PURDUE UNIVERSITY

School of Nuclear Engineering

NUCLEAR ENGINEERING NEWSLETTER

SPEARHEADING THE ENERGY TRANSFORMATION

Fall 2025 | Issue 7

NEXT-GEN INNOVATIONS

including

- NUCLEAR ENERGY SUMMITS
- NOVEL CREDENTIAL PROGRAM
- NEW COLLABORATION PACT

MESSAGE FROM THE HEAD

The year 2025 has been a year of phenomenal leaps for Purdue University's School of Nuclear Engineering (SNE). Renowned for world-class facilities and expertise, we elevated our impact in shaping the energy evolution at state, national and global levels. Our pioneering leadership in tackling the energy challenge spans research, education and partnerships.

Collaborating with the state of Indiana and corporations including Duke Energy and BWXT, we are spearheading momentum toward such promising solutions as small modular reactors (SMRs) and microreactors. This year, a SNE-led feasibility report for the Indiana Office of Energy Development inspired Gov. Mike Braun's moonshot goal to deploy SMRs in the state in eight years to address its growing, AI-fueled energy demand and boost its economy.

The past year brought federal and state government officials to tour our unique PUR-1 all-digital nuclear reactor and its digital twin, and 2025 culminated in a Global Energy Economic Summit that convened worldwide leaders to propel nuclear power deployment, innovation and workforce development. During the conference, we announced a partnership with BWXT to advance next-generation nuclear manufacturing, and we unveiled the nation's first online credential program in SMRs, a major step in building the talent pipeline.

Our faculty, students, alumni and partners make these achievements possible. Our faculty continue to blaze new research and education trails in such crucial areas as emerging reactor technologies, machine learning in energy systems, cybersecurity, and quantum information science. Our unique PUR-1 all-digital reactor continues to serve as a premier testbed for innovation. This year, it enabled a groundbreaking collaboration with Toshiba and Oak Ridge National Laboratory to demonstrate quantum secure communications in a nuclear environment, proving once again that Purdue is where the theoretical meets the practical.

We are teaching a record-breaking 281 students this fall, and I am proud to share that every single one of our graduate students is financially supported. Their excellence is evident, from securing prestigious fellowships to being named finalists in the American Nuclear Society's Student Design Competition.

I invite you to explore these stories in the pages ahead. They are a testament to a community that is not just witnessing history but making it.

Wishing you and your families a magnificent holiday season as we gear up for another year of consequential excellence.

Boiler Up!

Seungjin Kim
Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head of the School of Nuclear Engineering

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NE GLOBAL IMPACT

PURDUE HOSTS GLOBAL NUCLEAR ENERGY ECONOMIC SUMMIT TO ADVANCE INDIANA'S ROLE IN NUCLEAR INNOVATION

The Global Nuclear Energy Economic Summit, a landmark event hosted in partnership with the state of Indiana and Purdue University's College of Engineering, convened top leaders in energy, industry and public policy to shape the future of nuclear power in Indiana and beyond.

The Nov. 5-6 summit in West Lafayette focused on breakthrough technologies for small modular reactors (SMRs), including advanced nuclear manufacturing and technology integration, nuclear energy solutions for AI's energy demands, civil infrastructure and site construction, financing and regulatory assurance, and workforce development. Prominent speakers and expert panels drawn from across government, academia and the private sector participated. Several important announcements were made.

Purdue has launched the nation's first online credential program focused on SMRs, to address workforce shortages in the nuclear industry. (More information on p. 8.)

The Institute for Energy Innovation has been created to unite Purdue faculty, students and industry partners to develop transformational, industry-driven energy solutions that advance U.S. energy leadership, technology innovation, domestic supply chain resilience and Indiana's economic vitality.

Purdue and BWX Technologies, a leading supplier of nuclear technology for government and commercial customers globally, signed a memorandum of understanding that is part of a broader commitment by both institutions to deepen collaboration in support of their shared missions to advance nuclear energy, innovate civil infrastructure, integrate autonomous control systems and bolster cybersecurity to support next-generation nuclear technologies.

> "The quadruple announcements made at the Nuclear Energy Economic Summit mark a major milestone in Purdue's contributions to nuclear energy across education, research and industry partnership."
>
> **Mung Chiang, President of Purdue**

First American Nuclear, developer of a fast-spectrum SMR designed to deliver the most cost-effective utility-scale power in the world, plans to establish the company's headquarters, manufacturing facilities and an energy park in Indiana to position the state at the forefront of U.S. global leadership in nuclear technology.

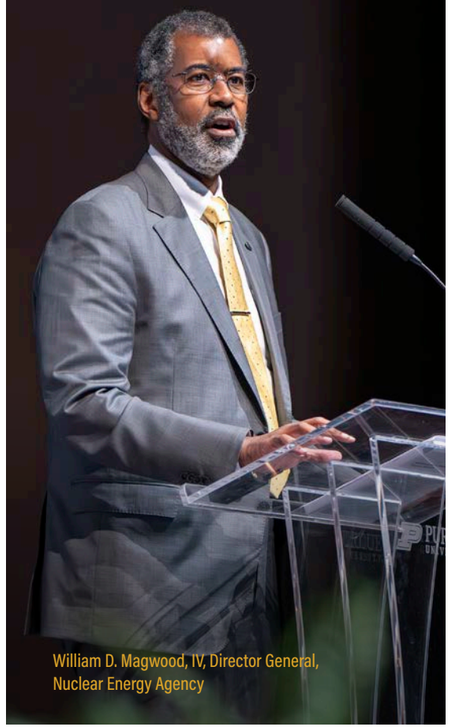
Giving keynote speeches were top leaders in the nuclear community, including Theodore Garrish, assistant secretary for nuclear energy in the U.S. Department of Energy; David Wright, chairman of the U.S. Nuclear Regulatory Commission; and William D. Magwood, director-general of the Nuclear Energy Agency.

Day 1 concluded with a fireside chat between Indiana Gov. Mike Braun and Purdue President Mung Chiang, who highlighted Purdue's globally-recognized research capabilities, underscoring the urgent need for a skilled workforce in the nuclear sector.

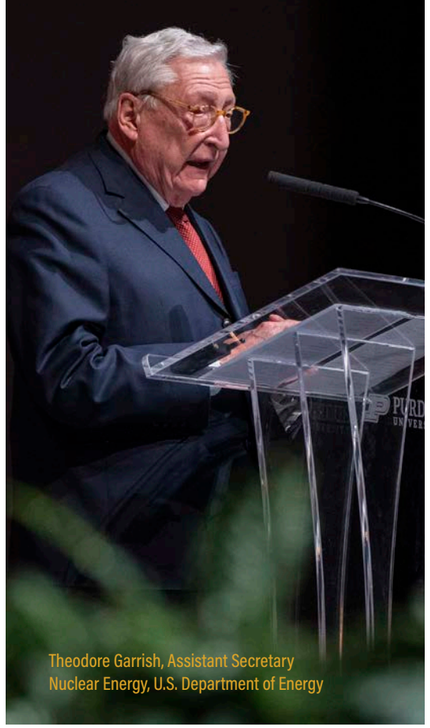
"The quadruple announcements made at the Nuclear Energy Economic Summit mark a major milestone in Purdue's contributions to nuclear energy across education, research and industry partnership," Chiang said. "As highlighted in the fireside chat with Gov. Braun, we have the opportunity to advance nuclear energy for national and economic security as electricity demand rises sharply in the age of AI and manufacturing reshoring."

Purdue, home to a top 10 nuclear engineering program, is recognized as a national leader in scalable and affordable energy innovation. The university operates PUR-1, the first and only nuclear reactor in the U.S. licensed by the Nuclear Regulatory Commission to use a fully digital instrumentation and control system. Purdue's long-standing expertise positions it at the cutting edge of next-generation nuclear technologies, including SMRs and microreactors.

"Purdue is at the forefront of nuclear energy innovation, particularly in the development and application of small modular reactors," said Arvind Raman, the John A. Edwardson Dean of Purdue's College of Engineering. "With world-class faculty and strong industry partnerships, we're driving research that supports an energy future with abundant energy and reinforces our leadership in this critical field."



William D. Magwood, IV, Director General, Nuclear Energy Agency



Theodore Garrish, Assistant Secretary Nuclear Energy, U.S. Department of Energy

David Wright, Chairman, U.S. Nuclear Regulatory Commission

Purdue University President Mung Chiang and Indiana Gov. Mike Braun participated in a fireside chat on Nov. 5 as part of the Nuclear Energy Economic Summit.

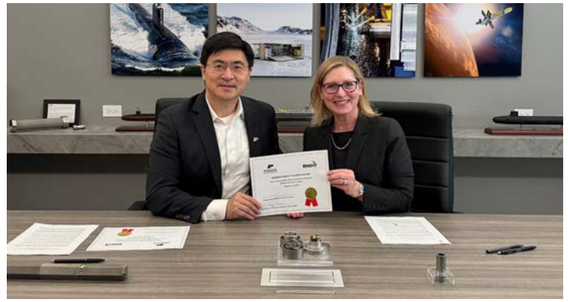
NE GLOBAL IMPACT

PURDUE, BWXT FORGE STRATEGIC COLLABORATION TO ADVANCE NUCLEAR INNOVATION

1ST AND ONLY

NUCLEAR REACTOR IN THE U.S.

WITH FULLY DIGITAL INSTRUMENTATION AND CONTROL SYSTEM



Purdue President Mung Chiang and Suzy Sterner, BWXT senior vice president and chief corporate affairs officer, signed an agreement that establishes a framework for joint research, technology development and student opportunities to advance nuclear innovation. (Photo courtesy of BWXT)

Purdue University and BWX Technologies Inc. (NYSE: BWXT), a leading manufacturer and supplier of nuclear components and services for the commercial and government sectors, have signed a memorandum of understanding to forge a groundbreaking research relationship focused on next-generation nuclear manufacturing, including small modular reactors (SMRs) and microreactors.

Through collaborative research and innovation, this agreement advances technical abilities and knowledge regarding nuclear energy that is essential to addressing growing energy demand, the economic resilience of the country, national defense and global security.

Purdue President Mung Chiang and Suzy Sterner, BWXT senior vice president and chief corporate affairs officer, signed the agreement Oct. 23 in Washington, D.C.

"This partnership marks a transformative moment for Purdue and the future of nuclear energy innovation," Chiang said. "By aligning our nationally recognized engineering programs with cutting-edge nuclear technologies, like small modular reactors, we're not only advancing research — we're also preparing the next generation of scientists, engineers and policy leaders to meet the energy and workforce demands of tomorrow."

Designed to be smaller and scalable with simplified operations and more efficient construction schedules, SMRs and microreactors are attracting growing interest for their ability to provide reliable, flexible power generation that can be deployed more quickly with lower overall capital costs than conventional, large nuclear facilities.

The Purdue-BWXT agreement is part of a broader commitment by both institutions to deepen collaboration in support of their shared missions to advance nuclear energy, innovate civil infrastructure, integrate autonomous control systems and bolster cybersecurity to support next-generation nuclear technologies.

The agreement outlines academic opportunities to advance career development for Purdue students and the broader nuclear workforce through:

- Research and development collaborations
- Continuing education opportunities and workforce development
- Shared expertise and infrastructure
- Support for the state of Indiana to deploy nuclear energy and nuclear manufacturing

"This agreement includes the key areas that will help the state of Indiana and the U.S. secure and grow our nuclear energy resources," Sterner said. "Many Purdue alumni have found a home at BWXT, where they are making real contributions in support of national security and domestic energy missions. We are excited to see this collaboration expand."

The signing of this agreement was announced as Purdue hosted the Global Nuclear Energy Economic Summit on Nov. 5-6, which brought together national and industry leaders to discuss the future of advanced nuclear manufacturing, SMRs and the growing role of artificial intelligence (AI) in industry. BWXT President and CEO Rex Geveden, who played a key role in the new agreement, delivered the keynote address.

"Our agreement with BWXT holds great value for the state of Indiana and the nation, as well as the nuclear energy industry and students," said Arvind Raman, the John A. Edwardson Dean of the College of Engineering at Purdue. "We are thrilled to be partnering with an industry leader to address critical energy needs by developing advanced technologies and training top-notch engineers to propel them to reality."

Paramount to the collaboration is Purdue University Reactor Number One (PUR-1), the only nuclear reactor in the state of Indiana and the first in the nation to be controlled and operated digitally.

As the first and only all-digital reactor licensed by the U.S. Nuclear Regulatory Commission, PUR-1 presents unique opportunities for innovative research and industry collaboration.

"This unique asset makes Purdue a national leader in nuclear engineering education, energy innovation and the empowerment of AI computing, while providing real-world experience to drive student success, helping fulfill demand in the nuclear workforce pipeline and bolstering economic development," said Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head of Nuclear Engineering at Purdue and facility director of PUR-1.

Purdue has taken a leadership role in advancing the nuclear science and civil engineering research infrastructure needed to develop nuclear technologies and provide hands-on training.

Purdue was awarded a $6 million grant from the U.S. Department of Energy in June 2024 to lead a consortium that will revitalize nuclear research facilities and expand university-led research for SMR and AR technologies.

In May 2024, Purdue was selected by the state of Indiana to assess the feasibility of deploying SMRs in Indiana. Results of the study were announced in February 2025. (Read more on p. 15.)

"This agreement between Purdue and BWXT further strengthens our state's position as a leader in energy innovation and technology-driven economic growth," said Jon Ford, executive director of the Indiana Office of Energy Development. "With the growing footprint of a digital economy drawing upon the electric grid, partnerships like this are essential to ensuring we have the skilled workforce and advanced energy systems to support them."

NE GLOBAL IMPACT

NUCLEAR ENERGY FORUM 2025 HIGHLIGHTS PURDUE NE AS CATALYST IN SHAPING INDIANA'S ENERGY FUTURE

Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head and professor in the School of Nuclear Engineering at Purdue, played a pivotal role in the Nuclear Energy Forum 2025, hosted by IBJ Media on July 24 in partnership with the Indiana Office of Energy Development (IOED).

Advancing the state of Indiana's drive to spearhead the nation's energy evolution, Kim participated in a panel discussion at the inaugural event in Indianapolis and wrote a related opinion piece for the Indiana Business Journal.

The forum coalesced top energy, policy, education and industry leaders to explore how nuclear energy can strengthen Indiana communities. This event built on momentum created when Indiana Gov. Mike Braun recently signed several bills to promote deployment of small modular reactor (SMR) technology to address Indiana's increasing energy needs. Braun has set a moonshot goal for Indiana to develop SMRs in eight years.

At the forum, Kim served on a panel on "Next Generation Nuclear: Is it a Viable Energy Source?" He joined Duke Energy, Rolls-Royce, Curio Energy and Holtec International executives to discuss technology innovation; safety advantages; spent-fuel uses; and how the always-on, carbon-free energy source will power the future.

In his IBJ article, Kim advocated for using nuclear power to "forge a resilient energy belt." Noting that nuclear energy "has arguably proven to be the most resilient and clean energy source over the past six decades," he pointed out that nuclear power currently provides about 20% of U.S. electricity, accounting for more than half of the nation's carbon-free energy.

"It is timely to explore integrating nuclear power into Indiana's energy portfolio" for a maintainable future, Kim wrote. He also stated that recent nuclear technology developments, such as emergence of SMRs and microreactors, "make nuclear energy an increasingly appealing option to Hoosiers" due to greater flexibility, safety and efficiency than conventional nuclear reactors. In addition, Kim wrote that repurposing Indiana's retired coal sites could reduce SMR project costs and offer lucrative job opportunities for retrained coal workers.

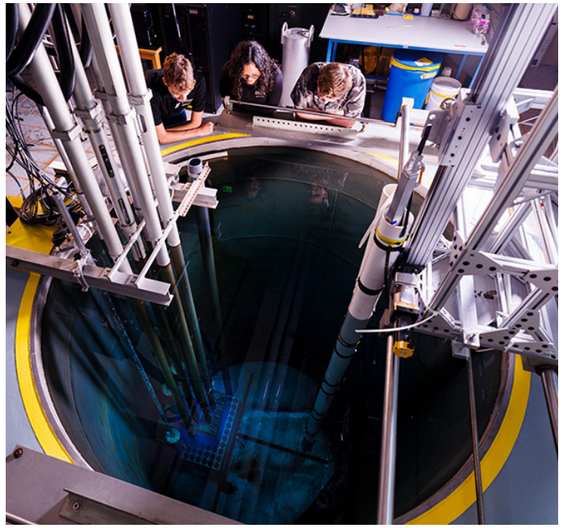
At the same time, Kim noted that realizing SMRs' full potential "will require deliberate action, strategic planning, and close coordination across all sectors of the state's energy landscape." He recommended that Indiana "proactively establish strategic partnerships with federal agencies, state leadership, industry stakeholders, and regulators to address financial risks, streamline approval processes, and foster innovation." Kim also called for early community engagement, as well as rigorous safety and environmental assessments.

Summing up, he wrote: "SMRs represent a promising pathway for Indiana to transition toward a cleaner, more resilient, and diversified energy future. Their successful deployment could position the state as a national hub for advanced technology supply chains-reaffirming Indiana's role as the Crossroads of American manufacturing and helping to transform the Rust Belt into a Resilient Energy Belt."

> "SMRs represent a promising pathway ... toward a cleaner, more resilient, and diversified energy future.."
>
> **SEUNGJIN KIM**

PURDUE LAUNCHES NATION'S FIRST ONLINE CREDENTIAL PROGRAM IN SMALL MODULAR REACTORS

NATION'S
FIRST AND ONLY
COMPREHENSIVE DIGITAL TWIN OF AN OPERATING NUCLEAR REACTOR
BUILT IN 2023



Scheduled to begin in spring 2026, the program will augment Purdue nuclear engineering's existing leadership in nuclear research and facilities, as well as collaboration with the state of Indiana and industry and academic partners.

Purdue University's School of Nuclear Engineering is launching the first online credential program in small modular reactors (SMRs) in the nation, addressing the need for more reliable, flexible power generation to meet growing electricity demand.

The graduate-level professional credential program was announced Nov. 5 at the Global Nuclear Energy Economic Summit, hosted by Purdue and the state of Indiana.

The new program will expand concerted efforts by Purdue NE and the state to propel adoption of SMRs, which a Purdue-led feasibility report found could drive economic growth through job creation and industrial advancements while providing a 24/7 source of clean electricity.

"Their successful deployment could position the state as a national hub for advanced technology supply chains — reaffirming Indiana's role as the crossroads of American manufacturing and helping to transform the 'Rust Belt' into a 'Resilient Energy Belt,'" Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head and professor in the School of Nuclear Engineering, wrote in an article for the Indianapolis Business Journal.

Scheduled to begin in spring 2026, the program will augment Purdue nuclear engineering's existing leadership in nuclear research and facilities, as well as collaboration with the state of Indiana and industry and academic partners.

Smaller, safer and more efficient than traditional nuclear reactors, SMRs are gaining traction as a better alternative for meeting rising electricity requirements as new technologies, including AI, increase pressure on the power grid. Citing the Purdue-led report, Indiana Gov. Mike Braun in July signed landmark legislation and set a moonshot goal to bring SMRs to the state in eight years.

"The U.S. nuclear economy cannot take off without a talent supply chain. Purdue Engineering is uniquely positioned to help nuclear energy workforce development for our state and nation — from skilled trades to engineers," said Arvind Raman, the John A. Edwardson Dean of Purdue's College of Engineering.

"We have the nation's first and only comprehensive digital twin of a nuclear reactor, which is key for workforce training, and we are the recipient of the largest grant ever from the DoE's Nuclear Energy University Program with workforce as a key focus. Launching the nation's first SMR credential program builds on that legacy and will help scale our nuclear energy workforce development effort nationally."

"Our credential program will provide a platform for professional engineers in various engineering disciplines to acquaint themselves with new advanced reactor technology and help mitigate workforce needs for SMR technologies," Kim said.

According to the U.S. Department of Energy, the nation's current nuclear reactor fleet employs approximately 100,000 people, and that number is anticipated to rise to 375,000 by 2050 with the deployment and commercialization of advanced reactors the deployment and commercialization of advanced reactors.

For more information, visit https://engineering.purdue.edu/Engr/AboutUs/News/Spotlights/2025/2025-1106-Purdue-launches-nations-first-online-credential-program-in-small-modular-reactors

PURDUE HIGHLIGHTS ACADEMIC STRENGTHS, COMMITMENT TO WORKFORCE DEVELOPMENT DURING VISIT FROM TOP FEDERAL AND STATE LEADERS

On July 16, Indiana Gov. Mike Braun and Indiana Department of Education Secretary Katie Jenner hosted U.S. Department of Education Secretary Linda McMahon's visit to the state, including a trip to Purdue's nuclear reactor research lab.

The visit included a tour of Purdue's Nuclear Engineering Building and Purdue University Reactor Number One (PUR-1) and its digital nuclear control and artificial intelligence (AI) systems with Purdue students, faculty and staff. PUR-1 is the first and only nuclear reactor in the U.S. licensed by the Nuclear Regulatory Commission to operate a fully digital instrumentation and control system. Discoveries stemming from PUR-1 research lead toward the development of advanced reactors, such as small modular reactors (SMRs) and microreactors.

Indiana Gov. Mike Braun hosted U.S. Department of Education Secretary Linda McMahon's visit to the state, which included a tour of Purdue's nuclear research facilities. (Purdue University photo/Kelsey Lefever)

During McMahon's visit, a roundtable discussion examined the need to develop a skilled workforce to fill jobs in critical fields, including nuclear engineering and AI. (Purdue University photo/Kelsey Lefever)

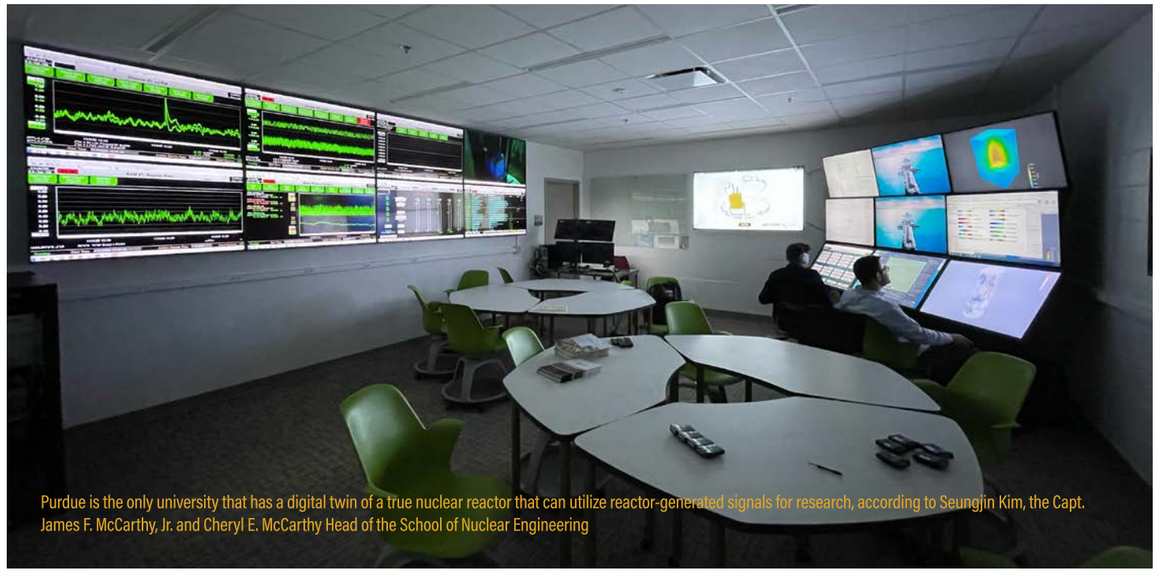
This asset makes Purdue a national leader in nuclear engineering education, energy innovation and the empowerment of AI computing, while providing real-world experience to drive student success, helping fulfill demand in the nuclear workforce pipeline and bolstering economic development.

McMahon, Braun and Jenner also moderated a roundtable discussion with leaders from federal government, state government, K-12 education and industry on the development of the skilled workforce needed to power critical fields.

With excellence at scale and a focus on student success and affordability, Purdue is excited to continue the national leadership in advancing nuclear power, AI computing capabilities and work-study programs, and through public-private partnerships create jobs, workforce and innovation.

NE GLOBAL IMPACT

PURDUE NUCLEAR ENGINEERING EMERGES AS A NATIONAL POWERHOUSE IN DIGITAL INNOVATION, SMR LEADERSHIP AND ADVANCED MANUFACTURING



Purdue is the only university that has a digital twin of a true nuclear reactor that can utilize reactor-generated signals for research, according to Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head of the School of Nuclear Engineering

Purdue University's School of Nuclear Engineering, founded in 1960 and home to the nation's first and only all-digital nuclear reactor, is accelerating a new era of U.S. nuclear innovation.

With a legacy of producing industry and government leaders around the world, the school is now shaping the future of nuclear power through three defining strengths: digital twin technology, small modular reactor (SMR) development and advanced nuclear manufacturing.

These advances come at a seminal moment in U.S. energy policy. Indiana Gov. Mike Braun has repeatedly emphasized the urgency of SMR investment as the state and nation transition toward cleaner, more resilient power systems.

"Small modular reactors offer innovative opportunities to expand Indiana's energy generation portfolio," Braun said. "Further exploration of SMR technology and its potential are imperative as we strive to be on the leading edge of energy modernization."

Braun added that Purdue plays a "valuable role in advancing our understanding of energy research, deployment and viable energy solutions," a role increasingly defined by digital innovation.

Digital twins: reshaping nuclear performance and safety

Purdue is home to the nation's first all-digital nuclear reactor — the fully modernized PUR-1 — and the first digital twin of a nuclear control system on a university campus. The reactor, licensed by the U.S. Nuclear Regulatory Commission for a fully digital safety and control system, has become both a research engine and a national testbed for next-generation nuclear technologies.

Stylianos Chatzidakis, a Purdue NE assistant professor and associate reactor director, and Vasileios Theos, a graduate research assistant, are pioneering the use of digital twins — highly detailed virtual models that mirror the real-time behavior of physical systems.

Their work, conducted within the Nuclear Radiation (RADIaNS) Laboratory, includes the creation of a cyber-physical testbed that synchronizes data from PUR-1 into the digital model. This allows algorithms to analyze and predict reactor performance with precision that cannot be reached through physical instrumentation alone.

"Digital twins provide valuable inputs about physical system operation with data that cannot be measured physically or predicted in the real-world system," Chatzidakis and Theos wrote in a recent article. This enhanced situational awareness enables early detection of material fatigue, component wear and operational risks — optimizing reliability while strengthening the case for more widespread nuclear adoption.

The benefits extend to training and research. Students and researchers can run virtual experiments without affecting real operations, enabling safe remote control, advanced monitoring, and even cybersecurity simulations.

> "Digital twins provide valuable inputs about physical system operation with data that cannot be measured physically or predicted in the real-world system."
>
> STYLIANOS CHATZIDAKIS

Purdue's digital twin momentum is accelerating further with U.S. Department of Energy funding to upgrade the Purdue Multidimensional Integral Test Assembly (PUMA). As the only operational scaled integral test facility for advanced light-water reactors in the U.S., PUMA is being modernized with new digital-twin capabilities and a full-scale control room. Researchers will be able to compare live operational data with digital predictions — pushing forward safety and reliability standards for future SMRs.

Chatzidakis and Theos view this work as a bridge to greater public confidence, writing, "Enhanced performance of these plants will contribute to an increase in public acceptance of nuclear energy."

Leading the charge on SMRs

As SMRs gain momentum nationwide, Purdue has emerged as a leader at both the state and federal levels. The university is spearheading a $6 million DOE-funded consortium to accelerate SMR and advanced reactor research. The initiative brings together five universities, two national laboratories and multiple industry partners to establish a Midwest regional center of excellence for nuclear research, workforce development and shared test capabilities.

SMRs — compact reactors that can be factory-built and shipped to remote locations — are seen as a transformative force in the future grid. They promise simpler designs, shorter construction timelines, passive safety systems and the ability to expand power capacity incrementally.

For Indiana, their potential is substantial. Purdue and Duke Energy recently released an interim report identifying SMRs as a promising technology to help meet the long-term power needs of the West Lafayette campus. Indiana's Office of Energy Development has also tapped Purdue to study SMR feasibility statewide.

The state's political trajectory now reflects that momentum. On July 9, 2025, Governor Braun signed three bills supporting SMR development — including an SMR pilot program — as part of an "all-of-the-above" strategy to expand Indiana's energy capacity.

"Indiana is uniquely positioned to be the national leader in nuclear energy," Braun wrote in a June op-ed, citing the state's emerging workforce pipeline. Purdue is a major contributor to that pipeline with undergraduate and graduate programs in nuclear engineering and the nation's first professional credentials program dedicated to SMRs launching in spring 2026.

The four one-credit modules will cover reactor evolution, safety advances, SMR operations and control, and convergence between materials, manufacturing, and management — preparing professionals for work in one of the fastest-growing corners of the energy sector.

Research at Purdue is also pushing beyond SMRs into microreactors — smaller, portable systems that can be truck-deployed to remote installations or serve as backup power during emergencies. Associate Professor Hitesh Bindra is studying the safe transport of these

truck-portable units, analyzing design envelopes and passive safety features. His team is also advancing high-temperature SMR designs and pairing them with thermal energy storage systems (TESS) to optimize microgrid reliability.

PURDUE IS THE NATION'S

#1

PRODUCER OF ENGINEERING DEGREES

(U.S. News & World Report, 2025 and 2026)

AND NATION'S

#1

IN MARKET DEMAND FOR ENGINEERING

NATION'S

FIRST

ONLINE CREDENTIAL PROGRAM

IN SMALL MODULAR REACTORS

(Announced in 2025; to launch in Spring 2026)

Bindra's findings show that thermal energy storage significantly reduces wasted renewable energy and allows nuclear to function as a stable baseload in hybrid microgrids. His team is also developing TESS-based safety enhancements for SMR deployment. Several of Bindra's innovations are patent-pending and disclosed to Purdue's Office of Technology Commercialization.

(Continued on page 13.)

Purdue University Multidimensional Integral Test Assembly (PUMA) facility

NE GLOBAL IMPACT

PURDUE NUCLEAR ENGINEERING EMERGES AS A NATIONAL POWERHOUSE IN DIGITAL INNOVATION, SMR LEADERSHIP AND ADVANCED MANUFACTURING

Advanced manufacturing: reinventing the nuclear supply chain

As nuclear power undergoes a renaissance, Purdue is tackling one of the industry's bottlenecks: manufacturing components capable of withstanding extreme reactor environments.

Associate Professor Xiaoyuan Lou leads advanced manufacturing research focused on materials and processes that improve component durability and speed production. Traditional nuclear manufacturing — casting, forging and welding — is costly, slow, and prone to vulnerabilities such as stress corrosion near welds.

Lou's group is turning to additive manufacturing (AM), or 3D printing, to produce large-scale, complex reactor components directly from digital designs. AM techniques such as laser powder bed fusion and direct energy deposition allow unprecedented geometric freedom, enabling designs that traditional machining cannot achieve.

Lou is also advancing powder metallurgy-hot isostatic pressing (PM-HIP), a method capable of fabricating large nuclear structures and joining dissimilar metals. Industry interest is high, especially for components like reactor pressure vessels for advanced reactors.

His work, conducted in collaboration with national labs and industry partners, supports essential code development, material qualification, and manufacturing innovation for the next generation of nuclear systems.

Together, these initiatives reflect Purdue's mission to deliver both incremental advancements and groundbreaking discoveries that push nuclear engineering into its next era.

With its world-class facilities, growing state and federal partnerships, and expanding educational programs, Purdue Nuclear Engineering is playing a pivotal role in shaping the future of clean, reliable, next-generation energy.

To learn more, read this related story: https://engineering.purdue.edu/Engr/AboutUs/News/Spotlights/2025/2025-0519-Purdue-Nuclear-Engineering-Leads-Nuclear-Power-Innovations

A broad frontier of nuclear innovation

Beyond its core strengths in digital twins, SMRs and advanced manufacturing, Purdue is pursuing dozens of additional frontiers in nuclear science. Research programs include:

- Cosmic-ray muon tomography to inspect spent fuel storage
- Quantum key distribution for secure nuclear communications
- 3D-printed sensors for real-time reactor monitoring
- Biomedical and national security applications of nuclear technologies

U.N. TAPS NE HEAD KIM FOR ADVICE ON SMALL MODULAR REACTORS

Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head and professor in Purdue's School of Nuclear Engineering

Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head and professor in Purdue's School of Nuclear Engineering, has been selected to join a United Nations expert roundtable on small modular reactors (SMRs), elevating Purdue's impact on the energy transition to the world stage.

U.N. Secretary-General António Guterres and his Scientific Advisory Board recently designated SMRs as a research priority area. The board will produce a science brief outlining recent advances, emerging and future considerations, and possible considerations for the U.N. and its partners. Comprised of globally recognized experts, the roundtable will make a vital contribution to this work, participating in an off-the-record discussion of scientific, technological and social issues.

"It's a privilege to be invited by the U.N. for this important discussion," Kim said. "I am happy to have this opportunity to represent Purdue in a global setting to help shape the future of nuclear energy and the broader energy transition."

Arvind Raman, the John A. Edwardson Dean of the College of Engineering, said: "We are proud that the U.N. has chosen Dr. Kim to share his significant expertise in a promising area in which we have advised the state of Indiana and attracted national attention. Dr. Kim's appointment heightens Purdue's prominence in the energy transition, demonstrated by his work and our Institute for Energy Innovation (IEI) initiative."

"We applaud Dr. Kim for this great honor, and we look forward to his roundtable participation expanding Purdue's leadership in accelerating the energy transition," said IEI co-chairs Fabio Ribeiro, the William Nicholas and Elizabeth Holstein Delgass Distinguished Professor of Chemical Engineering, and Lefteri Tsoukalas, professor of nuclear engineering, who leads the Center for Intelligent Energy Systems, both at Purdue.

Kim also serves as the Chair for the Council of Advisors of the OECD / Nuclear Energy Agency (NEA) Global Forum on Nuclear Education, Science, Technology and Policy, led by representatives from over 20 influential global universities with nuclear education programs. The Global Forum serves as a vital platform for collaboration among academic institutions, policymakers, and key stakeholders within the global nuclear energy sector.

Kim was the lead principal investigator of a study for the Indiana Office of Energy Development (IOED) on the feasibility and potential impact of implementing SMRs in the state and nationwide. Collaborators included Purdue's School of Nuclear Engineering, Ivy Tech Community College and Argonne National Laboratory. When the report was released in February 2025, Kim said it "underscores the transformative potential of SMRs, offering Indiana a pathway to a cleaner, resilient energy future."

The report states that SMRs, which are smaller than existing nuclear power plants and could be faster and less expensive to build, are a viable option for 24/7 carbon-free electricity in Indiana and may benefit the state economically. It identifies ways Indiana's strengths, including its robust manufacturing output, could help it become an early adopter of the new technology.

"Small modular reactors represent innovative solutions to bring additional and much-needed sources of energy generation to the state," Indiana Secretary of Energy Suzanne Jaworowski said. "Purdue University, the School of Nuclear Engineering, and Dr. Kim are valuable partners as Indiana continues to advance its understanding and engagement in a technology with boundless potential.

"Through Governor Braun's leadership, Indiana serves as a transformative leader in energy modernization and this honor is yet another example of our commitment — and many strengths — to achieve this goal."

PURDUE NUCLEAR ENGINEERING, TOSHIBA, ORNL DEMONSTRATE QUANTUM SECURE COMMUNICATIONS IN A REACTOR USING QUANTUM KEY DISTRIBUTION

Stylianos Chatzidakis

Purdue Nuclear Engineering, in collaboration with the Department of Energy's Oak Ridge National Laboratory (ORNL) and Toshiba, successfully demonstrated quantum secure communications in a nuclear reactor. The experiment in Purdue University Reactor Number One (PUR-1), which used Toshiba's Long Distance Quantum Key Distribution (QKD) technology, marked a significant advancement in the integration of quantum security into nuclear energy systems.

"The ability to maintain secure communications in reactor systems is critical to ensuring their resilience and safety," said Stylianos Chatzidakis, associate reactor director and assistant professor of nuclear engineering. "Reactors, especially microreactors deployed in remote regions, would rely on continuous data exchange for monitoring, control, and safety operations. Cybersecurity breaches in such systems could compromise sensitive information or even operational integrity, posing risks to public safety and energy security."

The three-year project, funded through the DOE's Nuclear Energy University Program, showcases how quantum communication technologies can be applied to secure the data streams of future advanced reactors, such as microreactors, particularly those located in remote or isolated areas. Microreactors are increasingly seen as a solution for providing reliable, abundant energy in remote and isolated locations, where traditional energy infrastructure may be infeasible or unreliable. These small reactors are designed to be transportable and capable of operating autonomously, making them ideal for powering off-grid communities, military outposts, research facilities and remote industrial sites. The findings from this initiative offer insights into enhancing cybersecurity for these next-generation nuclear energy systems.

"PUR-1 is uniquely positioned to address challenges like this one as the first fully digital nuclear reactor in the United States," said Phil Evans, senior R&D staff at ORNL's Quantum Communications & Networking group. "Equipped with state-of-the-art digital instrumentation and control systems and a digital twin, PUR-1 serves as a versatile research and education platform for exploring cutting-edge technologies in reactor operations and cybersecurity."

"The fully digital architecture of PUR-1 makes it an ideal testbed for integrating and evaluating quantum technologies in realistic nuclear environments," said Terry Cronin, vice president of marketing at Toshiba International Corporation. "This capability ensures that innovative solutions can be experimentally validated before being scaled to larger or remote reactor systems. By integrating quantum key distribution, this demonstration addresses these concerns with a level of security that is immune to interception or decryption by current or future computational technologies."

NE GLOBAL IMPACT

AT THE NATION'S ONLY ALL-DIGITAL NUCLEAR REACTOR, ENGINEERS CONDUCT THE FIRST EXPERIMENTS OF THEIR KIND IN THE U.S.

Purdue University's 63-year-old reactor gained capabilities in 2019 that next-generation reactors will also have, making it an ideal facility for testing AI, remote monitoring, autonomous control and advanced cybersecurity techniques that newer reactors will be able to use. (Purdue University photo/John Underwood)

Underground on Purdue University's campus is the only nuclear reactor in Indiana.

Although used just for research purposes — the total energy the reactor generates powers about the equivalent of 10 microwaves — Purdue University Reactor Number One (PUR-1) has specific features that no other reactor in the U.S. has. But those features are coming in the next generation of reactors.

With these features, future reactors could cost less to operate and maintain, be safer, and last longer — removing barriers in building additional reactors to increase generation of carbon-free electricity. Research that Purdue engineers are conducting with these features is helping develop new techniques that reactors could use to achieve these goals, which align with the university's efforts to investigate nuclear energy.

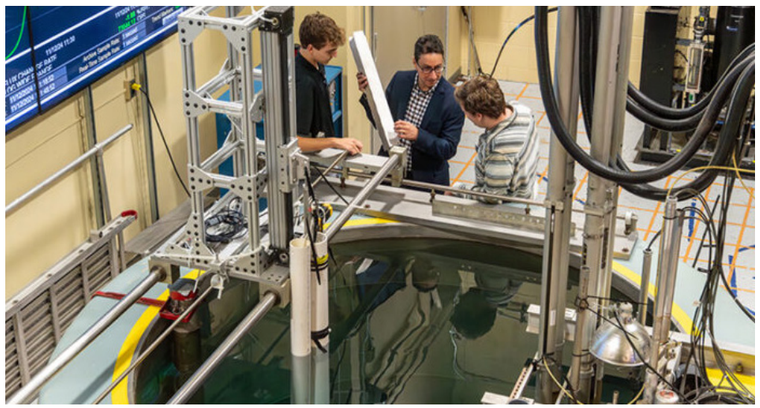
These features could be summed up with one word: "digital." "PUR-1" is the first in the nation to be controlled and operated digitally — think computer screens, keyboards and ethernet cables — rather than with dials, knobs and other analog technology that U.S. reactors have been using since the 1960s.

Although some countries already have reactors with digital controls, PUR-1 is the only all-digital reactor that has been licensed by the U.S. Nuclear Regulatory Commission. All-digital means that the "nervous system" of the reactor, its instrumentation and control system, entirely uses digital technology. The digital capabilities of other reactors in the U.S. are mostly limited to sensors and have not been applied to controls.

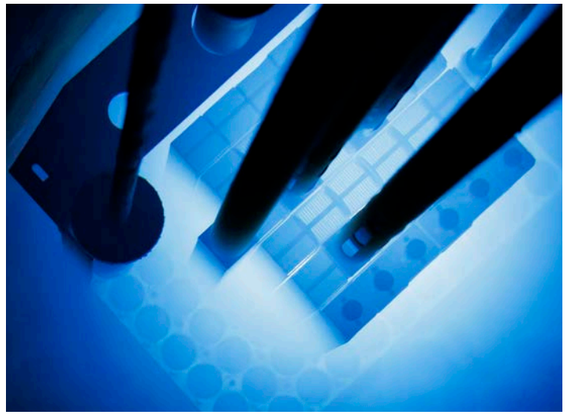
"Our switch to digital instrumentation and control signaled to the nuclear industry that this is possible in the U.S.," said Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head of Purdue's School of Nuclear Engineering and facility director of PUR-1.

PUR-1 was built in 1962 and converted from analog to digital in 2019 with support from the Department of Energy's Office of Nuclear Energy. Since this digital upgrade, Purdue engineering faculty and students have been performing first-of-a-kind experiments that are unique to the nuclear sector.

Their findings are helping inform the development of advanced reactors such as small modular reactors (SMRs) and microreactors, which would be significantly smaller and easier to construct than existing reactors so that they can power more communities, even in rural or remote areas. For efficiency, many of these reactors will be operated from a distance by the same control center, which means they will need to communicate digitally.



Purdue Assistant Professor Stylianos Chatzidakis, at center, and his students, Riley Madden and William Richards, interact with equipment that feeds a digital twin of Purdue's reactor. (Purdue University photo/John Underwood)



Purdue University Reactor Number One emits a blue glow, called Cerenkov radiation, that can be seen in the dark. This light is produced by electrons traversing the water at a speed greater than the speed of light in water. (Purdue University photo/John Underwood)

Going digital would also allow operators to take measurements from a reactor in real time and use artificial intelligence (AI) tools to monitor the reactor's performance. They could better predict and detect problems in between regularly scheduled maintenance, which would improve a reactor's safety and lifespan.

Revealing the potential of AI for nuclear reactors

PUR-1 is serving as the nation's first reactor testbed to help the industry figure out how digital communication, artificial intelligence (AI) tools and cybersecurity methods could work at a larger scale for advanced reactors.

The lab of Stylianos Chatzidakis, Purdue Nuclear Engineering assistant professor and associate reactor director, completed building a digital twin of PUR-1 in 2023. That milestone has allowed his research group and collaborators to conduct experiments on a digital copy of the reactor without affecting its operation. Funding from the U.S. Department of Energy's Office of Nuclear Energy supported the development of the digital twin.

The digital twin is a fully integrated physics and data-driven simulation that receives measurements in real time from PUR-1's sensors, makes predictions using AI-driven algorithms, and provides insights that can inform reactor operations. Chatzidakis and his students access the twin on computers in a lab adjacent to the reactor facility.

"We are the only university that has a digital twin of a true nuclear reactor that can utilize reactor-generated signals for research. That makes us unique," said Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head of the School of Nuclear Engineering.

In a study published in Nature's Scientific Reports, Chatzidakis and collaborators from Purdue and Argonne National Laboratory showed how PUR-1's digital twin could test a machine learning algorithm they developed for improving the performance of small modular reactors. They found that the algorithm could rapidly learn about the physics behind a measurement of how steadily the reactor is producing power and predict changes in this indicator over time with 99% accuracy.

Being able to access PUR-1's measurements from a different building has made it possible for Chatzidakis' lab to explore how a similar framework might work in the future to monitor and operate advanced reactors from remote locations.

"Let's say that you have a fleet of small modular reactors or microreactors operating in a remote location," Chatzidakis said. "If staff could be in a control room hundreds or thousands of miles away and monitor multiple reactors at once, we could minimize the operation and maintenance costs. Using PUR-1, we could quantify the potential reduction in costs."

Thinking ahead on cybersecurity needs as reactors advance

But to remotely operate reactors, communications would need to be secure from potential cyberattacks. In a technical letter report published by the U.S. Nuclear Regulatory Commission, Chatzidakis and other Purdue researchers conducted a project using real-time reactor data to evaluate how various AI and machine learning models could distinguish abnormal from normal cybersecurity states within nuclear systems.

The real-time data, available through PUR-1, helped train and test models in one of the cybersecurity use cases demonstrated in this project. Results showed that artificial intelligence (AI) and machine learning models could successfully detect abnormal cybersecurity events. "The idea is that the nuclear industry could refer to this report as they develop machine learning for cybersecurity," Chatzidakis said. Chatzidakis' lab also has been utilizing PUR-1 to study the feasibility of using quantum encryption to protect communications coming in or out of a reactor.

"Encryption based on quantum principles cannot be broken with any computer," he said. "It doesn't matter if you have a supercomputer or a quantum computer — it's unbreakable."

With data from PUR-1, Chatzidakis and his students have simulated how quantum encryption might work to remotely monitor and operate advanced reactors. Next up: conducting experiments and gathering real-world data to test if quantum equipment can encrypt signals from PUR-1, which they can access via the digital twin. Early results are promising.

To learn more, visit https://www.purdue.edu/newsroom/2025/Q2/at-indianas-only-nuclear-reactor-engineers-conduct-the-first-experiments-of-their-kind-in-the-u-s/

NE GLOBAL IMPACT

STUDY SAYS SMALL MODULAR REACTORS COULD HELP INDIANA SHIFT TO 24/7 RESILIENT ELECTRICITY WITH ECONOMIC BENEFITS

A Purdue University-led study prepared for the Indiana Office of Energy Development (IOED) explores the feasibility and potential impact of implementing small modular reactors (SMRs) in the state. It also outlines opportunities for Indiana to address key challenges with the deployment of this technology both within the state and nationwide.

"This report underscores the transformative potential of SMRs, offering Indiana a pathway to a cleaner, resilient energy future," said Seungjin Kim, the Capt. James F. McCarthy, Jr. and Cheryl E. McCarthy Head of Purdue's School of Nuclear Engineering and lead principal investigator (PI) of this study, released in February.

The study states that SMRs, which are smaller than existing nuclear power plants and could be faster and less expensive to build, are a viable option for 24/7 carbon-free electricity in Indiana.

SMRs also may benefit Indiana economically. The study estimates that the construction of each SMR plant could create approximately 2,000 jobs and their operation could employ 140 full-time workers. Workers at SMR plants could potentially earn 18% more than they would at coal plants, amounting to $352 million annually, which is double that of a similarly sized coal plant.

Indiana's electricity generation mix has changed over the past 10 years with the addition of wind and solar, but the state currently has no nuclear power plants to provide a continuous source of renewable energy.

IOED selected Purdue last year to conduct an Indiana-specific study to better understand SMR technology, the challenges and opportunities of its deployment, and its applicability to the state. The findings will serve as a resource for the IOED, aligning with its mission to provide comprehensive energy planning and policy development for Indiana that is affordable, stable, reliable, and inclusive of a diverse and balanced generation mix.

The study was a collaborative effort involving Purdue's School of Nuclear Engineering, Purdue's Administrative Operations, Purdue Polytechnic Institute, Purdue Extension Community Development, Purdue Center for Regional Development, Ivy Tech Community College of Indiana, the Energy Systems Network and Argonne National Laboratory.

"Small modular reactors represent innovative solutions for energy generation," said Indiana Gov. Mike Braun. "We applaud Purdue's work, which offers valuable insight as we continue to support a diverse and balanced portfolio of energy resources in the state."

While SMRs could add value to Indiana, the study points out several challenges with SMRs being a new technology not yet implemented anywhere in the U.S., such as high construction costs and the need for a stable supply chain. Other important considerations include complying with regulatory frameworks on both the state and federal level, meeting environmental and safety standards, growing a workforce, and increasing residents' awareness of SMRs through community engagement.

The study identifies ways Indiana's strengths could tackle these challenges. Among those resources are retired coal plants that SMRs could replace and Indiana's strong manufacturing output, which is the fourth largest of any state. If Indiana becomes an early adopter of SMRs, it would have the opportunity to establish itself as a supplier or manufacturer of nuclear power plant equipment in a nationwide supply chain.

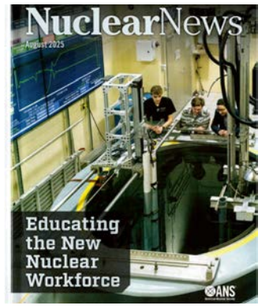
"We've studied SMRs to understand how our university might someday operate with clean nuclear energy," said Ryan Gallagher, associate vice president of Purdue Administrative Operations and co-PI for the project. "One cost consideration is that operation of a nuclear plant tends to be about half the cost of operation of a similarly sized gas or coal plant. Coupled with the fact that Indiana is near the top of the list of states having sites compatible with a coal-to-nuclear transition, it seems increasingly likely that our state and our university can benefit from deployment of SMRs here in Indiana."

The study authors list eight Indiana coal plants that could be considered for SMR installation, as noted in the U.S Department of Energy (DOE) 2022 Coal-to-Nuclear report. Repurposing these coal sites and their workforce could reduce SMR project costs by 7%-26%, according to the DOE's 2023 Liftoff report on the advanced nuclear sector, and provide a steady, dispatchable source of low-carbon energy to meet an expected electricity demand increase across the state of 1.5%-3% per year through 2030.

Indiana also has the benefit of several academic institutions that could meet workforce needs for SMRs.

IN THE NEWS

NUCLEAR NEWS COVER FEATURES PURDUE NUCLEAR ENGINEERING



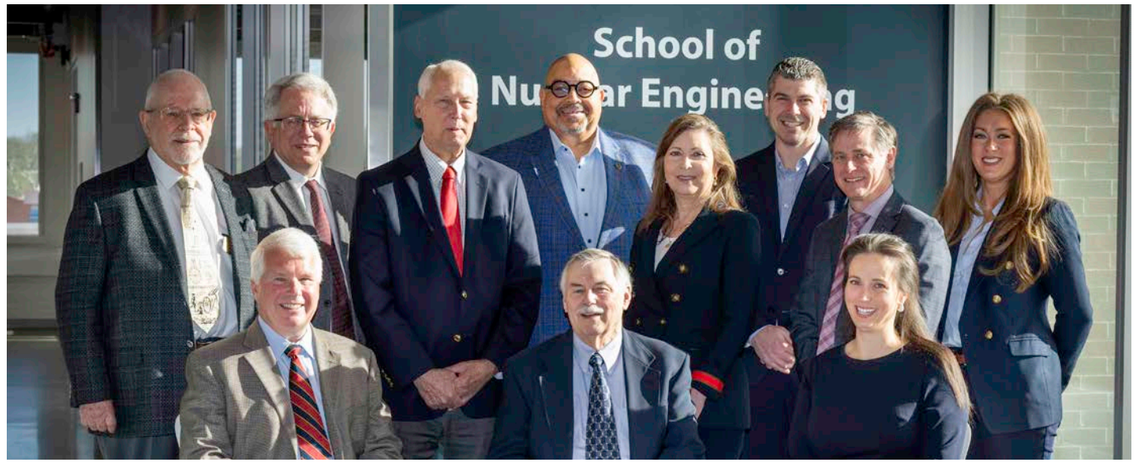
The cover of the August issue of Nuclear News, the flagship trade publication for the nuclear community, features a photo of Purdue Nuclear Engineering's PUR-1 – the first and only nuclear reactor in the U.S. licensed by the Nuclear Regulatory Commission to operate a fully digital instrumentation and control system.

The magazine of the American Nuclear Society wrote, "The PUR-1 is a busy place, hosting summer camps for high schoolers and teachers, workshops for industry professionals, training for reactor operators, and more."

Purdue NE is working with the state of Indiana and industry leaders to drive the groundswell for nuclear power to generate more of the nation's electricity. Along with propelling innovations to develop next-generation reactors, Purdue is pointing the way in addressing a shortage of nuclear engineers and other employees needed to drive the nuclear resurgence.

Further accelerating progress, on Nov. 5-6, the Purdue University College of Engineering partnered with the state of Indiana to host the Global Nuclear Energy Economic Summit on Purdue's West Lafayette campus. The summit brought together key stakeholders and catalyze collaborations for advancing Indiana's nuclear energy future.

SCHOOL OF NUCLEAR ENGINEERING HOSTS ANNUAL ADVISORY BOARD MEETING



Purdue's School of Nuclear Engineering held its annual advisory board meeting on April 22, bringing together key leaders in the nuclear engineering field. This pivotal meeting serves as a platform to discuss strategic initiatives that influence the future direction of the school.

The Nuclear Engineering Advisory Board (NEAB) is composed of distinguished professionals from industry, national laboratories, government agencies, and academia. Their invaluable insights and guidance are crucial in shaping the continued success and evolution of our educational and research programs. We are deeply grateful for their dedication and expertise.

We are pleased to welcome the following distinguished members: Timothy K. Hanley (Chair), Jack S. Brenizer, Jr., Jean-Marc Delhaye, John G. Gilligan, Robert Hill, William Jefferson, Carolyne Joseph, Maria Korsnick, Abbey Donahue Lindlof, Zach McDaniel, and Todd Smith. We look forward to working closely with this accomplished group to advance the mission of the School of Nuclear Engineering.

STUDENT HIGHLIGHTS

ATOMS AT WORK SUMMER CAMP ENGAGES HIGH SCHOOL STUDENTS

Purdue's School of Nuclear Engineering hosted its annual Atoms at Work summer camp for high school students from across the country, offering a unique opportunity for experiential and interactive learning on nuclear science and engineering.

Due to increased demand, the program was held in two sessions — July 14-18 and July 21-25 — at Purdue's West Lafayette location.

Atoms at Work brought together high school students alongside Purdue faculty, reactor staff and undergraduate and graduate mentors from Purdue NE. Students engaged in a wide range of interactive lectures, hands-on experiments, research activities, and community building events designed to showcase real-world applications of nuclear engineering.

Campers constructed their own radiation detectors, used several types of radiation detectors to quantify and characterize radiation sources, and applied their skills to use Purdue's subcritical pile to map neutron flux profiles and determine half-lives of unknown isotopes.

The program also included a tour of the Clinton Nuclear Power Station and an experiment utilizing Purdue's fully digital PUR-1 reactor, where students had the rare opportunity to observe Cherenkov radiation — a characteristic visible blue glow produced by high-speed particles moving through water inside the reactor core.

Organized and led by Purdue NE Head Seungjin Kim, Associate Reactor Director Stylianos Chatzidakis, and reactor staff True Miller and Brian Jowers — with guest lectures from Professors Allen Garner and Lefteri Tsoukalas — Atoms at Work aims to foster the next generation of nuclear engineers.

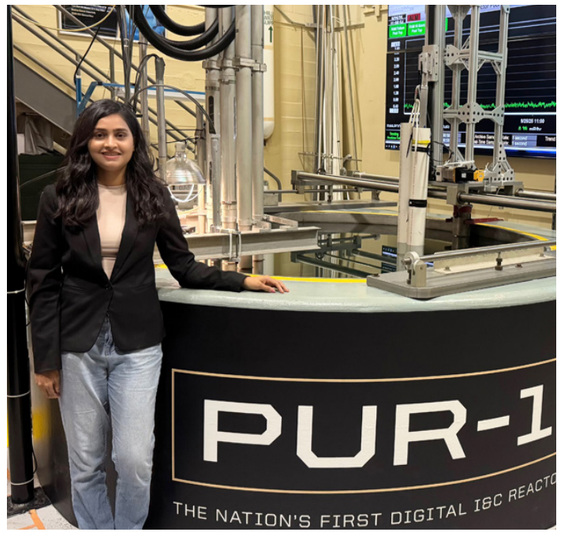
To learn more about the Atoms at Work summer camp, visit https://engineering.purdue.edu/NE/Summer-Camp/Atoms-At-Work.

NE PHD STUDENT UGHADE CHOSEN FOR NEA GLOBAL FORUM RISING STARS WORKSHOP

Reshma Ughade, a PhD student in Purdue's School of Nuclear Engineering, was selected by the Nuclear Energy Agency to participate in its NEA Global Forum Rising Stars Workshop 2025, on Dec. 10-12 at KTH Royal Institute of Technology in Stockholm. The program featured high-level speakers, panel discussions, mentoring sessions, and opportunities for participants to present their research.

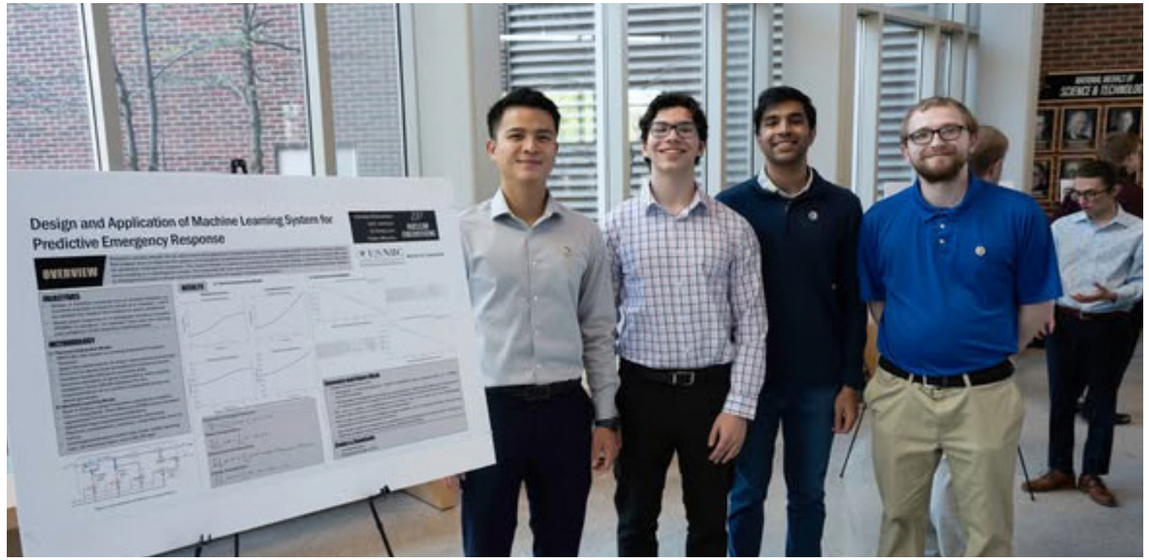
Ughade made an oral presentation and engaged in a question-and-answer session on "Physics-Informed Computational Tomography for Detection of Nuclear Materials Using Muons." Advised by Stylianos Chatzidakis, assistant professor of nuclear engineering, she develops advanced muon imaging methods for monitoring spent nuclear fuel in dry casks. Using cosmic ray muons and her novel μTRec algorithm, Ughade enables faster, more accurate, and near real-time imaging of nuclear materials hidden within dense shielding, strengthening nuclear safety and security.

Participation in the workshop connected her with mentors and Rising Stars from around the world. A networking dinner was hosted in KTH's Reactor Hall, the site of Sweden's first nuclear reactor. The workshop also included tours of KTH research labs, and, in honor of the Nobel Prize award ceremony Nov. 10, opportunities to hear from a Nobel Prize winner and tour the Nobel Prize Museum.



STUDENT HIGHLIGHTS

PURDUE NE SENIOR DESIGN TEAM NAMED NATIONAL FINALIST IN ANS STUDENT DESIGN COMPETITION

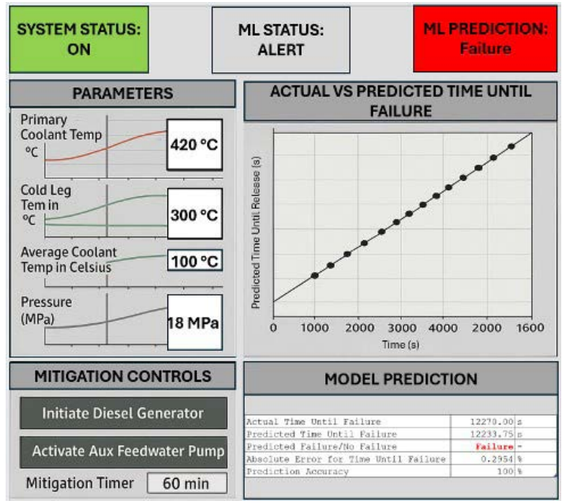


Purdue Nuclear Engineering continues to demonstrate the strength of its undergraduate design curriculum on the national stage. One of Purdue's eight senior design capstone teams competing in the 2025 American Nuclear Society Student Design Competition was selected as a national finalist to present at the ANS Winter Conference & Expo in Washington, D.C., in November.

Team NRC – "Design and Application of a Machine Learning System for Predictive Emergency Response" earned the finalist slot. Sponsored by the U.S. Nuclear Regulatory Commission, the team includes Jack Jackson, Qi Heng Law, Vishwas Raja Mukundan Krishnaswamy, and Halen Munday.

The finalist project developed a thermal-hydraulics-informed machine learning tool that can classify whether a short-term station blackout in a pressurized water reactor (PWR) will result in radiological release and estimate time-to-release when applicable. The integrated model achieved perfect classification between release and no-release cases and demonstrated high fidelity in forecasting failure time, enabling more informed and timely protective-action decisions.

"We are proud of the stellar performance of our senior design teams in the prestigious ANS competition," said Hitesh Bindra, NE associate professor, undergraduate program chair, and faculty advisor. "Reflecting the best in real-world problem solving, their achievements demonstrate Purdue NE's preeminence in workforce development and research impact."



FACULTY HIGHLIGHTS

CHATZIDAKIS SELECTED AS TEACHING LEADERSHIP AWARD FELLOW

The Teaching Leadership Award honors Purdue faculty and their departments for teaching excellence and leadership. The award aims to foster a culture of teaching excellence in academic departments, develop teaching leaders across all levels of Purdue faculty, and connect faculty members with teaching resources offered by the Center for Instructional Excellence (CIE).

The Purdue Teaching Academy and the CIE have selected Stylianos Chatzidakis as a Teaching Leadership Award Fellow. His proposal, "Enhance Teaching Effectiveness of TAs through Structured Mentorship and Training," aims to strengthen the preparedness of teaching assistants in lab-intensive courses through a two-semester initiative. As student enrollment continues to grow, many new TAs begin their roles without structured guidance, while experienced TAs often lack the resources to effectively mentor them. To address this gap, Chatzidakis' initiative introduces a structured TA mentorship program, in which senior TAs provide hands-on support and guidance under faculty supervision.

The program will also launch an online teaching mentor network, featuring a dedicated Discord channel for real-time collaboration, as well as monthly interactive sessions covering topics such as learning strategies, inclusive teaching, assessment design and syllabus development. In addition, an online repository of effective teaching practices will be developed to serve as an ongoing resource for current and future TAs. To broaden its impact, the program will feature universitywide events, including monthly development sessions and an end-of-semester teaching symposium, designed to foster cross-departmental collaboration and knowledge sharing.

PROFESSORS SIZYUK, XU PROMOTED

Yunlin Xu was promoted to associate professor of nuclear engineering with tenure. Xu is an impactful researcher in reactor physics and has consistently demonstrated excellence in mentoring graduate students and teaching a broad range of reactor physics courses.

His contributions extend beyond the classroom through active engagement with professional societies, national laboratories, the nuclear industry, and peer institutions. Notably, Xu is recognized as a pioneer and leader in the development of the state-of-the-art nuclear reactor physics code PARCS, which has been adopted by the U.S. Nuclear Regulatory Commission and is used by more than 30 countries.

Yunlin Xu

The Purdue School of Nuclear Engineering proudly announced the promotions of two distinguished faculty members, approved by the Purdue University Board of Trustees, effective Aug. 18.

Valeryi Sizyuk was promoted to research professor of nuclear engineering. He is recognized for his unique expertise in computational and theoretical plasma physics. Sizyuk has developed advanced computational methods for the simulation and optimization of various plasma systems and devices. His research focuses on plasma interactions with materials in both laser-induced and magnetically confined fusion plasmas.

Nationally and internationally respected, he has been acknowledged for his leadership in computational plasma physics through multiple tools he has developed — tools that are critical to the advancement of fusion reactors and semiconductor devices. His continued innovation pushes the boundaries of plasma physics research.

Congratulations to Sizyuk and Xu on these well-deserved milestones.

Valeryi Sizyuk

FACULTY HIGHLIGHTS

ABDEL-KHALIK CO-ORGANIZES GLOBAL IAEA-ICTP WORKSHOP ON AI AND MACHINE LEARNING

Hany Abdel-Khalik, professor in the School of Nuclear Engineering, co-organized the Joint IAEA-ICTP Workshop on "Artificial Intelligence and Machine Learning in Advancing Nuclear Engineering Technology: from Theory to Practice," held March 10-14 in Trieste, Italy.

Organized in cooperation with the IAEA Collaborating Centre on AI for Nuclear Power, the workshop explored artificial intelligence (AI) and machine learning (ML) in nuclear engineering, covering AI paradigms, ML techniques, decision support, and practical exercises to build skills for real-world applications.

In 2024, the International Atomic Energy Agency (IAEA) named Purdue's Center for Science of Information (CSOI) its first IAEA Collaborating Center on using AI for nuclear power, under a four-year agreement.

"To realize the immense AI potential, academic material must focus on training the workforce to not only understand the AI fundamentals but also the implementation details to help refine the technology and ensure its responsible and effective integration into the nuclear sector," Abdel-Khalik said.

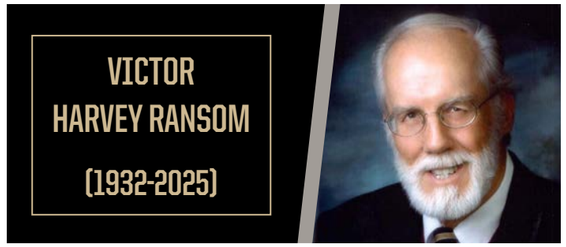
He is overseeing all IAEA Collaborating Center activities at Purdue, including coordinating projects with other member states worldwide. The Collaborating Center at CSOI advances new frontiers of nuclear technology through modeling and simulations, validating AI concepts for nuclear technologies, and training and education.

The genesis of the IAEA was a 1953 address by President Dwight Eisenhower to the U.N. General Assembly. The agency polices almost 200 member states and manages research projects around the world, supported by its collaborating centers, to help achieve the U.N.'s nuclear development goals.

To learn more about the workshop, visit https://indico.ictp.it/event/10826

IN MEMORIUM

PURDUE NE HONORS LIVES AND LEGACIES OF 2 DISTINGUISHED FACULTY MEMBERS



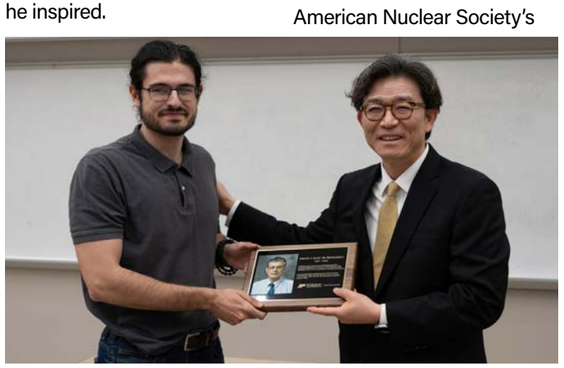
Victor Harvey Ransom, who served as head of Purdue's School of Nuclear Engineering from 1990-98 and continued as a professor in the school until 2001, passed away June 27, 2025, at 93.

Former colleagues, students and collaborators honored his life and impact at a special memorial event Nov. 12 during the 2025 American Nuclear Society Winter Conference & Expo in Washington, D.C. Organized by Shripad Revankar, Purdue professor of nuclear engineering, the panel session, "Vic Ransom Memorial: A Legacy in Computational Thermal Hydraulics," included technical briefs, personal reflections and professional insights on Dr. Ransom's contributions and enduring influence on generations of nuclear professionals.

During the service, Seungjin Kim, the Capt. James McCarthy, Jr. and Cheryl E. McCarthy Head of Nuclear Engineering and professor of Nuclear Engineering, gave a plaque to family members. The plaque cited Dr. Ransom's "outstanding and distinguished service and leadership" to Purdue Nuclear Engineering, and his "dedication to education, research and services to academies, national labs and government agencies." He was recognized for developing the RELAP5 code, transient simulation methods, and two-phase flow modeling.

Dr. Ransom received a BS in chemical engineering from the University of Idaho in 1955 and a PhD in mechanical engineering from Purdue in 1970.

Martin López de Bertodano, who had served as a faculty member in Purdue's School of Nuclear Engineering since 1992, passed away Feb. 26, 2025, at 67. His legacy lives on through the many students, colleagues and collaborators he inspired.



The school hosted a special memorial tribute April 30. During the event, Seungjin Kim, the Capt. James McCarthy, Jr. and Cheryl E. McCarthy Head of Nuclear Engineering and professor of Nuclear Engineering, presented his family with a plaque. Dr. López de Bertodano was remembered for his "outstanding and distinguished service" to Purdue Nuclear Engineering; "unwavering dedication to education and research"; and "seminal contributions" to the field of thermal hydraulics, particularly regarding stability and computational two-fluid modeling.

Dr. López de Bertodano was an active member of the American Nuclear Society's Thermal Hydraulics Division and served as technical program chair from 2001-04.

Born in Buenos Aires, Argentina, he earned a bachelor's degree in mechanical engineering from Stevens Institute of Technology in 1978, a master's degree in nuclear engineering from the Massachusetts Institute of Technology in 1983, and a PhD in nuclear engineering from Rensselaer Polytechnic Institute in 1992.

ALUMNI HIGHLIGHTS

NE ALUMNI LINDLOF, GRIMES RECEIVE 38 BY 38 AWARDS

Since its founding in 1874, the College of Engineering has produced alumni whose achievements have shaped our world. The 38 by 38 Award celebrates the remarkable achievements of 38 Purdue Engineering alumni who are 38 or younger and have demonstrated a clearly accelerated trajectory of professional success, achievements and impact. They are trailblazers in their respective domains, driving positive impact with every giant leap they take.

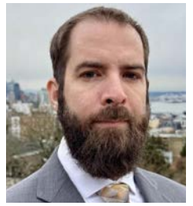
Congratulations to Purdue NE alumni Abbey Donahue Lindlof and Thomas Grimes on being recognized in 2025.

Abbey Donahue Lindlof | Nuclear Engineering
Chief Engineer, BWX Technologies, Inc.

As the global demand for abundant, affordable, reliable energy rises, Abbey Donahue Lindlof's work at the BWXT Advanced Nuclear Reactor (BANR) is making significant contributions to the nuclear energy sector. Her primary achievement is her role as BANR chief engineer. This project, supported by the U.S. Department of Energy's Advanced Reactor Demonstration Program, focuses on the development and deployment of advanced nuclear reactors. Her work encompasses the technical development of TRISO fuel, core and reactor components, and power conversion systems – including design, prototyping, fabrication and testing. Lindhof is a key technical interface with the U.S. Nuclear Regulatory Commission to directly influence licensing and safety standards for advancing nuclear reactors. Her successful licensing efforts have the potential to streamline the regulatory pathway for future deployments, reducing the time and cost associated with bringing advanced nuclear technologies to market.

Earlier in her career, Lindlof worked as a project engineer at AREVA, where she managed critical projects related to fuel transportation and storage. At SHINE Medical Technologies, she helped develop a facility that produces medical isotopes used in medical imaging and cancer treatments.

With the North American Young Generation in Nuclear, Lindlof has served on the board of directors, created educational resources, and promoted nuclear energy awareness. She volunteers with the American Association of University Women's Tech Savvy Program, and she was selected as an Atlantic Council Global Energy Center Fellow. Lindhof has been recognized by YWCA Rock County with a Woman of Distinction Award and by Lynchburg Business Magazine as a top professional under 40.



Thomas Grimes | Nuclear Engineering
Data Scientist | Chief Scientist, GenAI Initiative, Pacific Northwest National Laboratory

Describing Thomas Grimes as a high achiever is a grand understatement. As a PhD student, on top of his own research, he formed a team to investigate the properties of polyactic acid under the effects of gamma-induced cross-linking, leading to several papers, $25,000 in prizes, a patent on floor coatings, and a family of gamma dosimeters. During that time, Grimes met the requirements for his master's degree in nuclear engineering, finished a concurrent MBA from Purdue's Mitch Daniels School of Business, obtained his pilot's license, interned at Sandia National Laboratories, contributed to another Purdue group's AI research, and still managed to complete his PhD faster than the national average and with a 4.0 GPA.

At Pacific Northwest National Laboratory (PNNL), Grimes has been promoted three times in the last four years. Currently, he is the chief scientist for PNNL's GenAI Laboratory Directed Research and Development investment, a leading Department of Energy AI research facility. His core focus is overseeing the investment's highly successful project portfolio, which provides research funding in three thrusts: cloud-based AI, high-performance computing platforms, and partnerships with industry; using GenAI to advance DOE priorities; and expanding GenAI capabilities. He has upskilled hundreds of PNNL scientists on GenAI tools and driven outcomes often cited for commendation by clients.

Among his many industry engagements, Grimes was one of two federally funded scientists to attend and present at the 2025 International Atomic Energy Agency's Department of Safeguards Emerging Technology Workshop. He holds three patents and has written 16 journal articles, three preprints, and more than 20 full-length refereed conference proceedings.

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STUDENT AND FACULTY RECOGNITION

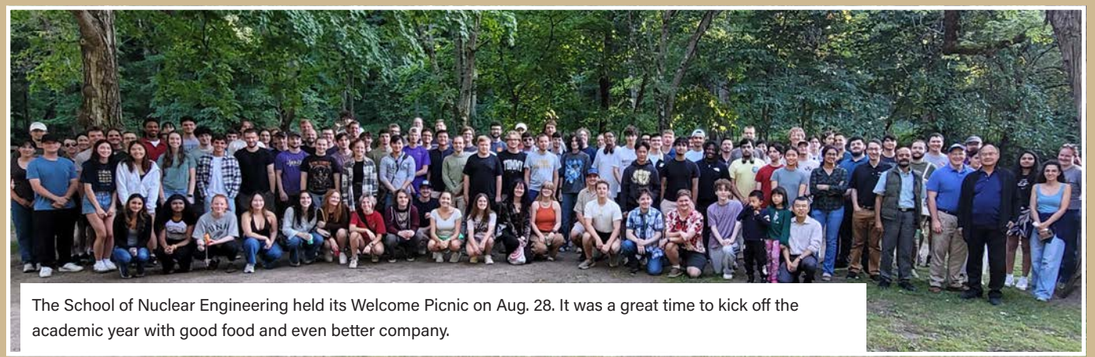
William Richards, Stylianos Chatzidakis and Konstantinos Gkouliaras receive awards.

The College of Engineering hosted its 2025 Graduate Student Awards Luncheon on April 16 to recognize the exceptional achievements of its students and faculty.

William Richards, a graduate student, received the Magoon Teaching Award for his excellence in teaching. Konstantinos Gkouliaras, a postdoctoral research assistant, was honored with the Magoon Research Award in recognition of his research achievements. Stylianos Chatzidakis, assistant professor of nuclear engineering, was named Outstanding Faculty Mentor for his dedication to mentoring graduate students.

The School of Nuclear Engineering congratulates all the honorees and thanks them for their dedication, excellence and leadership within the engineering community.

MOMENTS TO REMEMBER



The School of Nuclear Engineering held its Welcome Picnic on Aug. 28. It was a great time to kick off the academic year with good food and even better company.

Hank Hoelscher (BSNE '79), far right, a member of the Purdue Engineering Alumni Board, recently toured the PUR-1 reactor with other board members.

COMMENCEMENT

Spring 2025 PhD students

Spring 2025 master's degree recipients

Spring 2025 bachelor's degree recipients

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