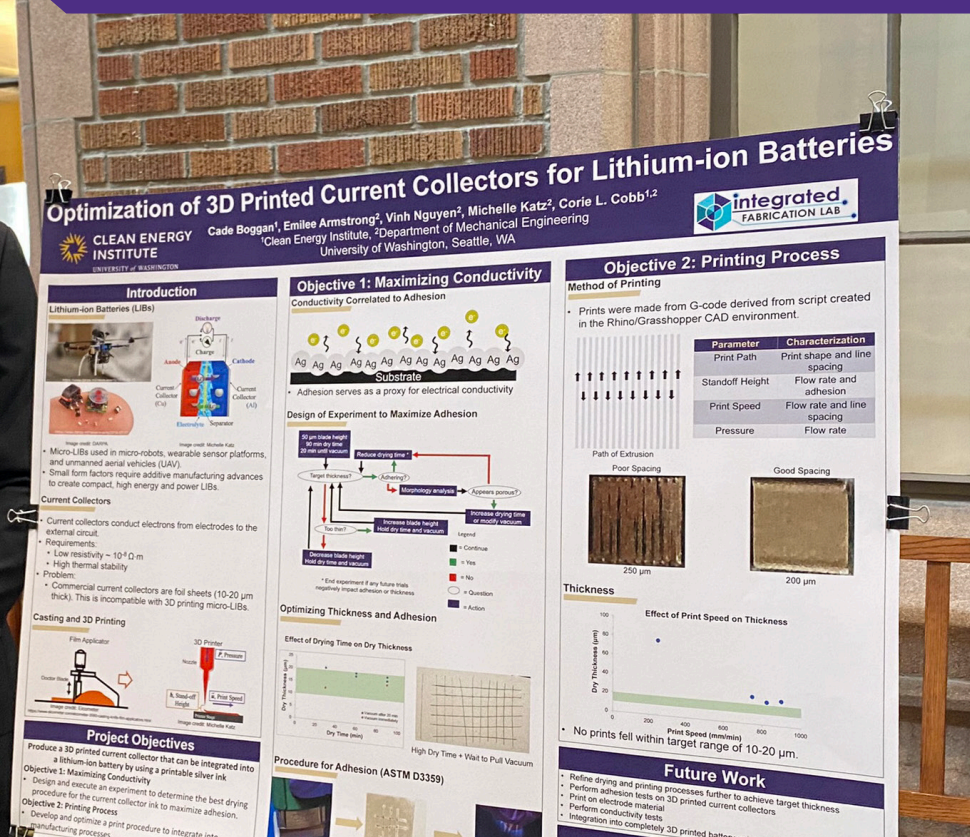
In partnership with other UW units, industry partners, and nonprofit organizations, CEI provides students from non-R1 universities, minority-serving institutions, and community or technical colleges with opportunities to perform hands-on research and learn from UW clean energy experts as well as local climate tech companies.

## Clean Energy Bridge to Research

Each summer, the Clean Energy Bridge to Research (CEBR) [Research Experience for Undergraduates](#) (REU) program provides a select group of 10-15 undergraduate, community college, and tribal college students with the opportunity to research solar energy, energy storage, grids and systems, and advanced energy materials under the mentorship of CEI faculty and student researchers. The CEBR REU is supported by the UW Undergraduate Research Program and funded by the National Science Foundation (NSF CHE-1950904). CEBR students embark on a nine-week immersive research project in a UW clean energy research lab, produce an abstract and poster summarizing their work, and present at the UW summer undergraduate research symposium. Participants receive a stipend, housing, food allowances, and a travel allowance. Among 75 total participants since 2016, 53% are women, 43% are underrepresented minorities, and 52% were pursuing degrees at two-year or community colleges.



CEBR participant Cade Boggan presents at the 2022 Summer STEM Undergraduate Poster Session.





## Outstanding Undergraduate Research Award

CEI's Outstanding Undergraduate Research (OUR) Award recognizes CEBR participants for exceptional undergraduate research and supports their continued journey in STEM fields. CEBR participants are nominated for this award by their graduate student mentors or their PIs. Awardees receive financial assistance of up to \$1,500 for a research conference of their choosing and the opportunity for another research experience in a UW CEI lab the following summer. The 2022 OUR awardees are:



**Chris Becraft** researched the reactivity of black phosphorus with the overall goal of clean energy transformation in [Alexandra Velian's](#) lab in summer 2022. She is pursuing bachelor's degrees in chemistry and applied math at the University of Illinois Urbana-Champaign. Becraft accepted a summer 2023 REU opportunity in the research group of chemical engineering professor [Jim Pfaedntner](#) to study the interactions of proteins with ions and surfaces using computer simulations and machine learning.



**Cade Boggan** worked with mechanical engineering professor and Washington Research Foundation Innovation Professor in Clean Energy [Corie Cobb](#) in summer 2022. He designed a process to 3D print current collectors for batteries and developed code to analyze images of 3D battery electrodes to estimate dimensions and quality. After completing bachelor's degrees in physics and mathematics at Howard University, Boggan plans to obtain a Ph.D. in Mechanical Engineering with a focus on generating or storing renewable energy. He will present his research at the January 2024 Joint Mathematics Meeting of the American Mathematical Society.



## Summer Research for UW Undergraduates

In partnership with the UW [Pathways for Inclusive Excellence](#) (PIE) program, [CEI provides a handful of summer research experiences](#) for UW undergraduates in order to promote retention and academic excellence in STEM. This program supported two students in 2022 for a total of 25 since 2015.

## Clean Energy Scholars Mentorship Program

Established in 2022 in partnership with UW EarthLab, the Clean Energy Scholars Mentorship program is a paid internship and mentorship program designed to equip dedicated and capable college scholars with the skills required to secure (and excel in) well-paid jobs in the renewable energy industry. The program progresses students through a well-defined, transdisciplinary curriculum spearheaded by industry-leading organizations. Energy Scholars attend seminars by CEI graduate student researchers and participate in professional development activities alongside CEBR REU students.

The 10 2022 Energy Scholars hailed from the following institutions : Bennington College, Fisk University, Miami University, Texas Tech University, University of Texas at Dallas, University of Washington, Wesleyan University.



## Research Experience for Teachers

CEBR also supports a [Research Experience for Teachers](#) (RET) program for local community college instructors who aim to integrate clean energy research into their curriculum. CEBR RET participants receive a stipend and spend six weeks in a CEI lab, where they learn a research technique and use it to develop a lesson for a two-year college with minimal equipment capability.

### Summer 2022 RET participants

#### Tommaso Vannelli

##### Whatcom Community College

Tommaso Vannelli worked with UW chemistry professor Cody Schlenker to design and synthesize advanced materials for heavy-atom-free solar photon upconversion. The technical goals of this project were to evaluate design strategies for new light-absorbing molecules with the potential to harvest energy from the sun that is not currently captured efficiently by existing solar photovoltaics. Vannelli continued working with Schlenker through the 2022-23 academic year to develop Course-based Undergraduate Research Experiences (CUREs) that provide community college students with exposure to authentic research experiences at their home institutions.



#### Anna Waschke

##### Northwest Indian College (NWIC)

Advised by UW ECE professor Baosen Zhang, Anna Waschke researched the fundamentals of building a microgrid, and how wind and solar could be integrated into the electric grid. She examined different types of wind turbines and the circumstances under which they would be optimal for deployment. Waschke's research supports NWIC's development of technical and vocational training programs in clean energy as well as a planned expansion of NWIC's two-year pre-engineering curriculum into a four-year engineering degree program focused on renewable energy.



# COMMUNITY ENGAGEMENT

## OVERVIEW

To promote the widespread, informed adoption of clean energy technologies, CEI engages Washington communities through K-12 educational programs and by supporting community clean energy projects and research.

CEI's outreach programs seek to expand participation in STEM by making STEM study and STEM careers more attractive and more attainable for a broader cross-section of the US population. Expert education staff and graduate trainees work to integrate cutting-edge UW clean energy research with K-12 and undergraduate STEM concepts. These programs serve K-12 students and teachers, two-year college students and educators, and the general public.

Research and project support programs help Washington communities understand the clean energy transition and take advantage of unprecedented state and federal funding for clean energy demonstration and deployment projects.

CEI ETF Jacob Finney (bottom left) leads a workshop for teachers.





## K-12 STUDENT ENGAGEMENT

CEI staff, students, and faculty have collaborated to develop a comprehensive library of K-12 clean energy lesson plans and hands-on activities in alignment with Next Generation Science Standards. CEI Education & Training Fellows lead their peers — student Clean Energy Ambassadors — on classroom, museum, and public-facing visits across Washington state, wielding science communication skills and UW's excellence in scholarship to bridge the critical knowledge gap between the STEM concepts covered in a conventional K-12 curriculum and the cutting-edge research that is carving the path towards a clean energy future.

Clean Energy Ambassadors are UW graduate and undergraduate students in STEM fields who lead students in hands-on activities at K-12 schools around Washington state and present at public events. The program is led by CEI ETFs and is open to any UW student aiming to give back to Washington state, hone their skills at communicating science to the public, or gain first-hand experience as a STEM educator. Ambassador activities include solar car races, a “Meet a Scientist” presentation, and lessons including hands-on workshops on mini solar panels or solar spinners. Through these activities, CEI seeks to inspire a new generation of diverse students to take up STEM careers to support the global transition to a clean energy economy.

In 2022-23, Clean Energy Ambassadors reached over 2,400 K-12 students and 36 teachers via 15 classroom visits, three virtual visits, seven STEM fairs, six UW campus tours, and two Science Olympiads. CEI and its Clean Energy Ambassadors also partnered with UW GEAR UP Achievers, a Department of Education program that provides support to middle- and high-school students from low-income families, to put on a Clean Energy Summer Camp. In addition, CEI developed new outreach relationships with Washington Alliance for Better Schools and World Affairs Council to host high school tours at the Washington Clean Energy Testbeds, the Molecular Analysis Facility, the UW power plant, and other campus facilities. CEI Graduate Fellows also volunteered to write and grade Science Olympiad exam questions on solar energy.

A Clean Energy Ambassador works with a GEAR UP Achiever at summer camp.



# RESEARCH AND PROJECT SUPPORT FOR WASHINGTON COMMUNITIES

Recent federal and state climate policies mandate investments in clean energy projects that benefit underserved and overburdened communities. To advance the equitable deployment of clean energy, CEI established the Community Engagement Testbed to help analyze and design energy systems that align with community values and achieve specific goals. Community Engagement Testbed analysis can support community goals such as:

- Reducing energy cost burden or generating income
- Lowering emissions and improving local air quality
- Keeping power on during electricity outages
- Sustaining critical energy services during extraordinary power interruptions
- Estimating costs, benefits, and impacts of clean energy options

In 2023, CEI launched three pathways for communities to partner with UW faculty, students, and staff to co-develop clean energy strategies and tailored outcomes to meet community needs:

## **1. Open-ended exploration and analysis via UW Engineering capstone projects:**

Several teams of UW Engineering seniors worked with the [Jamestown S'Klallam Tribe](#), [Jefferson County Emergency Management](#), and the [Clallam County Sheriff's Office](#) to explore and develop tailored energy resilience designs.

**2. Microgrid technical analysis:** Washington Clean Energy Testbeds staff scientists analyzed solar-storage microgrid design options with the Yakama Nation Housing Authority.

**3. Deep-dive research collaboration:** CEI supported co-designed research by [Front and Centered](#) and UW civil engineers to understand air quality and health impacts on communities burdened by traditional energy.

To enable Community Engagement Testbed projects, Testbeds managing director Mike Pomfret worked with the UW Attorney General to update the Testbeds' user agreement so that sovereign nations have the same IP and data privacy rights as user companies.



# FACILITIES

## WASHINGTON CLEAN ENERGY TESTBEDS

CEI opened the [Washington Clean Energy Testbeds](#) in 2017 to provide academic and industry researchers with state-of-the-art capabilities for full-cycle development of climate technologies, including prototyping, testing, scaling, and validating new materials, devices, and software tools. The lab facility, which currently occupies about 16,000 square feet of leased space near UW, is a unique public venue for innovation and demonstration that offers pay-as-you-go, open access to users without impacting their intellectual property.

Testbeds staff scientists and engineers provide customized, hands-on training on each instrument and can also perform contract-based remote work. The staff have experience in relevant sectors including power electronics, climate tech, clean energy, and mass production.

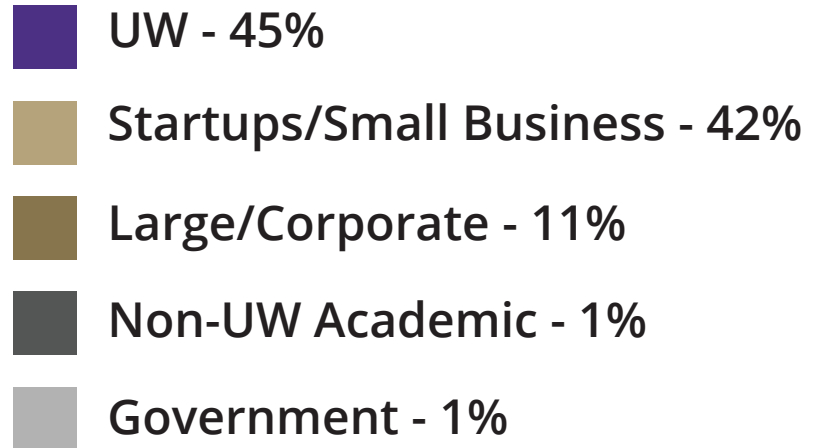
Unique Testbeds instruments include:

- Modular, multi-functional, roll-to-roll processing line
- Multi-nozzle ultra-high resolution ink jet printer capable of nano-scale additive manufacturing
- Controlled environment manufacturing lab
- Real-time digital simulator that allows users to test software and hardware “in the loop” instead of independently developing their own testing platform
- Scaled thin-film manufacturing tools for applications such as perovskite solar cells, including a laser scribe and a large-area vacuum deposition chamber

WSU spinout Ecellix has hired UW alums to develop battery materials at the Testbeds.



## FY23 Testbeds Users

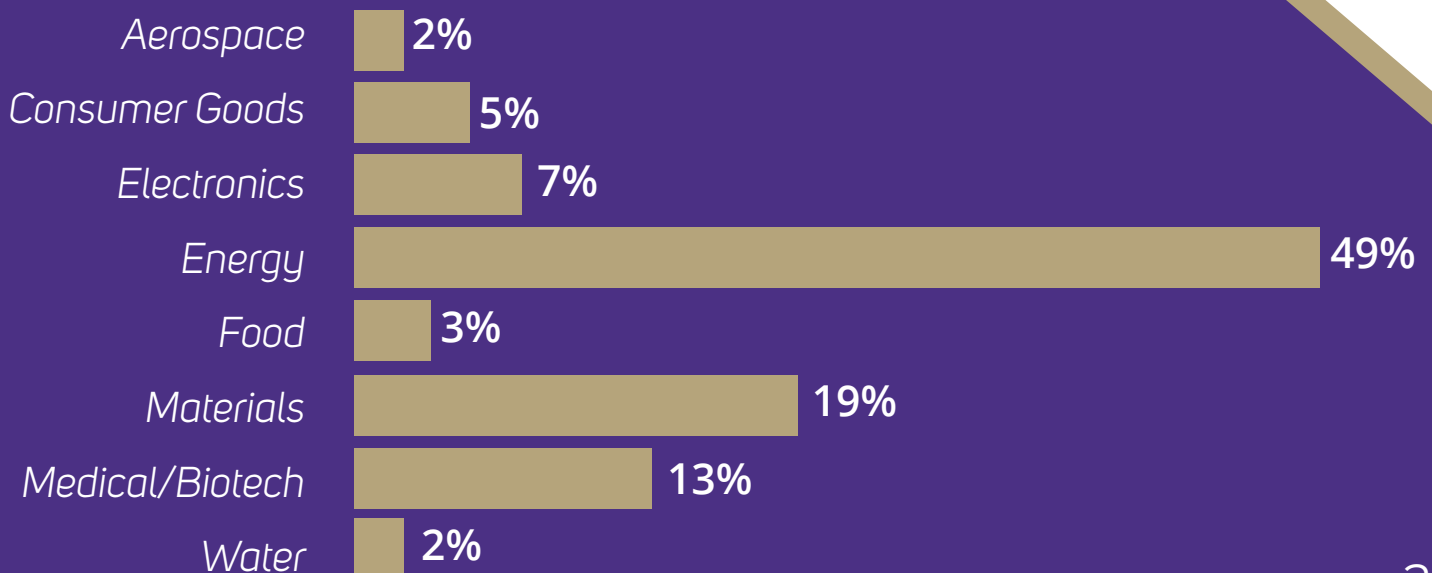


**62** NEW USERS INCLUDING 24 NEW COMPANIES IN FY23

**70** USERS PER MONTH IN FY23, ON AVERAGE

OVER **59,000** HOURS WORTH OF WORK IN FY23

## Testbeds Users by Industry Sector



## FY23 User Highlights

- **EvolOH**, a CA-based, minority-owned company, won the Outstanding Venture—Early Stage award at the National Renewable Energy Lab’s Industry Growth Forum.
- **Group14 Technologies** closed \$614M in Series C funding led by Porsche and Microsoft’s Climate Innovation Fund, received an additional \$100M from the U.S. Department of Energy via the Bipartisan Infrastructure Law, and broke ground on the world’s largest silicon battery materials factory in Moses Lake, WA.
- **MujiElectric**, a minority-owned startup based in Renton, WA, was accepted into the U.S. DOE’s American-Made Challenge for perovskite solar cells.
- **StorEdge AI**, a minority-owned company based in Bothell, WA, won a \$1.3M Small Business Innovation Research (SBIR) grant from the DOE’s Solar Energy Technologies Office.

## CleanTech Hardware Innovation Prototyping (CHIP) Program

Established in 2021 in partnership with Seattle-based nonprofit [CleanTech Alliance](#) and [VertueLab](#), a Portland, OR-based nonprofit that supports climate entrepreneurs, the [CleanTech Hardware Innovation Prototyping](#) (CHIP) program was created to increase access to advanced capabilities for scaled prototyping, testing, and demonstration of energy hardware technologies. Annually, the CHIP program provides two cohorts of three to six companies each with \$10k-\$25k worth of Testbeds access over six months, with an emphasis on supporting entrepreneurs and pre-B-round startups aiming to establish a foundation for more significant follow-on funding from grants or investors.

CHIP supported eight companies in 2022-23:

- **Aquagga** developed a reactor to break down toxic per- and polyfluoroalkyls (PFAs).
- **StorEdge AI** built and tested a non-wired grid-forming inverter for remote solar + storage deployments.
- **Vizi Metering** deployed wireless voltage meters and used the data to establish energy efficiency protocols for facilities.
- **AMPD.CAMP** prototyped and tested vehicle-to-grid hardware and software for RVs.
- **BlueDot Photonics** developed perovskite manufacturing techniques.
- **EvolOH** advanced solar electrolyzers to produce hydrogen from water.
- **Emissol** is advancing emissions control technologies, including carbon capture.
- **Powerit** is developing solid-state aluminum-ion batteries.

## Experts-in-Residence

Testbeds Experts-in-Residence advise entrepreneurs and early-stage climate tech startups at free, weekly office hours, and host workshops and events.

The Testbeds **Entrepreneur-in-Residence (EIR)** advises companies on team formation, product development, strategic marketing, fundraising, manufacturing strategy, and business development.



Testbeds EIR Dr. Thomas Madden is the chief technology officer at Advanced Cell Engineering. Previously, Madden was the Principal at Madden Echem Concepts, CTO at BenAn Energy and Aquion Energy, and led energy storage stack development at Lockheed Martin Advanced Energy Storage and UTC Power. Madden is an affiliate professor of chemical engineering at UW, from where he received his PhD in chemical engineering, and serves as a Proposal Reviewer for DOE EERE and ARPA-E funding solicitations and as a Merit Reviewer for DOE EERE programs.

The Testbeds **Investor in Residence (IIR)**, established in partnership with angel investment group E8, consults on funding proposals, investor pitches, financial strategy, fundraising, and strategic partnerships.



Testbeds IIR Jeff Canin is a member of the Board of Directors at E8 and a co-manager of E8's venture fund. Jeff's career includes extensive experience in financial services and venture capital. His current efforts are focused on providing advisory services to early-stage companies and university technology commercialization spinouts.



MSE doctoral student Cassidy Sarah Anderson working in a glove box in the RTT.



## RESEARCH TRAINING TESTBED

Part of the Washington Clean Energy Testbeds system, the [Research Training Testbed](#) (RTT) provides UW students access to industrial-quality research tools and training in clean energy concepts that cut across academic disciplines. Located on the 1st floor of the Nanoengineering and Sciences Building, the lab is open to UW research groups as well as students interested in developing and testing their climate tech prototypes. The RTT is home to CEI's unique Energy Materials, Devices, and Systems course.

“*The RTT's synthesis and testing equipment is state-of-the-art and almost the exact same equipment as what I use in my day job. Having that sort of alignment and continuity — across academia, national laboratories and industry — is excellent for professional training and development. It really prepares students for their next steps.*”

*-- EMDS participant Cassidy Sarah Anderson, a UW Ph.D. student in materials science & engineering and a PNNL staff scientist*

## BATTERY FABRICATION

With new state funding to align with demand for people and ideas that fuel innovation in battery materials and manufacturing, the Testbeds hired postdoctoral researchers and planned a 1,600-square-foot lab focused on battery manufacturing. The expansion includes 900 square feet of dry room space, and features state-of-the-art pouch cell fabrication tools to demonstrate and deploy new materials and cell architectures in a standard industry format. The planning committee included stakeholders from the UW, PNNL, and members of industry such as Group14 Technologies, a battery materials company co-founded by CEI TAC member Rick Luebbe that is building a million-square-foot silicon anode production facility in Moses Lake, WA. Capital purchases for the expansion are anticipated in FY24.

# BRIGHTWORK: A NEW BUILDING FOCUSED ON SOLUTIONS FOR A HEALTHY PLANET

In March 2022, the UW Board of Regents approved a project plan for the first major development within the new [Portage Bay Crossing](#) district on the west side of the Seattle campus. The new building will be known as Brightwork, and will focus on solutions for a sustainable future. Brightwork will be located between NE 40th Street and the Burke-Gilman Trail, with University Way NE (“the Ave”) to the east and Brooklyn Avenue NE to the west. Brightwork will include space for UW research and education, as well as market-rate leasable spaces for UW mission-aligned partners. Wexford Science + Technology was selected to develop and manage the building and recruit external tenants.

CAMCET, including the Washington Clean Energy Testbeds, will occupy more than 30,000 of the 130,000 square feet allocated to UW within the Brightwork building, which is estimated to be completed in Spring 2025. This doubling of the Testbeds’ footprint will expand fabrication capabilities, including advanced manufacturing of pouch cell batteries, and will create dedicated spaces for testing solar, batteries, and other materials, private user R&D activities, community engagement, and events.



A rendering of the Brightwork building in Portage Bay Crossing, the future home of the Testbeds. (ZGF Architects)

# EXPENDITURES: OVERVIEW

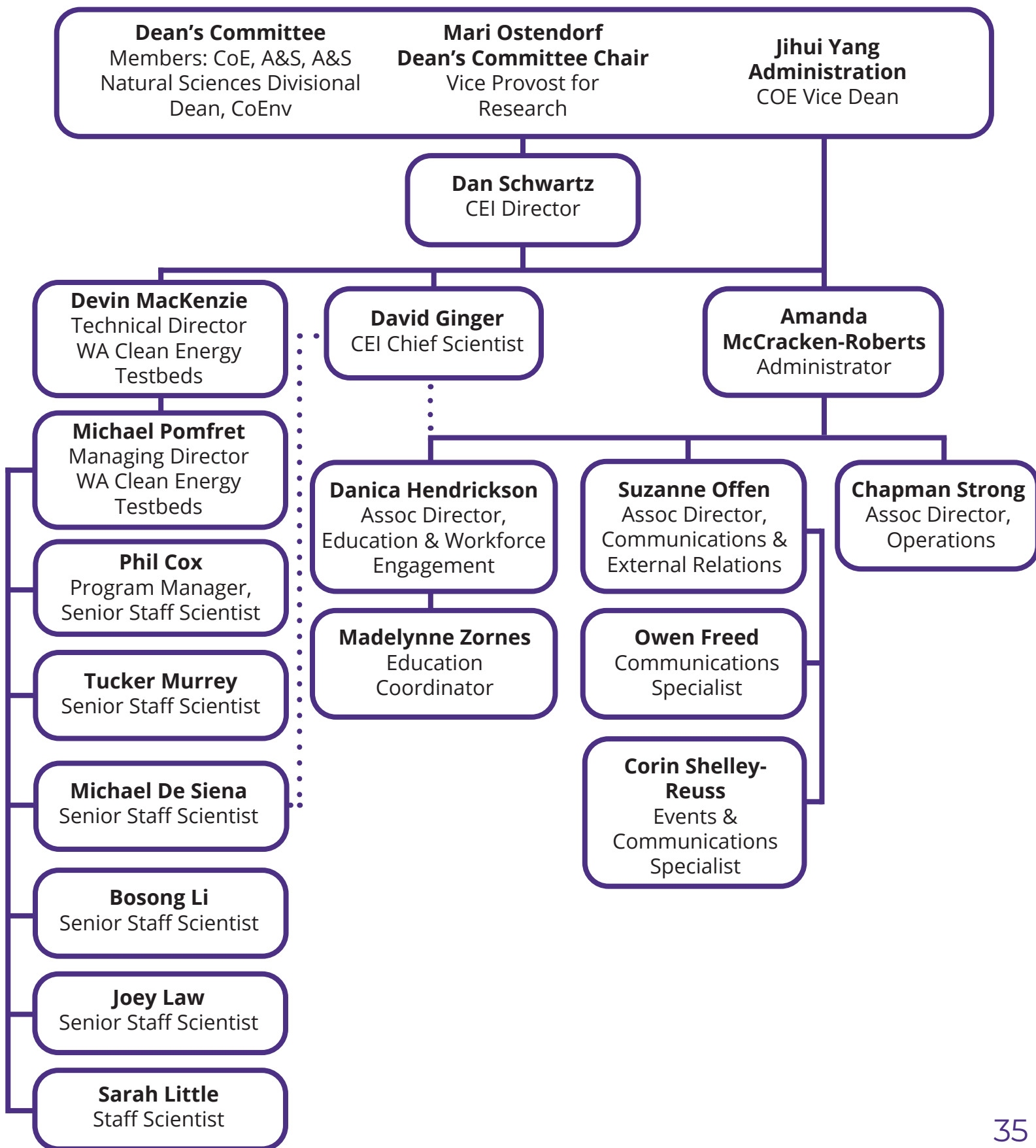
FY 2020 - 2023

	FY21	FY22	FY23
Faculty Support	\$603,902.79	\$835,951.25	\$441,902.37
Student & Trainee Support	\$380,541.38	\$469,458.90	\$1,858,968.22
Administrative Staff & Operations	\$442,500.00	\$681,416.76	\$450,543.04
Education & Workforce Engagement	\$1,150,870.36	\$1,034,617.41	\$467,056.91
Research, Facilities, & Infrastructure	\$1,972,982.22	\$2,874,920.38	\$2,737,275.97
Community Events & Sponsorships			\$67,897.03
Total	\$4,550,796.75	\$5,896,364.70	\$6,023,643.54



# APPENDIX 1

## CEI ORGANIZATIONAL CHART



# APPENDIX 2

## TRAINEE & FACULTY ADVISORY BOARD



**Brandi Cossairt**

Professor of  
Chemistry



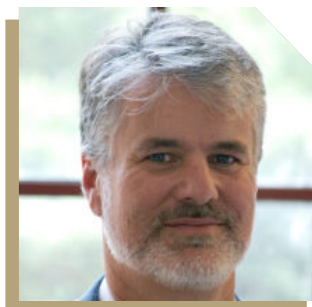
**Daniel Gamelin**

Professor of  
Chemistry



**David Ginger**

*TFAB Chair*  
Professor of  
Chemistry



**J. Devin MacKenzie**

Professor of Materials  
Science & Engineering  
and Mechanical  
Engineering



**Emily Nishiwaki**

CEI Graduate Fellow,  
PhD candidate in  
Chemistry



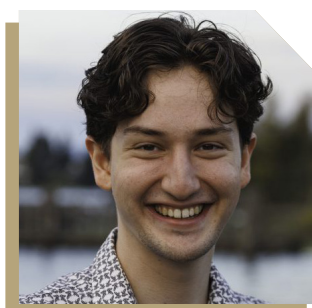
**Lilo Pozzo**

Professor of Chemical  
Engineering



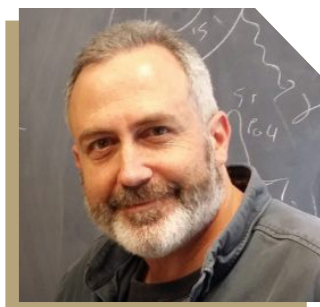
**Cody Schlenker**

Professor of  
Chemistry



**Ethan Schwartz**

CEI Graduate Fellow,  
PhD candidate  
in Mechanical  
Engineering



**Jerry Seidler**

Professor of Physics



**Xiaodong Xu**

Professor of Physics  
and Materials Science  
& Engineering



**Baosen Zhang**

Professor of Electrical &  
Computer Engineering

# APPENDIX 3

## CEI TECH ADVISORY COUNCIL

**David Benson**, Co-Founder and Managing Director, Bia Energy Capital

**\*Susan Betcher**, Partner and Firmwide Co-Chair of Clean Technology Practice, Perkins Coie LLP

**Katy Briggs**, Global Service Area Leader, Renewables Advisory, DNV GL – Energy

**Jeff Canin**, Board Member & Fund Manager, E8 Angels

**Byron Crawford**, Power Business Development Lead, HDR, Inc.

**Dave Curry**, Chairman, CarbonQuest and NextWatts

**\*Renee Gastineau**, Cleantech Advisor

**Craig Husa**, Director, Lockheed Martin Energy

**Jun Liu**, WRF Innovation Chair in Clean Energy and Campbell Chair Professor, Materials Science & Engineering and Chemical Engineering, UW

**Rick Luebbe**, CEO & Co-Founder, Group14 Technologies

**Daniel Malarkey**, Senior Fellow, Sightline Institute

**Uzma Siddiqi**, Technology Principal Engineer, Seattle City Light

**Ben Straughan**, Partner, Emerging Companies & Venture Capital, Perkins Coie LLP

**Lawrence Tsang**, Senior Vice President, Corporate Development, Convergent Energy + Power

**Malcolm Witter**, Director, Dean Witter Foundation

\* = CEI TAC co-chair



# APPENDIX 4

## DEAN'S COMMITTEE



**Mari Ostendorf**  
*Committee Chair*  
UW Vice Provost for Research



**Nancy Allbritton**  
Dean of the College  
of Engineering



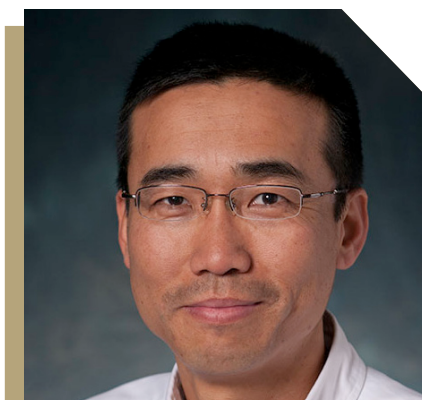
**Dianne Harris**  
Dean of the College of  
Arts and Sciences



**Maya Tolstoy**  
Dean of the College  
of the Environment



**Dan Pollack**  
Divisional Dean of Natural Sciences,  
College of Arts and Sciences



**Jihui Yang**  
Vice Dean of the  
College of Engineering