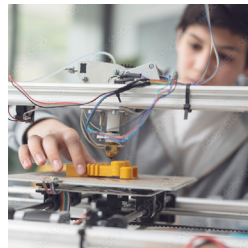
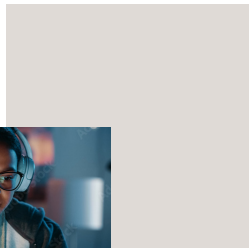
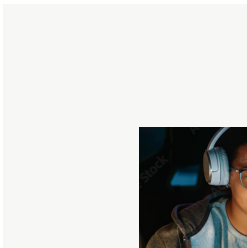
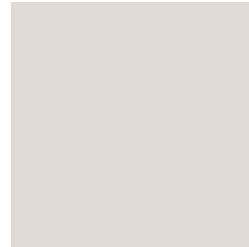
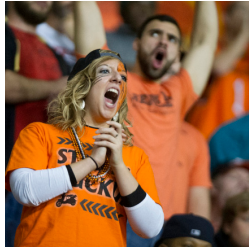
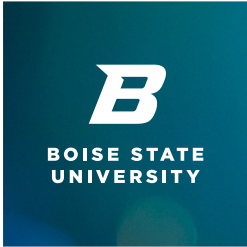
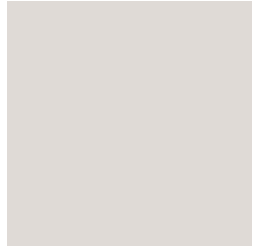
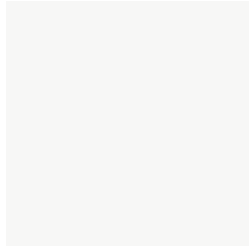




# 2021 ANNUAL REPORT



*This report provides an overview of the main accomplishments of the CAES community in FY21.*

# DIRECTOR'S LETTER

## AS WE FORGE AHEAD WITH THE SECOND DECADE OF THE CENTER FOR ADVANCED ENERGY STUDIES,

we would like to look back at a few people who were instrumental in its founding and success. CAES was established in 2005 as a condition of the contract to operate Idaho National Laboratory between Battelle Energy Alliance and the U.S. Department of Energy. Battelle committed to constructing a \$14-million CAES building in Idaho Falls in partnership with the state of Idaho, which contributed \$7 million. Harold Blackman, Fred Gunnerson and the late Richard Jacobsen were instrumental in the effort. Here is a glimpse at each of them:

### Harold Blackman

Blackman retired in June as interim vice president for research and economic development at Boise State University, a position he held since 2018, and which gave him a seat on the CAES Steering Committee. Blackman was the second CAES director, leading the consortium from 2006

until 2011. During his tenure, Blackman oversaw the construction of the CAES facility and the development of a foundation of collaboration among the universities, INL, industry and government agencies. Blackman spent decades at INL before joining CAES, and he was instrumental in

establishing networks between the lab's world-class researchers and the faculty and students at the universities. During his tenure, CAES researchers were awarded more than \$20 million in competitive research grants and other funding.

### Fred Gunnerson

Gunnerson is a professor emeritus at University of Idaho, but at the time of CAES' inception he was director of the University of Idaho's Idaho Falls campus. He was instrumental in developing the initial concept of CAES and securing its funding. Gunnerson, who conducted his postdoctoral research at INL and led a distinguished career in the nuclear

field, recognized that education was the foundation of our society, and the vehicle for advancement in science, technology and the arts. He also recognized the importance of nuclear energy, referring to it as an attractive option for generating carbon-free electricity. He recognized CAES' potential to help develop new materials, fuels and reactors, and to

educate and train the next generation of engineers and scientists to help address these issues. His vision is being realized at CAES through development of an Advanced Manufacturing Suite featuring a new transmission electron microscope and the Small Modular Reactor Simulator Laboratory.

### Richard Jacobsen

Richard "Jake" Jacobsen retired in 2019 after an illustrious career that took him from University of Idaho to INL to Idaho State University. Jacobsen served two stints as CAES associate director for Idaho State, from 2009 until 2012 and again from 2015 until his retirement in 2019. Upon his retirement, Jacobsen was also ISU's associate vice president for research and a professor of nuclear engineering. Prior to his time at CAES, Jacobsen served

as dean of the College of Engineering at Idaho State and as executive director of research development for the university's Meridian campus. From 1999 to 2005, Jacobsen served as chief scientist at what was then Idaho National Engineering and Environmental Laboratory, while concurrently serving as an associate lab director from 2001 until 2005, and as a deputy lab director from 1999 until 2001. Jacobsen spent 27 years at his

alma mater, the University of Idaho, as dean of the College of Engineering in Moscow, director of the Center for Applied Thermodynamic Studies, chair of the Department of Mechanical Engineering and professor of mechanical engineering. He was instrumental in developing the collaboration among universities and INL that led to CAES' creation.

*These are exciting times at CAES, and we are thankful for the roles Jacobsen, Gunnerson and Blackman played in making them possible.*



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## NEW FACES

### New VP at Boise State University



**Nancy Glenn** was named interim vice president of research and economic development at Boise State University in June. Glenn formerly served

as Boise State's senior advisor of strategic initiatives and research advancement. She is also a professor in the Department of Geosciences within the College of Arts and Sciences and was a founding director of the university's interdisciplinary Human-Environment Systems (HES) initiative, an intensive research effort that couples the human and biophysical sciences. As a researcher with more than 90 peer reviewed publications, Glenn, along with her students and colleagues, has developed remote sensing science tools to monitor and improve dryland ecosystems. She has garnered over \$30 million in external funding for her lab to advance students' knowledge in remote sensing, data science and engineering, research processes, and communication. Her research has been funded through grants from NASA, the

National Science Foundation, the National Oceanic and Atmospheric Administration, and the U.S. departments of Defense, Energy, Agriculture and Interior. Glenn received her Ph.D. in geo-engineering from the University of Nevada, Reno, where she also received her bachelor's degree in geological engineering. She earned her master's in geotechnical/civil engineering from the University of California, Berkeley. Prior to joining Boise State's Department of Geosciences in 2013, Glenn launched Idaho State University's remote sensing program in the Department of Geosciences and expanded it to include Idaho Falls and Boise campuses.

### New Research, Education, Innovation Specialist



**Hillary Fishler** joined the CAES staff in November 2020 as Research, Education and Innovation specialist overseeing several initiatives

including the CAES Summer Visiting Faculty Program, the CAES Fellows program, the Energy Frontiers Challenge and more. Fishler's focus is fostering relationships among members of the CAES community, including industry. She earned her Ph.D. in environmental science and public policy from Oregon State University and her master's in public policy from Oregon State.

### CAES names new assistant safety officer



**Dustin Hughes** joined CAES as assistant safety officer in summer 2021. This Idaho State University position provides safety support and

oversight of research and development work at the CAES building. The assistant safety officer assists Chief Safety Officer Kristi Moser-McIntire with implementing and improving safety programs at CAES, including identifying program deficiencies and developing appropriate corrective actions.

### New lab lead for Radiochemistry Lab



CAES welcomed back **Bryan Forsmann**, a former technician in the Advanced Manufacturing Laboratory with Boise State University, who

is now operating as the laboratory lead for the Radiochemistry Laboratory.



## NuScale lab opens at CAES

A state-of-the-art NuScale power plant control room simulator made its debut at CAES in June. Expected to assist in training related to NuScale's small modular reactors (SMR). With workforce development and outreach, the SMR Simulator Laboratory is the result of a \$285,000 Nuclear Energy University Program (NEUP) award to a University of Idaho-led project, Multi Universities SMR Simulators: NuScale. Rich Christensen, director of U of I's Nuclear

Engineering department, is the project's principal investigator, and U of I professors Robert Borrelli, Michael Haney and Michael McKellar are collaborators. The simulator is located on CAES' first floor in what previously was four offices.

Christensen's undertaking is one of three university-led projects that received an NEUP award aimed at broadening the understanding of advanced nuclear technology in a control-room setting and providing students, researchers, operators

and members of the public opportunities to engage in science, technology, engineering and math research and education. NuScale's small modular reactor is the first to receive design approval from the U.S. Nuclear Regulatory Commission, and tentative plans call for the first 12-unit, 60-megawatt SMR plant, called the Carbon Free Power Project, to be constructed on INL's 890-square-mile desert Site west of Idaho Falls. The reactors are expected to be commercially operational by the end of the decade.

## Boise State University VPR, a former CAES director and INL associate laboratory director, announces retirement



**Harold Blackman**, Boise State University's interim vice president for research and economic development (VPR) since 2012, retired over the summer. Nancy Glenn, formerly Boise State's senior advisor of strategic initiatives and research advancement, assumed the role of interim vice president for research. Prior to joining Boise State almost a decade ago, Blackman was director of research for INL's Materials and Fuels

Complex. He had previously served as CAES director and associate laboratory director for INL's Energy and Environment Science and Technology Directorate. During Blackman's tenure at Boise State, the university attained classification as an RII doctoral research university with "high research activity" by Carnegie Classification of Institutions of Higher Education. The university also saw a 62% increase in research and sponsored projects awards, and an increase in invention disclosures and patents.

## New transmission electron microscope installed, awaiting certification

The first phase of an INL-funded, \$5 million project to install a new Transmission Electron Microscope (TEM) at the CAES facility was completed in December. Installation of the TEM was completed in fall 2021 and is awaiting certification. The new microscope is more technologically advanced than any of the current TEM resources across the CAES complex and is expected to be the centerpiece of a planned Advanced Manufacturing Suite at CAES. Advanced manufacturing is one of seven focus areas identified in the CAES Strategy, and the TEM will advance collaborative research, education and innovation in this focus area in several ways, including advancing the timeline for nuclear innovation and the acceleration of modeling efforts needed to advance the discovery and qualification of materials for nuclear applications. It also will allow for the investigation of defects in functional energy materials found in batteries with atomic precision – a key step in improving battery performance – and will help CAES advance its efforts to develop the next generation of energy workers. As a Nuclear Science User Facilities laboratory, the new Advanced Manufacturing Suite will be accessible to students and faculty at the CAES universities and to researchers all over the world. The ease of access of CAES not only applies to students, faculty and private industry but also to INL, particularly its Advanced Design and Manufacturing initiative. The TEM is INL's latest investment in CAES that is designed to create opportunities for collaborative materials research.

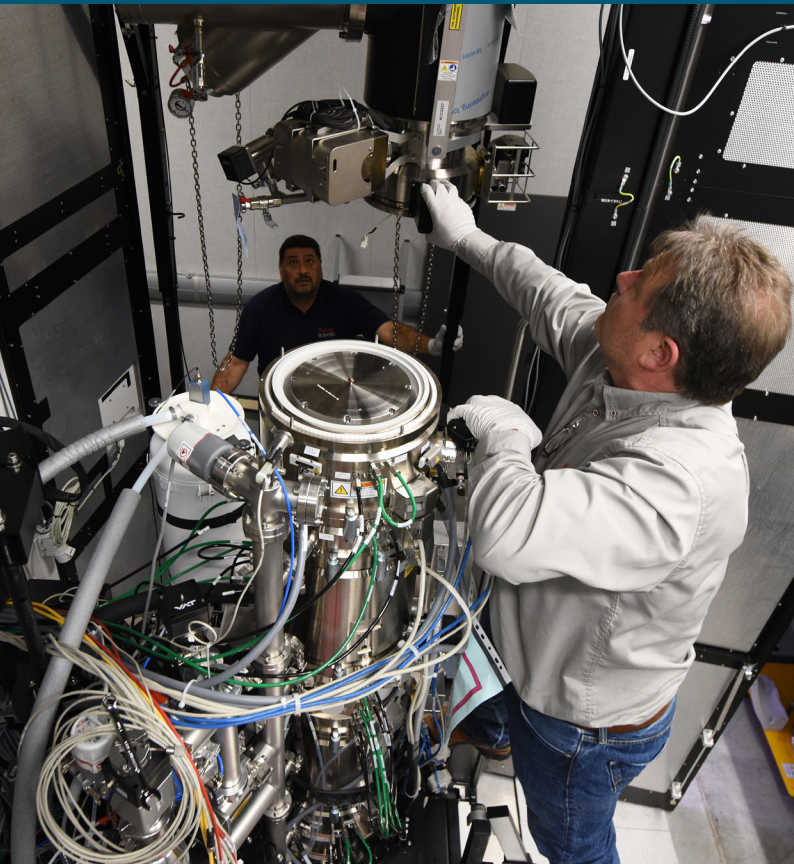


## ISU-INL project featured at ISU alumni event

The Idaho State University Alumni Association hosted a virtual town hall in late January featuring the ISU College of Science and Engineering and new Disaster Response Complex, an outdoor campus that accommodates research, curriculum development and training/exercises for military and law enforcement personnel from across the region. CAES provided seed funding for the project, which involves INL and dates to 2018, when the project lead, ISU Professor Mustafa Mashal, a CAES Fellow, met INL Researcher Byron Marsh at the CAES Security Collaborative Research Planning Meeting. Later that year, the project received CAES Collaboration Program Development Funds, the first year of the CAES initiative designed to provide funding to proposals by INL researchers that would enhance collaborative relationships with CAES universities, in line with the CAES Strategy. In 2019, Idaho's Higher Education Research Council awarded the project nearly \$1.1 million through the Idaho Global Entrepreneurial Mission initiative. The complex is located on approximately 300 acres in ISU's business park in Pocatello.

## Firefighters train at ISU's Disaster Response Complex

The Idaho Falls Fire Department trained at the Disaster Response Complex at Idaho State University in March. The complex is capable of accommodating research, curriculum development and training/exercises for military and law enforcement personnel from across the region. In the March training session, 20 firefighters converged on the facility to practice navigating confined spaces and hoisting techniques. Among the exercises, they undertook during six hours of training was a drill that required the navigation of more than 100-feet of subterranean confined space.



## CAES helps fund improvements at Idaho State University laboratory

CAES and the Idaho State Board of Education's Higher Education Research Council provided \$250,000 in funding to upgrade and expand the Structural Laboratory (SLAB) at Idaho State University. The improvements include the addition of a Visualization Laboratory and new equipment that have significantly expanded opportunities for experimentation in SLAB, a unique large-scale testing facility that was constructed in 2017 by the students and faculty from ISU's Department of Civil and Environmental Engineering. CAES Fellow Mustafa Mashal, associate professor of civil and environmental engineering and director of the SLAB, led the project along with Lab Manager and Research Engineer Jared Cantrell. The upgrades

included a 2.5-million-pound isolation frame with a custom-built load cell, hydraulic rams, 10,000-pounds-per-square-inch pump, and other accessories for testing high-capacity components; a 10,000-pound forklift; 12-cubic-foot concrete mixer; upgraded data acquisition system; two 225,000 pounds tension/compression hollow load cells; and eight computers for students. The new Visualization Laboratory is equipped with two professional-grade virtual reality headsets with eye tracking, a Dell Alienware laptop and two Alienware desktops to develop VR environments, an iPad Pro with built-in Light Detection and Ranging scanner for augmented reality, four monitors, and other accessories.

## Second ISTP CAES Fellow named



The Idaho Science and Technology Policy (ISTP) Fellowship recently announced the selection of **Samantha Werth** as ISTP CAES Fellow for 2021-22. Werth is an expert in environmental and economic impacts of cattle production and food supply chains who earned a Ph.D. in animal biology, master's degree in animal biology

and bachelor's degree in animal science, all from the University of California, Davis. As the second ISTP CAES fellow, she will provide support to the Idaho Governor's Office of Energy and Mineral Resources and the Idaho Department of Environmental Quality.

The ISTP Fellowship is a partnership among Boise State University, Idaho State University and the University of Idaho that is led by the University of Idaho's McClure Center for Public Policy Research. It is a nonpartisan program that places scientists, social scientists and engineers in state agencies to develop and implement solutions that address some of Idaho's greatest challenges.

The ISTP Fellowship launched its first cohort in August 2020. The inaugural ISTP CAES fellow, Veronika Vazhnik, served in the Idaho Governor's Office of Energy and Mineral Resources. During her fellowship, Vazhnik focused on leading an update to Idaho's Energy Assurance Plan, a blueprint to help Idaho prepare for and prevent crises related to energy system disruptions.

## CAES Summer Visiting Faculty Program project receives funding



A project that emerged from the CAES Summer Visiting Faculty Program and aims to gain a better understanding of public perceptions of nuclear energy received \$20,000

from the ISU-CAES Collaboration Fund. Led by INL's **Rae Moss** (Communications & Outreach director) and ISU professor **Irene van Woerden**, the project calls for examining the perceptions of nuclear energy and INL throughout Idaho. The rationale behind the proposal is that nuclear energy is typically not seen in a positive light, and public opposition to nuclear energy has contributed to cancellations of nuclear projects and increased costs tied to regulatory delay. The funding allows Moss and van Woerden to enlist the help of two students to conduct an in-depth analysis of the public perceptions of nuclear energy regarding risks to physical safety, the environment, public health, energy security and economics, and how it compares to other energy sources. The goal is to identify areas of concern and answer three key questions:

- How do demographics and location correlate with attitudes toward nuclear energy?
- Are school tours associated with more positive perceptions of nuclear energy?
- How are demographics and location associated with perceptions of nuclear energy being included in a zero-carbon energy future?



## Boise State University finishes second in DOE Solar District Cup

A team of students from Boise State University was among the winners in the U.S. Department of Energy's Solar District Cup. The Boise State team finished second in their district in the annual competition, which challenges college students to integrate solar, storage and other technologies to power a cluster of buildings. The team, which was advised by CAES Innovation Adviser Michael Baskin, presented their project to an expert panel during a live showcase in April. The winners were identified as systems that were the most economical for the buildings and demonstrated the highest offset of annual energy consumption. The Solar District Cup is designed to prepare students from different academic backgrounds for careers in energy, aligning with CAES' goal of training and educating the next generation of energy workers.

## ACCOLADES

### CAES Fellow wins ANS award



CAES Fellow **Ron Boring** received the Don Miller Award at the annual meeting of the American Nuclear Society in June. Boring, a distinguished human factors scientist at INL, was one of two recipients of the award, which recognizes outstanding engineering, research and development, licensing, or project

achievements in the fields of nuclear instrumentation, control and human-machine interface technology from around the world. The award is given to an individual or team who has made recognized contributions to the advancement of the fields of nuclear instrumentation and control or human-machine interface.

### CSVFP alumni and CAES-affiliated faculty member from Boise State University awarded Air Force fellowships

Two alumni of the CAES Summer Visiting Faculty Program, Boise State University's Liljana Babinkostova and Nirmala Kandadai, and CAES-affiliated assistant professor Harish Subbaraman, were awarded Air Force Summer Faculty Fellowships in 2021. Babinkostova joined the Research Laboratory on Quantum Computing Theory and Simulation for her fellowship. Her research focused on quantum cryptography. Kandadai and Subbaraman served their fellowships at Wright-Patterson Air Force Base in Ohio, in the Sensors Directorate.

### Boise State University Ph.D. student with INL ties wins Idaho competition



Boise State University's **Ember Sikorski** took first place in the 2021 Statewide Three Minute Thesis Competition, which calls for graduate students to present their research in three minutes or less. This year's competition was held virtually and included 12 students from Boise State, Idaho State University and University of Idaho. A former Idaho National Laboratory intern, Sikorski is a fifth-year materials science and engineering doctoral student whose research focuses on uranium nitride and its potential to improve safety and efficiency in comparison to traditional nuclear fuels. Her research has been powered in part by INL supercomputers Sawtooth, Lemhi and Falcon. She is co-advised by Brian Jaques and Lan Li. Jaques is an assistant professor of Materials Science and Engineering at Boise State. Li

is an associate professor of Materials Science and Engineering at Boise State. Both are CAES Fellows and frequent collaborators with INL researchers through the Advanced Sensors and Instrumentation Program. Sikorski won \$1,000 for her first-place finish.

# PROGRAMMATIC

## Winners announced in CAES' annual pitch competition

Modeled after the “Shark Tank” television show, CAES Annual Pitch Event 2021: Pathways to INL Net Zero was designed to help the CAES research community develop and hone the skills needed to effectively pitch technical ideas or solutions while helping INL accelerate its goal of becoming carbon neutral by 2031. Researchers from all of the CAES entities participated in the competition, which began in July with a call for ideas in three categories: projects that were ready to implement today, demonstration-level projects that require development before implementation and an open submission category in which all ideas were welcome. Fourteen ideas advanced to the semifinals, and the contestants took part in training designed to help them more effectively pitch their ideas.



The field was cut to eight for the final round, and each finalist was allotted five minutes to pitch their idea live before a panel of judges (see below). One winner was selected in each of the three categories. Each will receive \$15,000 in research funding to help further develop their idea, and the runners-up also will receive funding to help advance their ideas.

### Judges Panel

**Stephen Boorman**, Idaho Falls Power assistant general manager

**Shannon Bragg-Sitton**, Integrated Energy Systems lead in INL's Nuclear Science & Technology Directorate

**Hayes Jones**, Resilience and Security and Operations lead for the U.S. Department of Energy's Federal Energy Management Program

**Mitchell Kerman**, INL Institutional Planning and Programs director

**Deborah Tate**, INL Campus Planning director

### Annual Pitch Competition winners

#### Track A: Demonstration Projects

**FIRST PLACE:** **Amey Khanolkar/INL**,  
“Innovative Carbon-Free HVAC Systems using Nuclear Micro-Reactors at INL's Site,” \$15,000

*A faculty member from Idaho State University and two INL researchers were named winners of CAES' annual pitch event.*

**FIRST RUNNER UP:** **Naqsh Mansoor/Boise State University**,  
“Energy Efficient Water Remediation via Flow Electrode Capacitive Deionization,” \$13,000

**SECOND RUNNER UP:** **Muhammad Usama Usman/INL**,  
“INL Internet of Buildings (INL-IoB) Platform,” \$10,000

#### Track B: Implement Today

**FIRST PLACE:** **Benny Varghese/INL**,  
“Solar Covered Parking Spots,” \$15,000

**FIRST RUNNER UP:** **Damon Woods/University of Idaho**,  
“Infrared Thermostat,” \$10,000

**SECOND RUNNER UP:** **Amey Khanolkar/INL**, “Modernizing INL's Buildings Using Electrochromatic Smart Windows”

#### Track C: Open Submission

**FIRST PLACE:** **Mustafa Mashal/Idaho State University**,  
“Sustainable and Green Concrete Mixes for INL's Infrastructure,” \$15,000

**FIRST RUNNER UP:** **Michael Hoover/INL**,  
“Essential Function Analysis Capability – Business Continuity,” \$10,000

## Flagship program hosts fourth cohort

The CAES Summer Visiting Faculty Program (CSVFP) featured 15 research teams composed of faculty members from the CAES universities and researchers from Idaho National Laboratory. In its fourth year, the program pairs university faculty and researchers throughout the summer, with the goal of developing a joint-funded research proposal of value to both parties.

The program is a cog in CAES' effort to enable the one-on-one collaborations needed to build and sustain a research collaboration ecosystem, per the CAES Strategy. It provides university participants access to the national laboratory, allowing them to learn about its inner workings,

capabilities and expertise, while building lasting networks between INL researchers and their students and colleagues. For INL researchers, the program offers an opportunity to build new academic connections, gain exposure to diversified funding opportunities, and connect with students supporting the faculty member. Participants were selected based on proposals submitted by faculty in one of the CAES focus areas: nuclear energy; advanced manufacturing; cybersecurity; innovative energy systems; energy-water nexus; energy policy; and computing, data and visualization. The faculty were then paired with INL researchers.

### **Past CSVFP projects that have received funding include:**

*An offshoot of a project led by Boise State University professor Mike Hurley that will soon lead to installation of a 3D metal printer for nuclear grade materials at CAES.*

*A project led by Idaho State University professor Irene van Woerden and INL Director of Communications and Outreach Rae Moss that calls for an in-depth analysis of the public perceptions of nuclear energy.*

*A project led by Boise State's Edoardo Serra that uses Lego Mindstorms to help teachers inspire middle-school students to pursue careers in cybersecurity.*

University Faculty	INL Researcher(s)	INL Directorate(s)	CAES Focus Area
<b>Boise State University</b>			
Yantian Hou	Koushik A. Manjunatha	NS&T	Nuclear energy
Jayash Paudel	Lionel Toba and Mamunur Rahman	EES&T	Energy Policy
Frank Lu	Binghui Li	EES&T	Innovative Energy Systems
Dan Deng	Casey Icenhour	NS&T	Computing, Data, & Visualization
Min Long	Yidong Xia, Trishelle Copeland-Johnson	EES&T, MFC	Computing, Data, & Visualization
<b>Idaho State University</b>			
Mostafa Fouda	Kurt Derr	N&HS	Cybersecurity
Andrew Chrysler	Lloyd Landon	N&HS	Cybersecurity
Justin Wood, Marcus Burger	Ron Fisher	N&HS	Cybersecurity
Mustafa Mashal, Dan LaBrier	Chandrakanth Boliseti, Som Dhulipala	NS&T	Nuclear Energy
Irene van Woerden	Rajiv Khadka	NS&T	Nuclear Energy
<b>University of Idaho</b>			
Vibhav Durgesh	Stephen Hancock	EES&T	Nuclear Energy
Michael Maughan	Thomas Lillo	EES&T	Advanced Manufacturing
Damon Woods	Bhaskar Mirtra	EES&T	Innovative Energy Systems
Rick Sheldon	Craig Rieger	N&HS	Cybersecurity
David Arcilesi	Amey Shigrekar, Joshua Fishler	NS&T	Nuclear Energy

*NS&T = Nuclear Science and Technology, EES&T = Energy & Environment Science & Technology, N&HS = National & Homeland Security, MFC = Materials & Fuels Complex*



## CAES launches new initiative to accelerate energy innovation, collaboration

CAES launched a new initiative designed to accelerate innovation to solve complex energy issues. Open to students and faculty at the CAES universities and Idaho National Laboratory researchers, the Energy Frontiers Challenge is structured to provide resources to catalyze transdisciplinary, multi-institution teams to pursue highly competitive funding opportunities that can lead to a CAES Center for Excellence (a National Science Foundation Engineering Research Center, for example, or an Energy Frontier Research Center through the U.S. Department of Energy).

## CAES universities launch pilot program for entrepreneurial faculty, graduate students, research staff

Representatives from Boise State University, CAES, Idaho State University and University of Idaho launched an initiative designed to help faculty, research staff and graduate students commercialize their research. The pilot program, called Idaho I-Corps Ignite, is designed to fill a gap in commercialization and entrepreneurship resources for faculty from the three CAES universities, which do not currently belong to an Energy I-Corps

program through the Department of Energy. Idaho I-Corps Ignite focused on scalable ventures; offered a stipend for participants; provided introductions to a network of mentors; and helped refine solutions into ventures through research, customer discovery and idea validation. Here are the participants in the pilot program that took place over the summer:

### ***Boise State University:***

- Anna Drennen
- Scott Phillips
- Brett Shelton
- Tony Valayil Varghese

### ***Idaho State University:***

- Amir Ali
- Jared Barrott
- Nirajan Bhattarai
- Taher Deemyad
- Donna Delparte
- Anish Sebastian

### ***University of Idaho:***

- Ken Baker
- Adam O'Keeffe
- Kelsey Ramsey
- Dakota Roberson
- Dev Shrestha
- Jeremy Tamsen
- George Tanner



## CAES Collaboration Fund recipients selected

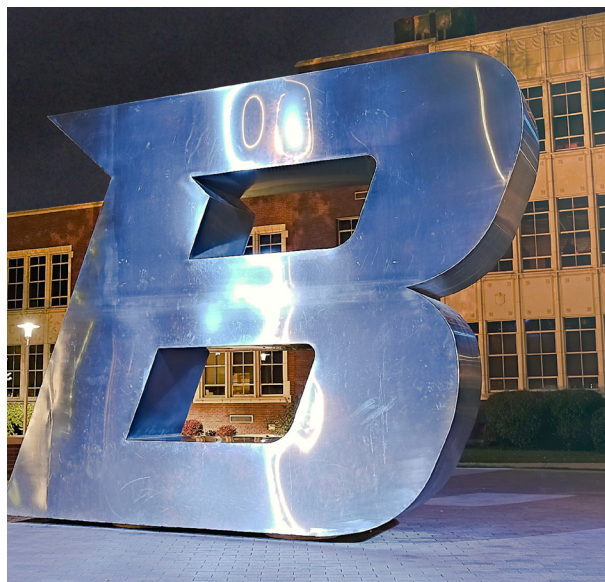
Nine teams were selected for CAES Collaboration Program Development Funds in 2021. The collaboration funds have been awarded for four years to projects led by Idaho National Laboratory researchers that include faculty from the CAES universities. The goal is to establish and foster relationships between the CAES entities in research, education and innovation. Each year, CAES leadership identifies the proposals best-suited to enhance collaborative relationships among the CAES entities in at least one of the seven focus areas outlined in the CAES Strategy, with priority given to projects with a tie to future direct-funded work such as through a U.S. Department of Energy solicitation. Here are the recipients:

Collaborators	Project title	CAES focus area(s)
INL's Joshua Hansel, Nuclear Science and Technology (NS&T) Directorate and Amir Ali, Idaho State University	Nuclear Microreactor Heat Pipe Modeling and Simulation Database	Nuclear Energy/Computing, Data, and Visualization
Kunal Mondal, INL (Energy and Environment Science and Technology (EES&T)), and Mustafa Mashal, Bruce Savage, Rene Rodriguez, and Kavita Sharma, Idaho State University	Bulk Storage of Hydrogen Energy	Advanced Manufacturing
Lu Cai, INL (EES&T), and Lan Li, Boise State University	Thermal Analysis of Nuclear Materials	Nuclear Energy
Bryon Marsh, INL (N&HS), and Mustafa Mashal, Idaho State University	Radiological Dispersal Device Training	Nuclear Energy
Craig Rieger, INL (N&HS), and Costas Koliass, University of Idaho	Evaluation of USB Peripherals	Cybersecurity
Boopathy Kombaiah, INL (MFC), and Indrajit Charit, University of Idaho	Manufacturing Materials Development	Advanced Manufacturing/ Nuclear Energy
Amy Lientz, INL (EES&T, NS&T, and N&HS), and Karen Corral and Jim Kroes, Boise State University	Growing the Next Generation of Supply Chain Professionals	Cybersecurity
SM Shafiul Alam, INL (EES&T), and Yacine Chakhchoukh, University of Idaho	Cyber Vulnerability Issues of Distribution Systems	Cybersecurity/Innovative Energy Systems
Som Dhulipala, INL (NS&T), and Leslie Kerby, Idaho State University, and Lars Kotthoff, University of Wyoming	Randomized Computing for Multiphysics Modeling and Simulations	Computing, Data, and Visualization

## EDUCATION HIGHLIGHTS

### Boise State grant leads to NSF site at CAES

Boise State University received a \$365,000 grant to launch a National Science Foundation Research Experience for Undergraduate (REU) Site at CAES. The funding will allow CAES to offer a 10-week summer research program for undergraduate students each year for three years starting in summer 2022. This provides students hands-on research experiences and networking opportunities to develop their STEM (science, technology, engineering and math) identity and literacy, while also providing professional development opportunities for careers in the energy sector. The project is led by **Dave Estrada**, CAES associate director for Boise State, and Brian Jaques, an assistant professor in Boise State's Micron School of Materials Science and Engineering, director of the Boise State Advanced Materials Laboratory, Boise State's lead in the nuclear energy focus area at CAES and a CAES Fellow. Plans call for bringing 10 students to CAES to conduct research each summer – five students from two- and four-year institutions in Idaho and five students from a pool of applicants from across the nation. Faculty from Idaho State University and University of Idaho contributed to the



proposal and will mentor REU student projects at the CAES facility. During the summer camp, students will network with and learn from Idaho National Laboratory researchers, share their work with an active research community and co-author publications and presentations based on their research findings. The project is funded by the Division of Engineering Education and Centers and the Established Program to Stimulate Competitive Research.

### CAES, ATR team up

Several CAES faculty members and leadership at Idaho National Laboratory's Advanced Test Reactor (ATR) have begun helping students understand ATR's world-class capabilities. The efforts began in fall 2020, providing students access to the Advanced Test Reactor Critical (ATR-C) facility and the ATR gamma tube to conduct experiments and observe operations. Although a mechanism for collaboration has not been determined, plans are developing for a pilot opportunity.

Several CAES faculty members - Idaho State University professor Dan LaBrier, Boise State University professor Brian Jaques, and University of Idaho professor Rich Christensen - have agreed to



participate and ATR's team is assembling a test plan and user guide to share with faculty. ATR-C, which has been operating since 1964, has traditionally been used to verify the safety of a proposed experiment before it is placed in the ATR. Recent improvements in experiment modeling are expected to lessen the reliance on ATR-C for pre-testing, leading to capacity in ATR-C and opportunities for students.



## ISU, UI unveil cybersecurity offerings

Idaho State University is offering two new cybersecurity certificates as part of the statewide cybersecurity education initiative between the CAES universities and Idaho National Laboratory. The certificates are the result of collaboration between ISU's computer science faculty and INL's National and Homeland Security Directorate, and are intended to help INL and regional entities fill critical skills needs over the next five years. They are designed to provide students the skills required to handle a range of responsibilities, from technical program coordination to project management to the ability to thwart cyberattacks.

The other CAES universities boast cybersecurity offerings, too: Boise State University began offering undergraduate and graduate cybersecurity certificates in fall 2020, the same time University of Idaho began offering a bachelor's degree in computer science with a cybersecurity emphasis.

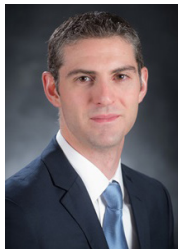
In addition, the Idaho State Board of Education this year approved University of Idaho's plans for a new master's degree program in cybersecurity. The offering is designed to meet increasing demand for cybersecurity professionals in Idaho and the nation.

A recent report from the Idaho Department of Labor found that cybersecurity job openings have increased 160 percent statewide since 2015. Enrollment in U of I's cybersecurity bachelor's degree program has grown exponentially since its launch. Part of the appeal is that the university participates in the CyberCorps: Scholarship for Service program, which offers cybersecurity training and career placement at several federal agencies. Funded through the National Science Foundation, the program covers tuition and offers stipends for students. Industry partners in the program include INL, Idaho Power, POWER Engineers, Avista Utilities and Schweitzer Engineering Laboratories. The university is working to launch a doctorate program in cybersecurity, which is one of the seven focus areas outlined in the CAES Strategy. Cybersecurity is also the focus of a state initiative that provided \$950,000 to Idaho's universities and community colleges to develop a joint cybersecurity major this year.

## RESEARCH HIGHLIGHTS

### University of Idaho faculty member leads team that receives National Science Foundation award

University of Idaho faculty member **Michael Maughan** leads a research team that received a \$3.9 million Research Infrastructure Improvement Track-2 Focused Established Program to Stimulate Competitive Research Collaboration award from the National Science Foundation's Office of Integrative Activities in fall 2021. The project calls for teams from the University of Idaho and Auburn University to create a framework to utilize renewable and waste feedstocks to develop 100% bio-based materials for the Advanced Housing Manufacturing Industry of the Future. The project includes outreach to high school chemistry students, educating



undergraduate and graduate students, and mentoring postdoctoral scholars and early-career faculty members.

The two collaborating states involved in the project, Idaho and Alabama, are expected to benefit economically from industry partnerships and technology developments that emerge from it. Maughan is an assistant professor in the Advanced Manufacturing and Material Properties Group at University of Idaho and a member of the fourth cohort of the CAES Summer Visiting Faculty Program.

### Boise State faculty member, a CAES Fellow, on team awarded NEUP grant



CAES Fellow **Brian Jaques** of Boise State University is among the researchers collaborating on a project that received a \$300,000 grant

via the Nuclear Energy University Program in fall 2021. Led by a researcher from the University of Texas at San Antonio, the project supports fabricating and testing advanced nuclear fuels and materials, specifically the development of the uranium-bearing compounds, alloys and composites. Jaques, an assistant professor of material science and engineering, is a frequent collaborator with INL researchers in the High Temperature Test Laboratory, Transient Reactor Test Facility and ATR on the In-Pile Instrumentation Program. He is also the Boise State representative in CAES' effort to collaborate with ATR for student engagement.

### University of Idaho team receives IGEM award



University of Idaho was recently awarded a \$206,000 grant from the Idaho Global Entrepreneurial Mission (IGEM) to collaborate with industry partner Hempitecture Inc. in the research and development of a natural fiber insulation product. The goal is to develop the product, called HempWool, into a pioneering sustainable product in the building industry.

The U of I team is composed of several researchers in the university's College of Natural Resources and includes **Damon Woods**, interim director of the university's Integrated Design Lab and a leader of the Innovative Energy Systems working group at CAES. Hempitecture is a building materials supplier based in Ketchum, Idaho. The company said HempWool will be created with the fiber from industrial hemp grown sustainably in rural communities across the U.S.



## CISU researchers work on sensors for INL's Advanced Test Reactor

Idaho State University researchers have completed a collaborative project investigating the performance of a prototype of a remote, canister-monitoring system, to determine whether it could be implemented in storage canisters for used fuel plates from Idaho National Laboratory's Advanced Test Reactor. The project dates to 2020, when INL was tasked by the U.S. Department of Energy's Office of Environmental Management with evaluating sensor technologies

that could provide in situ measurements of moisture and hydrogen content within extended dry storage canisters used to house aluminum-clad used nuclear fuel. The prototype developed by INL researchers was a combined sensor system capable of acquiring a point measurement of information within the canister, including temperature, relative



humidity and hydrogen gas concentration. The equipment was tested at CAES by a research team led by Principal Investigator Evans Kitcher (INL) and co-Principal Investigator **Daniel LaBrier** from ISU. The team, which included INL employees John Buttles, Michael Fanning, Nancy Johnson and Phil Winston, and ISU researcher Eslam Ali, also investigated the use of wireless transmission of collected data to a remotely located data acquisition system. The project was successfully completed in May.

## CAES Fellow part of team that lands NSF grant



CAES Fellow **Claire Xiong** from Boise State University is a member of a research team that recently received a grant of nearly \$2 million

from the National Science Foundation to engage prospective elementary teachers' mathematical learning through science, technology, engineering and math (STEM) inquiry and experiential learning. The goal of the research is to improve prospective elementary teachers' engagement

through innovative, interdisciplinary and inquiry-based approaches to address the pressing needs for integrating multiple disciplines in STEM. The grant will empower interdisciplinary collaboration across STEM fields, including mathematics, computer science, and materials science and engineering, across four universities: Boise State, Augusta University, the University of Texas at San Antonio, and Kapi'olani Community College. Xiong is an associate professor of materials science and engineering at Boise State.

## Boise State University Ph.D. student, INL graduate fellow wins best poster competition at global conference



INL Graduate Fellow **Kiyo Fujimoto**, a Ph.D. student at Boise State University, won top honors at The Minerals, Metals and Materials

(TMS) Technical Division Student Poster Competition in the spring. The poster competition was a highlight of the TMS 2021 Virtual Annual Meeting and Exhibition, which drew nearly 3,000 scientists, engineers and students from all over the world. The event featured 2,493 presentations, including 273 poster presentations and 583 student presentations. Fujimoto's poster, "Utilizing Advanced Manufacturing for the Development of Advanced In-pile Sensors and Instrumentation," took first place in the Functional Materials Division.

## CAES Energy Policy Institute director collaborates with INL researcher on article



**Kathy Araújo**, director of the CAES Energy Policy Institute at Boise State University, teamed with Idaho National

Laboratory researcher David Shropshire on an article on the resilience of zero-carbon power systems in extreme weather that appeared in the journal *Energies* in July. The article, "A Meta-Level Framework for Evaluating Resilience in Net-Zero Carbon Power Systems with Extreme Weather Events in the United States," outlines a new approach for regulators, utility officials and community leaders to more thoroughly evaluate and track resilience.



## University of Idaho faculty collaborate on project that won R&D 100 Award



Two CAES-affiliated professors from University of Idaho are members of an Idaho National Laboratory-led team that won an R&D

100 Award. **Dakota Roberson**, a CAES resident and assistant professor in U of I's College of Engineering, and Roger Lew, a research assistant professor in U of I's Virtual Technology & Design Program, are collaborators on Route Operable Unmanned Navigation of Drones (ROUNDS), which utilizes the use of

unmanned aerial vehicles to gather data in hazardous situations. ROUNDS is described as a cost-effective method for charting a course in a structure that lacks a strong GPS signal by utilizing self-navigating drones. Self-navigation is achieved by determining the drone's location from the visual angle of QR codes placed along a desired course, then dynamically adjusting its path. Drones using ROUNDS could be deployed to gather instrument data, check inventory, perform security rounds or complete other tedious tasks, saving time and money while increasing operational efficiency in a range of industries. ROUNDS also could improve

safety by eliminating the need for people to enter hazardous areas. The project, one of three INL-led projects to win an R&D 100 Award this year, is led by Principal Investigator Ahmad Al Rashdan, an INL researcher. R&D 100 Awards celebrate research and development technologies from both public and private sectors and are a prestigious distinction for inventors. Laboratories and companies across the nation submit nominations, and a panel of more than 40 industry-leading experts ranks the entries based on technical significance, uniqueness and applicability across industry, government and academia.

## University of Idaho's Dakota Roberson on team that garners national recognition

University of Idaho assistant professor **Dakota Roberson** is part of a team recently identified by Public Utilities Fortnightly as one of the Top Innovators 2020 in the category of Transmission. Roberson's team – which is led by Hitachi ABB Power Grids and includes U of I College of Engineering distinguished professor Brian Johnson, Bonneville Power Administration, Argonne National Laboratory and University of Illinois at Urbana Champaign – is working to create an array of protections for high-voltage transmission systems to detect and deter cyberattacks. Funded through an initial \$200,000 subcontract from a U.S. Department of Energy grant to Hitachi, and an additional \$100,000 grant from Hitachi, the U of I team has developed algorithms to defend against attackers who have breached these systems by spoofing control commands and measurements or altering the configuration of a device.

## Boise State team receives DOE EPSCoR grant for quantum computing research

An interdisciplinary team from Boise State University received \$5 million in funding for quantum computing research through the U.S. Department of Energy's Established Program to Stimulate Competitive Research (EPSCoR). Focused on identifying information needed to build dye components for quantum computing, the project was one of nine projects covering a range of energy research topics

including grid integration, solar energy, wind energy and advanced manufacturing that received \$22 million in funding. According to a DOE news release, "these projects are located in communities traditionally underserved by federal research and development." The funding is intended to ensure that all parts of the country are central to efforts to solve the climate crisis and meet the Biden

administration's goal of net-zero carbon emissions by 2050. This funding is intended to improve geographic distribution of federal R&D funding, strengthen research capabilities in underserved regions of the country, and enable institutions in those regions to better compete for federal R&D funding. There are 28 jurisdictions designated under EPSCoR, including 25 states and three U.S. territories.

## Paper on collaborative project that won state grant is published



The Journal of Composite Materials published a paper on a project involving Boise State University and University of

Idaho that addresses the growing need to safely store the nation's nuclear waste. The project received a \$238,000 grant through the Idaho Global Entrepreneurial Mission (IGEM) program in 2017 to further research into the effort and bring the resulting technologies to market. The collaborative project also involves industry partner Sakae Casting, a Tokyo-based company that opened its first U.S. office in Idaho Falls in 2017, after the grant was awarded. The project calls for the development of an aluminum cast with embedded natural boron for cooling used nuclear fuel. The lead author of the article is Kaelee Novich, a Boise State University

Ph.D. student in the Advanced Sensors and Instrumentation program led by professor **Brian Jaques**, a CAES Fellow and principal investigator on the project. Titled "Synthesis of boron carbide reinforced aluminum castings through mechanical stir casting," the article addresses the need to develop a commercially viable alternative to the traditional containment of storing spent nuclear fuel in pools of water, due to delays in finding a long-term repository for the waste. Used fuel rods are typically placed in deep pools of water for 10 to 20 years before the rods have cooled enough to be safely transported to long-term storage. With no long-term repository for the waste, pool storage capacity is becoming constrained, and building more pools is costly and faces significant regulatory hurdles. As a result, dry cask designs have become a growing alternative, implemented at 65 reactor sites in the U.S. The research by Boise State

and University of Idaho addresses the main limitation to current dry cask designs: The fact that they can only store spent fuel after they have been cooled in a pool for at least a year. The alternative identified by the CAES-affiliated research team was to integrate serpentine water-cooling coils into an aluminum plate manufactured by conventional sand casting, with the boron carbide particles sand casted into the aluminum plates, allowing the spent fuel to be stored earlier in the casks at a low cost and potentially reducing the current risks associated with storing nuclear waste in pools. Boise State, with assistance from Sakae, focused on the fabrication process of sand casting and best practices for boron carbide dispersion, while the University of Idaho made neutron simulation charts that helped determine the necessary wall thickness of the cask based on boron carbide concentration and dose rate.

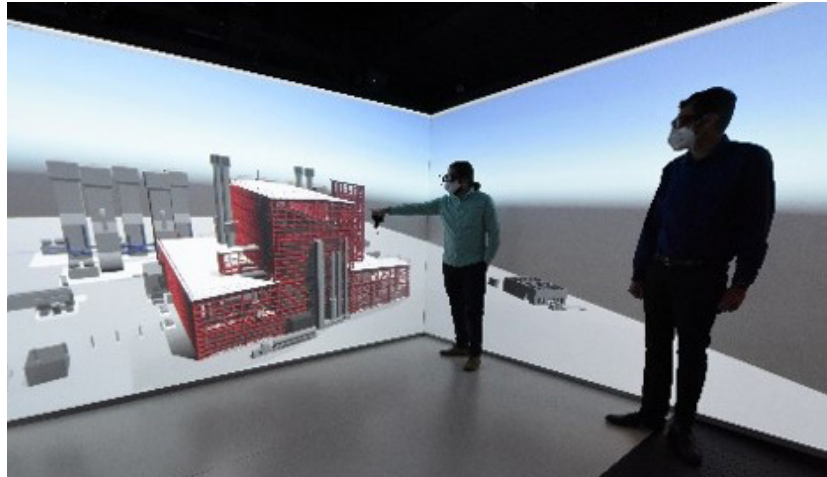
*The project received an IGEM grant in 2017. It is one of several IGEM grants awarded to CAES researchers in recent years, including two in 2019 and another in 2021.*

## CAES project garners media attention



A project involving researchers from Idaho National Laboratory, University of Idaho, Idaho State University and

private industry that would accelerate the development of the world's first Molten Salt Nuclear Battery (MsNB), a nuclear reactor to generate heat and produce electricity, was featured in Idaho Business Review in mid-December. The project, which received \$40,000 in seed funding through the CAES Collaboration Fund, features a new testing device designed by U of I professor **Rich Christensen** that physically validates the MsNB as an improved, more reliable and cost-effective molten salt reactor for its ability to naturally circulate liquid fuel. The device would save millions of dollars in testing costs and accelerate development of the MsNB by two years, according to the project's collaborators, which include INL researcher Piyush Sabharwal and Tennessee-based nuclear energy company Micro Nuclear. The device uses ohmic heating to heat liquid via an electric current and acts as a reactor surrogate, mimicking the internal heat generation that would occur through fission within the reactor. Generating energy from nuclear fuel dissolved in molten salt does not require a solid fuel like the uranium or plutonium used in most nuclear reactors today, increasing the operation's safety and efficiency. Research is ongoing to commercialize the technology, and a patent is being filed on the concept's application in nuclear power plants.



## Applied Visualization Laboratory develops tools, videos for INL

Staff at the Applied Visualization Laboratory (AVL) developed a virtual flythrough tour of INL for the National Reactor Innovation Center. AVL researchers also developed a visualization capability that will be used in digital twin modeling, analysis and

evaluation of next-generation nuclear reactors, in collaboration with the INL Energy and Environment Science & Technology Directorate's Digital Engineering program's work with the Versatile Test Reactor project.

## Boise State University students earn recognition

Nine Boise State University-affiliated students from various disciplines recently earned the recognition of the National Science Foundation (NSF) for the quality and promise of their research endeavors. Four students received offers to join the NSF Graduate Research Fellowship Program, which awards students in STEM-based graduate programs with a \$12,000 allowance for tuition and fees and a \$34,000 annual stipend for their meritorious research and promising outlook.

An additional five Boise State students received NSF Graduate Research Fellowship Program Honorable Mention in recognition for their research, including Ariel Weltner, a first-year doctoral student of the CAES associate director for Boise State, Dave Estrada, in the university's Advanced Nanomaterials and Manufacturing Laboratory.

Weltner also was awarded a Nuclear Energy University Program fellowship from the U.S. Department of Energy. This fellowship provides Weltner with \$52,000 annually for three years, plus \$5,000 toward a summer internship at a DOE research laboratory, aimed at bolstering the ties between students and DOE's energy research programs. Weltner's fellowship is expected to support her research developing flexible energy harvesters that could power remote sensors for monitoring conditions within nuclear reactors and spent fuel storage facilities.

Weltner's award is one of 31 graduate fellowships and 50 undergraduate scholarships for students at 35 universities in 23 states. In all, more than \$5 million in scholarships and fellowships was awarded through the Nuclear Energy University Program.



## EVENTS

### CAES Energy Policy Institute

#### HOSTS ANNUAL CONFERENCE VIRTUALLY

The CAES Energy Policy Institute at Boise State University held the 10th annual Energy Policy Conference in mid-October. More than 200 people attended, the best draw in the event's history. Keynote speakers included John Wagner, Idaho National Laboratory director; Abigail Ross Hopper, president and CEO of the Solar Energy Industry Association; William Magwood, director-general of the Nuclear Energy Agency; Jennifer Fordham, former senior vice president of Government

#### CAES ENERGY POLICY INSTITUTE HOSTS VIRTUAL PANEL DISCUSSIONS

The CAES Energy Policy Institute held its Power Talks series virtually throughout the year. Power Talks focuses on energy decision-making and policy, bringing together leading authors, researchers and technologists with those interested in energy to share insights and engage in discussion. The series is free and open to the public.

Presenters included Steve Hubble, Climate Action manager for the city of Boise; John Phelan, Energy Services senior manager for Fort Collins, Colo.; Christopher Thomas, Senior Energy and Climate Program manager for Salt Lake City; and documentary filmmaker

Affairs for the Natural Gas Supply Association; and Jon Wellinohoff, CEO of Grid Policy, Inc. and former chairman of the Federal Energy Regulatory Commission.

The conference featured sessions on resilience in the power sector and the future of electric vehicles, all revolving around the conference's theme of "Disruption and Megatrends in Energy." The conference was cancelled in 2020 due to the COVID-19 pandemic.

Scott Tinker, who is also director of the Bureau of Economic Geology, the state geologist of Texas and a professor holding the Allday Endowed Chair in the Jackson School of Geosciences at The University of Texas at Austin.

The sessions were moderated by Kathleen Araújo, EPI director and an associate professor of Sustainable Energy Systems, Innovation and Policy at Boise State.





# MEETINGS, OPEN HOUSES, SEMINARS AND SPEECHES

## CAES Currents discussions held

CAES Currents panel discussions respond to global events, providing a forum for students, researchers and the public to gain insight into the event, discover opportunities and solution-based outcomes, and increase dialogue among CAES affiliates, leading to further collaboration and education. The goal is to present an engaging Q-and-A forum that covers a range of topics happening globally and locally. Three CAES Currents presentations were held in 2021:

**Trash Talk** focused on recycling, plastics and sustainability. The virtual discussion centered on the impact of policy changes in China on recycling programs and the waste industry in the U.S., and featured representatives from Boise State University, the city of Boise, U.S. Department of Energy, Idaho National Laboratory, University of Idaho, and the National Waste & Recycling Association. Panelists discussed their roles in responding to the changes and the ways their work intersects with the issue.

**Insights on Energy** featured a presentation by Rep. Mike Simpson, a Republican from Idaho, on the federal appropriations process. CAES Energy Policy Institute Director Kathleen Araújo moderated the ensuing conversation, which included panelists:

**Paul Kjellander**  
*President of the Idaho Public Utilities Commission and the National Association of Regulatory Utility Commissioners*

**John Kotek**  
*Senior vice president of the Nuclear Energy Institute*

**Jeff Malmen**  
*Senior vice president of public affairs for Idaho Power*

**Brianne Miller**  
*Director of INL government affairs*

**Bear Prairie**  
*General manager of Idaho Falls Power*

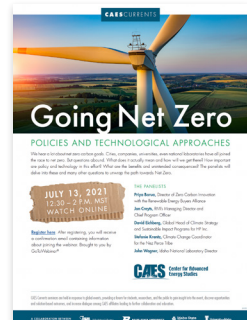
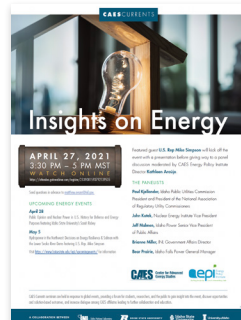
**Going Net Zero** featured experts on carbon-neutral energy policies, including INL Associate Laboratory Director Todd Combs, and was moderated by Veronika Vazhnik, the inaugural Idaho Science and Technology Policy CAES Fellow. Panelists included:

**Priya Barua**  
*Director of Zero Carbon Innovation with the Renewable Energy Buyers Alliance*

**Jon Creyts**  
*Managing director at RMI (formerly the Rocky Mountain Institute)*

**David Eichberg**  
*Global head of climate strategy and sustainable impact programs for HP Inc.*

**Stefanie Krantz**  
*Climate change coordinator for the Nez Perce Tribe*



## CAES Executive Board hosts virtual town hall

The CAES executive board hosted a live virtual town hall in the spring to provide residents with updates on several initiatives and projects underway at the CAES facility. Those projects include Installing a new transmission electron microscope and construction related to the SMR Simulator Laboratory and new Advanced Manufacturing Suite. Initiatives discussed included the CAES Summer Visiting Faculty Program, Energy Frontiers Challenge, CAES Fellows and progress on the development of a Joint Certificate in Nuclear Safeguards & Security.

## Boise State teams with national laboratories to help students

CAES representatives from Boise State University collaborated with Idaho National Laboratory and Pacific Northwest National Laboratory to host an online workshop on the Department of Energy's Science Undergraduate Laboratory Internships (SULI) program. National lab representatives provided an overview of their SULI programs and described the research and internship opportunities available to undergraduates, providing an opportunity for students to meet scientists and learn about upcoming internship opportunities.



## Proposal writing panel discussions draw robust crowds

*CAES held a series of three professional development webinars on proposal writing.*

### First Webinar

The Responding to Funding Opportunity Announcements event featured presentations from a representative of a consulting firm specializing in proposal development, enhancement, and refinement, as well as INL proposal gurus and representatives from the CAES universities, including:

#### Carly Cummings

*Director of the Office of Research and Faculty Development at University of Idaho*

#### Chad Watson

*Director of Strategic Initiatives at Boise State University*

#### Dave Harris

*Assistant vice president for research at Idaho State University*

The panelists focused on helping participants respond to calls from DOE and the National Science Foundation. More than 240 people attended.

### Second Webinar

More than 100 people tuned in to Developing and Funding a Center. The event featured a presentation from KB Science, a consulting firm specializing in proposal development, enhancement and refinement.

**Third Webinar** More than 50 people, from university students to INL researchers, tuned in for Post Award Review: What other opportunities can I pursue if my proposal is not selected for funding? This panel discussion featured representatives from the CAES universities and INL. Steve Hartenstein, chief science officer for National and Homeland Security, moderated as the panelists addressed a range of topics, including a discussion on alternative funding paths available for innovative research concepts. The panelists included:

#### Lisa Aldrich

*Manager of INL proposals management*

#### Jonathan Cook

*Licensing and commercialization manager in INL's Technology Deployment Department*

#### Mary Lou Duznik-Gougar

*Associate professor and dean of Idaho State University's College of Science and Engineering*

#### Dave Estrada

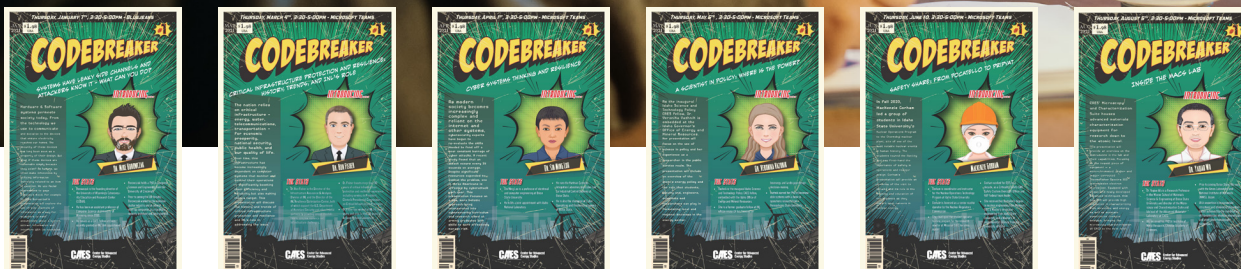
*CAES associate director for Boise State University who holds a joint appointment with INL*

#### Catherine Riddle

*Senior research scientist with INL's Nuclear Science and Technology directorate*

#### Natalie Summers

*Innovation projects analyst at INL*



## Codebreaker

This monthly webinar provides a forum for students and researchers to address their work, communicate opportunities and challenges to a receptive audience, and increase dialogue among CAES affiliates. Presenters in 2021:

### Ron Boring

*CAES Fellow, founder of the Human Systems Laboratory at Idaho National Laboratory and a manager in INL's Human Factors and Reliability Department*

### Mike Borowczak

*Assistant professor of Computer Science at University of Wyoming*

### Alan Carr

*Senior historian at Los Alamos National Laboratory*

### Indrajit Charit

*Chair of the Department of Nuclear Engineering and Industrial Management at University of Idaho, Idaho Falls*

### Ron Fisher

*Director of INL's Infrastructure Assurance & Analysis Division and the INL Resilience Optimization Center*

### Mackenzie Gorham

*Coordinator and instructor for the Nuclear Operations Technology Program at Idaho State University*

### Christine King

*Director of Gateway for Accelerated Innovation in Nuclear*

### Sin Ming Loo

*Professor of electrical and computer engineering at Boise State University*

### Bear Prairie

*General manager of Idaho Falls Power*

### Veronika Vazhnik

*Inaugural Idaho Science and Technology Policy CAES Fellow*

### Yaqiao Wu

*Director of the Microscopy and Characterization Suite at CAES*



## Boise State University, CAES host webinars for researchers

Boise State University hosted a webinar for all CAES entities on the National Science Foundation's Graduate Research Fellowship Program in fall 2021. The program offers a prestigious fellowship that recognizes and supports early career graduate students who demonstrate the potential to make impactful research contributions in STEM or STEM education. The fellowship provides three years of financial support with an annual stipend of \$34,000. The virtual workshop featured an overview of the program and featured previous and current NSF graduate research fellows who shared their insights on what makes for a competitive application.

Also in the fall, CAES hosted a webinar on the Nuclear Science User Facilities (NSUF) Rapid Turnaround Experiments program for researchers interested in learning more about NSUF and opportunities for collaboration, particularly at CAES' Microscopy and Characterization Suite (MaCS), one of 50 NSUF user facilities at 19 partner institutions throughout the world. NSUF's mission is to facilitate advancement of nuclear science and technology by providing researchers with access to world-class capabilities at no cost to the researcher.

The Rapid Turnaround Experiments award process offers an avenue for researchers to perform irradiation effects studies of limited scope on nuclear fuels and materials of interest utilizing NSUF facilities. The webinar featured presentations by NSUF Program Administrator Jeff Benson and MaCS Director Yaqiao Wu, and a panel discussion on approaches for developing a competitive proposal.

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## CAES sponsors remote summer boot camp in data science

The CAES-funded Remote Boot Camp in Data Science held in July drew more than 140 registrants from across the CAES entities. The four-day virtual event was led by Boise State University faculty member and CAES Fellow [Lan Li](#) and Idaho State University faculty member [Leslie Kerby](#). It featured presentations by researchers from Idaho National Laboratory, the CAES universities and industry representatives. The boot camp was open to students, faculty and researchers, and the goal was to teach them the skills needed to



incorporate data science tools in their research. This is the third remote boot camp in data science sponsored by CAES since 2020. Last summer, more than 300 students, researchers and faculty members attended two sessions.

## Virtual roundtable held with new INL leader, CAES faculty



Faculty members from the CAES universities presented their research at a roundtable event in the spring. Twelve faculty members took part in the

roundtable, which featured a presentation from Jess Gehin, associate laboratory director for Idaho National Laboratory's Nuclear Science & Technology Directorate. CAES Associate Director for the University of Idaho [John Russell](#) organized the virtual event, which included presentations from these faculty members:

### *Boise State University*

- Jim Browning
- Brian Jacques
- Lan Li
- Claire Xiong

### *Idaho State University*

- Amir Ali
- Mustafa Mashal
- Chad Pope

### *University of Idaho*

- Jason Barnes
- Indrajit Charit
- John Crepeau
- Vivek Utgikar
- Matthew Swenson

## Researchers from CAES lab host workshops

Researchers from CAES' Applied Visualization Laboratory led workshops at a virtual conference in the spring hosted by the Rocky Mountain Advanced Computing Consortium. The consortium is comprised of academic and research institutions throughout the intermountain states focused on facilitating the widespread effective use of high-performance computing. Lab lead John Koudelka and researchers Xingyue Yang and Rajiv Khadka led two workshops:

### High Performance Computing for Scientific Visualization

This workshop addressed the ways visualization can help enhance understanding of big-data analysis and large-scale simulations. Its focus was to help attendees use high-performance computing for data visualization more efficiently.

### Virtual and Augmented Reality (VR/AR): Applications and its Future

This workshop touched on the history of VR/AR and its growth in a diverse range of fields, including engineering, medicine and education, and provided practical insights to inspire attendees to develop, refine and avoid pitfalls using VR/AR in their work.

## CAES' Applied Visualization Laboratory hosts demonstrations

CAES' Applied Visualization Laboratory hosted two demonstrations in the spring. One visit consisted of a demonstration and discussion focused on the design of a radiation glovebox and laboratory space that will support nuclear fuel cycle research at Idaho National Laboratory. AVL staff members demonstrated the engineering model for the new lab and the ergonomics of its design, including the height of the glovebox equipment, access to lab safety equipment and the location of countertops and other workspace items.

The second demonstration was part of a comprehensive INL tour by Associate Laboratory Director for Nuclear Science & Technology Jess Gehin and several personnel from the Department of Energy's Idaho office, and was intended to showcase the use of virtual reality and augmented-reality technology and digital twin capability for rapid prototyping and design.



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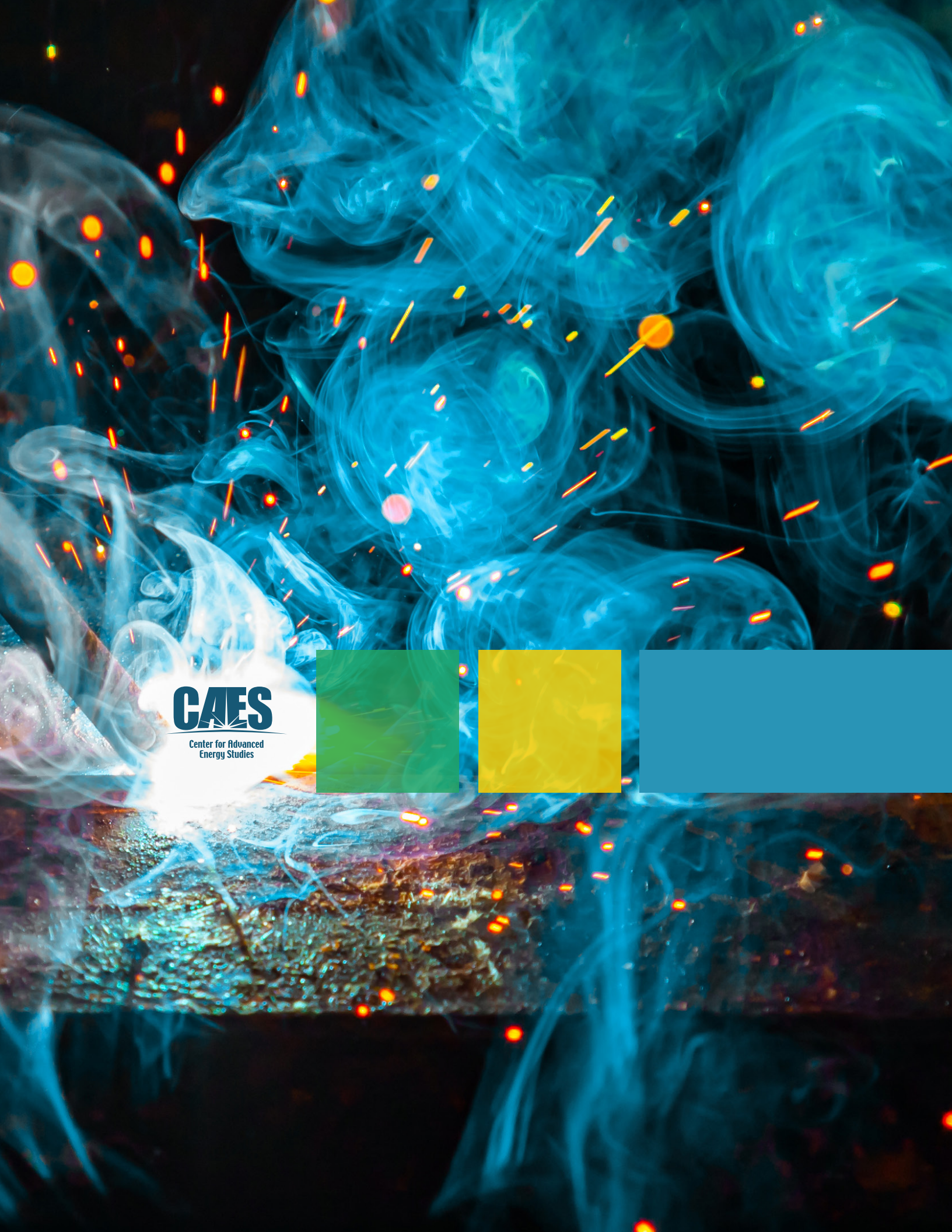
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