

Fall 2022

Connection

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***Acid Mine Drainage Treatment
with Critical Mineral Recovery***
pg. 20



PennState
College of Earth
and Mineral Sciences

John and Willie Leone Family
**Department of Energy and
Mineral Engineering**

features



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Cover photo: Sarma Pisupati, acid mine drainage treatment with critical mineral recovery



Dear Friends,

The past couple years have challenged us in many unforeseeable ways as a world, and as a department. One of the many lessons learned during that trying time is the importance of our connections with each other. In the John and Willie Leone Family Department of Energy and Mineral Engineering (EME) we do our best to foster connections that reach all around the globe, both through our alumni network and through the impact of our programs and research. We've missed some of the traditional ways of interacting with our community, but we've discovered a few new ones as well.

As we reestablish our newsletter after a COVID-inspired hiatus, it is my hope to reconnect with you, our alumni and friends, by highlighting some of our accomplishments during that time, to touch on what we can look forward to in the coming months, and to encourage all of you to join in the new ways you can connect with EME.

As always, our students are our pride and joy. To prepare them for their careers and instill in them a beating passion for learning and research has been and will always be our priority. Seeing EME commit to that mission at the onset of the pandemic may have been one of the finest moments for the department. Early in 2020, the sudden call to "transition to remote" required redesigning labs, classrooms, and numerous administrative processes. Nothing could be overlooked. Sometimes projects that we love, like our *Connections* newsletter or our in-person awards ceremonies, had to be postponed to ensure our focus was always on the safe delivery of unparalleled education and experiences. Despite the many additional stresses, I am

proud of how our department embraced and met the challenge whole-heartedly.

We've continued to offer new educational opportunities for students. During the early stages of the pandemic, we designed a summer research internship program for the students who saw opportunities disappear as businesses recalibrated. The 10-week program gave students foundational, hands-on research experience working one-on-one with faculty and industry partners. The program looks to have evolved into a permanent addition, and I am happy to see the steady expansion of applicants for this exciting new endeavor.

Few things from the past year have been more exciting than our new course focused on energy crisis management. The course is built around case studies of actual industry crises and culminates with a demanding, 24-hour crisis simulation that pushes students to their limit. The simulation, designed by petroleum and natural gas engineering alumnus Peter Rigby, provides invaluable experience and an unforgettable opportunity for students to engage with alumni.

We've continued to welcome new faces, say cheerful goodbyes to those who have retired or graduated, and celebrate new accomplishments as well. You'll find introductions to our newest family members later in this issue.

One of the great joys from last year was to see professor emeritus Raja V. Ramani's induction into the National Mining Hall of Fame. Few have had a greater impact on the department than Dr. Ramani, who joined Penn State in 1966, served as department head of Mineral Engineering from 1987 to 1998, and remains a valuable and vibrant voice for our department to this day.

The College of Earth and Mineral Sciences celebrated its rich history dating back more than a century, by embarking on a yearslong celebration of its 125th anniversary.

A cornerstone of that celebration was the announcement by the college of the 125th Anniversary Fellows, recognizing the achievements of 125 graduates. The celebrations continue with in-person events scheduled for this fall.

In addition to honoring our alumni achievements, we've seen numerous accolades for our faculty. To name a few, Brandon Schwartz received the Dr. N.G.W. Cook Ph.D. Dissertation Award from the American Rock Mechanics Association, Shimin Liu was named a rising star in energy research by *Energy & Fuels* journal, and Mohammad Rezaee was named a 2021-22 Henry Krumb Lecturer by the Society for Mining, Metallurgy & Exploration.

We've continued developing groundbreaking research aimed at solving some of the most important problems facing our societies. Chiara Lo Priete was awarded the prestigious NSF CAREER award that, as many of you know, is fiercely competitive. Hilal Ezgi Toraman was awarded a \$3.4 million contract from the REMADE Institute to fund research targeting the inefficient methods we use to process mixed plastic waste, while Barbara Arnold received \$327,849 from the National Institute for Occupational Safety & Health to research ways to reduce or eliminate the toxicity of mine dust.

We continued to institute new initiatives and set new precedents. This past fall we collaborated with the Shandong University of Science and Technology and the *International Journal of Coal Science & Technology* to launch the first international symposium dedicated to mine dust and aerosol research. The symposium brought together a diverse set of stakeholders from multiple industries, regulatory agencies, and academic institutions, and I am proud to see EME as a leader building a worldwide community dedicated to solving the dust-related risks associated with mining. The Center for Critical Minerals that hosts several researchers from our department continues to grow from strength-to-strength with several major awards and has seeded major collaborations with other institutions.



We're building a stronger community within EME too with a continued commitment to diversity, equity and inclusion. We appointed Dr. Lo Prete as the associate head in charge of diversity, equity and inclusion related activities in the department. A new seminar series "Celebrating Women in Energy and Water Research" and the special two-part "Women's History Month series" spotlight

the successes of women in academia and industry and provide an opportunity to establish and expand the networks and mentoring relationships for both students and faculty. The seminars are viewable on our YouTube channel, and they shine a light on important work that has been driving the energy field forward and help amplify the unique voices that are leading the way. In the aftermath of the energy crisis in Texas, we hosted a series of three webinars that featured our faculty as well as top industry experts discussing the causes and effects of the crisis and the steps that need to be taken to prevent such crises in the future.

Despite the challenges, EME's steadfast commitment to producing unrivaled excellence in academics and research and to taking every opportunity to celebrate and embrace all the reasons that make us shout "We Are!," I hope you enjoy reading the newsletter and are proud of all the things we've accomplished, I know I am. I hope to see you, either in-person or via Zoom, at one of our upcoming events or by giving us a hearty hello on our growing LinkedIn, Twitter, or Facebook channels too. As a community, and a department, celebrating our connections is one of the most important, fulfilling things we do.

Cheers,

A handwritten signature in black ink that reads "Sanjay Srinivasan".

Sanjay Srinivasan named distinguished member by Society of Petroleum Engineers

Sanjay Srinivasan, head of the department, has been honored as a distinguished member by the Society of Petroleum Engineers (SPE). One of twenty-two recipients selected for 2021, he joins only 696 other members honored since the establishment of the award in 1983.

The Distinguished Member award recognizes SPE members who achieve distinction deemed worthy of special recognition, who made significant contributions to the society, or who have attained eminence in the petroleum industry or the academic community.

Srinivasan is being recognized for his advances in geostatistics, reservoir characterization, and reservoir engineering that have been applied for early appraisal of ultra-deepwater plays in the Gulf of Mexico, and for characterizing natural fracture networks in conventional as well as unconventional reservoirs. He has pioneered algorithms, methods and partnerships with geophysicists, and geo-modelers to develop novel schemes for integrating seismic data in reservoir models.

"It's truly an honor to be selected as a SPE distinguished member," said Srinivasan. "The history of SPE and its legacy among petroleum engineers is unmatched and I am humbled to join the ranks of such a select group of esteemed members."

Read full story: bit.ly/3IGxONx

Mining engineering professor selected as honorary member of AIME



Barbara Arnold, professor of practice in mining engineering, was awarded honorary membership in the American Institute of Mining, Metallurgical, and Petroleum Engineers (AIME). AIME honorary membership is one of the highest honors that the institute can bestow on an individual.

Arnold was recognized for “her dedication and perseverance in developing a strong and more vibrant Society for Mining, Metallurgy, and Exploration (SME) Foundation continuing through exemplary service as SME president.” She was recognized virtually at the 2021 SME Annual Conference & Expo.

Arnold was also awarded the Frank F. Aplan Award, named in honor of Penn State’s distinguished professor emeritus of metallurgy and mineral processing, from AIME.

“It’s truly an honor to be selected as an AIME honorary member,” she said. “The history of AIME and its legacy in mining and metallurgy are phenomenal. I am humbled to join the ranks of its honorary members that include Penn State emeritus faculty member Raja Ramani and the late Frank Aplan.”

Read full story: bit.ly/3z7f1YQ

Mohammad Rezaee selected for professorship designed to boost early career



Mohammad Rezaee, assistant professor of mining engineering, was selected to receive the Centennial Career Development Professorship in Mining Engineering in the College of Earth and Mineral Sciences.

“I am very honored and humbled to receive the Centennial Career

Development Professorship, and I appreciate this recognition from the college,” Rezaee said. “I am also thankful for the department, the EMS Energy Institute, my colleagues and family members for their wonderful

support, and my graduate students for their dedicated work.”

Rezaee’s research focuses on developing sustainable mining waste disposal practices from which valuables such as critical elements can be recovered for commercial use while the remaining materials are processed to generate environmentally benign materials. His work centers around the extraction of critical elements from primary and secondary sources, coal preparation, mineral processing, environmental management, and computational fluid dynamics and scale modeling.

Read full story: bit.ly/3yHvfWS

Professor Emeritus Raja Ramani inducted into National Mining Hall of Fame



Raja V. Ramani, professor emeritus of mining and geo-environmental engineering, was inducted into the National Mining Hall of Fame (NMHF) at the 2021 National Mining Hall of Fame Induction Banquet. Ramani’s selection into the NMHF is in “recognition of a lifelong commitment to education and research that has influenced a generation of mining industry leaders.”

“I was humbled, but more than that, my first reaction was surprise,” said Ramani, reflecting on the induction announcement. “When I came from India in 1966, I didn’t even know what a hall of fame was. Over the years I have nominated people to the hall who have contributed a lot to mining over their lifetimes, as I had a sense of their extraordinary achievement. I am really humbled to get elected.”

One of four inductees this year into the limited NMHF, Ramani will join six previously inducted Penn State personnel: Frank Aplan, George Deike Sr., Howard Hartman, David Mitchell, John T. Ryan Sr., and Edward Steidle.

Ramani joined the Penn State faculty in 1970 and devoted most of his career to educating mining industry leaders through his more than fifty years at the University. Ramani’s commitment to safety, productivity, and environmental issues extended beyond Penn State through numerous national and international appointments and consultations, including the United Nations and World Bank.

Read full story: bit.ly/3o2UhLb

Karpyn and Elsworth awarded endowed professorships

Zuleima Karpyn, associate dean for graduate education and research in the College of Earth and Mineral Sciences and professor of petroleum and natural gas engineering, was named the inaugural Donohue Family Professor.

Former Penn State professor David Donohue and his son, Timothy, both alumni of the University, established the professorship with a \$1 million gift. The Donohue Family Professorship supports a faculty member whose research focuses on petroleum and natural gas engineering.

“It is an honor to be named the inaugural Donohue Family Professor,” Karpyn said. “The Donohue family has been a longtime supporter of EMS’ and Penn State’s mission of advancing education through research. Being the steward of their generous gift is a true privilege. Their support provides the resources necessary to continue and further my contributions to teaching, research, and service.”

Karpyn specializes in reservoir characterization. She integrates laboratory experiments and numerical modeling to improve the understanding, representation, and prediction of transport behavior in geologic systems, underground pollutant migration, and hydrocarbon recovery processes.

In July 2020, she succeeded John Hellman as associate dean of graduate education and research in the College of Earth and Mineral Sciences.



Karpyn holds a bachelor’s degree in chemical engineering from the Central University of Venezuela, and a master’s degree and doctorate in petroleum and natural gas engineering from Penn State.

She said the support from the professorship will allow her to focus research efforts in the area of rock-fluid interactions during geologic carbon storage and on the optimal utilization of

captured carbon dioxide for simultaneous reduction of carbon intensity in hydrocarbon production operations and improved recovery.

“I look forward to engaging students and contribute to their development as future leaders through research training and creative research activities,” Karpyn said.

Derek Elsworth, professor of energy and mineral engineering, was been selected as the inaugural G. Albert Shoemaker Chair in Mineral Engineering.

“This endowment will support our continuing interests in sustainable modes of energy production and transformation in the energy-economy-environment nexus,” Elsworth said. “This issue is one of the greatest challenges of our time.”



Elsworth’s research interests are in computational mechanics, rock mechanics, and in the mechanical and transport characteristics of fractured rocks. His current research looks at the role of fluids on natural and engineered processes in the Earth’s crust. This has applications in geothermal energy, the deep geological sequestration of radioactive wastes and of carbon dioxide, unconventional energy extraction, and instability and eruption dynamics of volcanoes.

Elsworth, has been an educator, researcher, and consultant for more than thirty years. He is the cofounder of the Center for Geomechanics, Geofluids, and Geohazards and also has an affiliate appointment in the Department of Geosciences.

Elsworth said he was “surprised, honored, and grateful” for the endowed professorship, which offers research funding through the \$1 million endowment from the late Mercedes Shoemaker to honor the memory of her husband, a Pittsburgh civic and industrial leader dedicated to the support of higher education.

Endowed professorships, said Elsworth, allow faculty members to pursue “high risk, high reward” research while maintaining support in existing areas. The

supplemental funding also helps Penn State draw in top students and postdoctoral researchers.

“As we continue the shift toward energy sources that are more sustainable, while managing carbon through sequestration, the world now more than ever needs the areas of research for which Dr. Elsworth is an internationally recognized expert,” said Lee Kump, John Leone Dean in the College of Earth and Mineral Sciences. “The benefits made possible through the generous support of the Shoemaker family extend far beyond Penn State.”

The Shoemaker Chair endowment was a final estate gift from Mrs. Shoemaker to the College of Earth and Mineral Sciences. She also established the G. Albert Shoemaker Lecture Series in Mineral Engineering in 1992. G. Albert Shoemaker graduated from Penn State in 1923 with a bachelor’s degree in mechanical engineering and went on to lead an eminent career in the mineral industries. He engaged in many civic and philanthropic activities including serving on the boards of several corporate and non-profit organizations. He was elected a distinguished alumnus of Penn State and served on the board of the Penn State Foundation for ten years and as a member of the University Board of Trustees for more than twenty years, from 1957 to 1978, and as board president from 1970 to 1973.



G. Albert Shoemaker

Lo Prete receives NSF CAREER award to investigate capacity adequacy options

Chiara Lo Prete, associate professor of energy economics, received a Faculty Early Career Development Program (CAREER) award from the National Science Foundation to investigate electricity market structures to provide efficient incentives for generation capacity investment under increasing renewable penetration.

Organized wholesale electricity markets in the United States converged to a common market design framework that has been successful at promoting efficient and reliable operations of electric power systems since the 1990s. However, the growth of intermittent renewables poses challenges that were unknown, or less material, in the early design efforts. In particular, energy prices alone are unlikely to provide incentives for investment in sufficient generating capacity or promote the right mix of conventional and renewable energy sources. This “missing money” problem is exacerbated by increasing renewable generation, as lower (on average) and more volatile energy prices may discourage new investment in generation capacity.

Grid operators in the United States currently use a variety of approaches to mitigate issues of revenue sufficiency. All regional transmission organizations (RTOs) instituted various forms of scarcity pricing, which allows energy and ancillary service prices to rise above the average variable cost of operating plants when the system is capacity constrained. In PJM Interconnection, the RTO that coordinates the movement of electricity in all or parts of thirteen states including Pennsylvania,

generation units earn revenue for capacity, in addition to energy and ancillary services. These approaches have been able to support investment in new generation capacity over the last twenty years, but there is no consensus as to which one may provide efficient incentives in the appropriate generation mix, as intermittent renewables grow in the system.



Image from ferc.gov

“Increasing levels of renewable generation induce a decrease in energy prices and utilization of traditional power generation technologies, eroding revenue streams from the energy market, and shifting a greater proportion of returns for cost recovery to the capacity market, if one exists,” said Lo Prete. “As a result, further reliance on markets and incentives other than energy and capacity markets may become necessary to ensure that generation resources needed for long-term reliability remain financially viable.”

Lo Prete's group is examining this market design challenge associated with increasing renewable penetration using an approach that combines optimization and experimental economic methods. The research team is developing multi-stage equilibrium models to simulate investment and operation decisions in electricity markets under alternate designs for resource adequacy and revenue sufficiency. They are also designing and conducting human subject experiments to compare performance characteristics of market designs. Contrasting model predictions with outcomes from the experimental markets will offer insight into real-world market design.

"The laboratory is an ideal environment to evaluate market designs under conditions that we can control, providing an opportunity to gather evidence on the relative strengths and weaknesses of each design, examine human decisions in settings that reflect salient market features, and develop modifications at a relatively low cost before implementation in the field," said Lo Prete.

Lo Prete said the expected project outcomes have the potential to advance understanding of efficiency gains associated with electricity market designs, contribute to sharper answers on the most efficient path forward to integrate renewables, and help shape future market design decisions. Ongoing collaboration with regional electricity markets will facilitate dissemination of research findings and implementation of promising market design innovations.

The research is closely integrated with the the project's educational activities, which address two urgent challenges in STEM fields. Lo Prete is exploring methods to recruit and engage female undergraduate students in research. For example, she is working with undergraduate students on the creation of short videos explaining key terms in energy markets. Funds from the NSF will also be used to establish a scholarship program, WEEER (Women Engaging in Electricity Economics Research), with the aim to broaden female student participation in Lo Prete's research group and encourage their interest in pursuing advanced degrees in economics and STEM disciplines.

"These efforts are inspired by the deep commitment to advancing women in research and academia shown by Dr. Carl Heath, who for many years has supported first-year engineering doctoral students (like myself) at Johns Hopkins University," said Lo Prete.

She also is developing materials and skills for explaining the operations of electricity markets, which are complex institutions combining economic principles with the physics of electric delivery. She is planning a range of activities to train young scholars to become effective communicators and make their work accessible to a broad audience. For example, she plans on integrating science communication training into a new graduate-level course in the department.



"Increasing levels of renewable generation induce a decrease in energy prices and utilization of traditional power generation technologies, eroding revenue streams from the energy market, and shifting a greater proportion of returns for cost recovery to the capacity market, if one exists,"

- Chiara Lo Prete

Photo Credit; Pixabay

Department associate heads appointed to amplify diversity efforts in EMS

Furthering its mission to support diversity, equity, and inclusion (DEI), the College of Earth and Mineral Sciences (EMS) provided funding for each of its five departments to appoint faculty to serve as DEI associate heads.



These positions will lead department DEI efforts and coordinate with the college to support and deepen the work being done by the college's Office of the Associate Dean for Educational Equity.

"These faculty members are providing an important service to their departments and the college in leading DEI efforts and in fostering

a sense of belonging for all our faculty, staff, and students," said Victoria Sanchez, associate dean for educational equity in EMS.

The department's associate head is Chiara Lo Prete, associate professor of energy economics.

"I look forward to making a contribution to building a more diverse and inclusive department that fosters a strong sense of belonging for faculty, staff, and students," said Lo Prete.

The positions, analogous to departmental associate heads for undergraduate and graduate programs, provide each department with a point person to drive specific DEI activities and to think day to day about the culture and environment. The associate heads will work with the existing DEI infrastructure in their departments and collaborate with faculty, staff, postdocs, and graduate and undergraduate students to coordinate and advance DEI efforts, Sanchez said.

One of the first initiatives Lo Prete launched was a seminar series, Celebrating Women in Energy and Water Research, to highlight the successes of women in research, to engage women students, and to provide an opportunity for faculty to establish and expand their professional network and mentoring relationships.

Read full story: bit.ly/3PpoMGX

International symposium launched to promote mine dust and aerosol research



To promote the development of dust and occupational health-related science and technologies associated with mining, an international symposium on mine dust and aerosol research was held by the Penn State College of Earth and Mineral Sciences in collaboration with the Shandong University of Science and Technology, and the *International Journal of Coal Science & Technology*.

The inaugural International Symposium on Mine Dust and Aerosol Research included discussions and presentations from multiple industries, including mining and construction, on both existing dust control technologies and potential innovations. Equal emphasis was given to sharing best practices across the industries from both research and policy perspectives.

Shimin Liu, associate professor of energy and mineral engineering, helped coordinate the multidisciplinary symposium with Penn State's Energy Institute with the goal to stimulate the exchange of academic ideas and explore potential issues and collaborations.

According to Liu, no cure exists for most lung diseases and prevention by reducing dust exposure is key, requiring a better understanding of the fundamental mechanisms of the dust and aerosol mixture within mine-confined spaces.

"Penn State has a long history of driving dust research, and we are excited to be organizing the first of its kind symposium, a forum that brings together such a diverse array of perspectives from industry and academia focused solely on mine dust and aerosol research," said Sanjay Srinivasan, department head.

Read full story: bit.ly/3OfhcOk

Available on YouTube!

Watch the discussions, seminars and research talks on EME's YouTube channel.

Webinar focusing on rising oil and gas prices

During the fall 2021 semester, a panel of energy experts from Penn State and industry discussed the reasons behind rising oil and gas prices during the pandemic; what it meant for winter heating bills; potential policy responses to keep energy prices in check; and how rising prices might encourage or thwart a transition to alternative sources of energy.

The virtual panel discussion was sponsored by the department along with Penn State's Center for Energy Law and Policy

Three-part webinar series focused on energy resilience

A webinar series, *Energy Resilience in a Time of Change-Lessons from the Texas Energy Crisis*, brought together a panel of energy experts from Penn State and industry to discuss the factors contributing to the winter 2021 energy interruptions in Texas and how the event changes our thinking about planning for extreme weather.

The discussions were moderated by Seth Blumsack, professor of energy policy and economics and director of the Center for Energy Law and Policy. The panel included experts from Guidehouse Consulting, Targa Energy, Midcontinent Independent System Operator, and PJM Interconnection.

The first webinar, "What Messed with Texas, and Could it Happen Here?," focused on reviewing the causes of the interruptions and asked fundamental questions regarding how an energy-rich state could be left in the dark and what measures should be taken to reduce the risks associated with extreme weather events were examined.

The second webinar, "Who Decides on Resilience for Energy Systems?," discussed the meaning of energy resilience and how decisions on energy network resiliency should be made.

The third webinar, "Planning for the Unplanned: Designing Resilience in Energy Systems," explored how energy systems are currently designed to withstand rare, but highly impactful events.

So long, Joe!

Since 1979, the Penn State Miner Training Program has provided the safety training services to Pennsylvania miners and mining companies, training thousands annually. For thirty-five years, Joseph Flick directed the program until his retirement in December 2021.

According to Flick, his tenure at Penn State began under the most peculiar of circumstances.

"It's funny how the stars aligned," Flick said. "I was working with a mine safety consulting firm, and my neighbors who were leaving for Christmas break asked me if I would get their newspaper. Well, little did they know if I'm going to get it—I'm going to read it. And lo and behold, there was a job advertisement from Penn State for a mine safety instructor. I read it and the rest is history. What are the odds?"

The program offers training services to the entire Commonwealth of Pennsylvania, for all levels of workers and management across a broad range of occupations and responsibilities in all commodities of mining, which Flick delivered in person.

"I could probably be a Pennsylvania tour guide," said Flick. "After all these years I've been to the basement or third floor of just about every church, fire hall, or social club conducting these training programs. And if you can imagine, I'm lugging a twenty-seven-inch television with VCRs up three flights of stairs to a safety meeting. My back really appreciated some of the positive changes that technology has brought."

At his retirement party, Flick described his career as a special learning experience that allowed him to meet mine workers, witness the tight relationships the mining community shares, and see the positive impact on mine worker safety.

"My grandfather was killed in a mining accident. I understand how important it is for loved ones to come home from work safely. It just gives me the shivers that we're playing in such a high stakes game and to know that our program has been influential in saving lives, which in turn leads to intact families and the chance for them to have a bigger and better and brighter tomorrow. This has been the learning experience of a lifetime. It's been a pretty cool ride."

Flick's retirement plans include spending time with his wife, Linda, three daughters, three grandchildren, and an exponentially growing honey-do list. Flick hopes to find time to meet a trout along some Pennsylvania mountain stream too, as he shifts to the next chapter of his life.



Energy, economics, investment expert earns GEMS alumni award



Peter Rigby, a 1979 Penn State graduate in petroleum and natural gas engineering, was awarded the 2021 Graduates of the College of Earth and Mineral Sciences (GEMS) Alumni Achievement Award and accepted the award in September at the college's Obelisk Society dinner.

The GEMS Alumni Achievement Award is given annually by GEMS, the college's alumni society, to recognize outstanding achievement by EMS alumni. All alumni of EMS are eligible to receive this award.

Rigby was selected for innovatively applying his engineering background to financial aspects of the energy sector. Rigby is an author and works with various philanthropic, educational, and humanitarian causes. Before that, he was global head of risk analytics and research at Standard & Poor's. There, he analyzed financial and securities data and worked on more than \$200 billion in power, energy, and infrastructure projects.

"Peter Rigby exemplifies the interdisciplinary expertise that we promote in the college's John and Willie Leone Family Department of Energy and Mineral Engineering (EME)," said Sanjay Srinivasan, department head.

"Years before we began actively encouraging our students to combine business analysis, sustainability, and engineering in their studies, Peter utilized his degree in petroleum and natural gas engineering and subsequent MBA earned from University of Michigan to develop the insight and understanding needed in the financial, policy, and market aspects of the energy industry."

Rigby was also recognized for service and mentorship to EME students. On this front, Rigby designed and launched a unique course on energy crisis leadership,

which he co-taught with EME faculty. This course gives undergraduate students the opportunity to learn about crisis management through case study discussions of actual disasters, and put their skills into practice by managing a fictitious crisis that plays out in real-time over 24 hours. In this capstone experience, students assume the role of c-suite executives of an energy company as they formulate a response strategy to a major incident. Their board presentations and press conferences are then judged by members of the media and a board of directors.

Rigby wrote and organized the complex crisis simulation. He even helped recruit people to assume the roles of board members and media for the course, which were played by Penn State alumni, many of whom are executives at energy companies.

"The course is one of the most innovative educational opportunities developed for the college in recent years," said Seth Blumsack, professor of energy policy and economics. "Peter's gifts of funds to support the program, as well as the time he invested in structuring and participating in the first course offering, has provided a truly unique opportunity for engaged scholarship to students from many different degree programs."

Rigby is a frequent guest speaker in EME classes, including those taught by Blumsack. One guest lecture included a "Shark Tank" exercise where students were asked to develop and give elevator pitches to promote made-up energy companies. Rigby is a long-time financial investor who is specifically focused on investing in and supporting start-up companies led by women.

"Peter's career achievements in the petroleum industry and in finance have been exceptional, and we are very lucky that he has been so willing and interested to share his knowledge with students in EMS," Blumsack said.

Rigby said he's honored to receive this award and to give back to the Penn State community that helped him launch his career, first as a petroleum engineer.

"It has been exceptionally gratifying to deliver a course to EMS students which builds on their Penn State education to prepare them with a unique experience which they may have to draw on one day in their professional careers," Rigby said.

Career in teaching, business development earns EMS grad alumni award



David Donohue was among eight Penn State alumni selected to receive the 2021 Distinguished Alumni Award—the highest honor the University bestows on its alumni.

“It’s an honor to be recognized like this,” said Donohue, who, in addition to receiving his doctorate from the College of Earth and Mineral Sciences, is a former Penn State professor. “I’ve always had a great

affection for Penn State, and my time there was a great foundational period for me.”

Donohue pursued his own career in oil and gas after studying engineering at McGill University and receiving a bachelor of science in petroleum engineering from the University of Oklahoma and a doctorate in petroleum and natural gas engineering from Penn State. He followed his ambitions and eventually started two successful companies, along the way becoming a noted technical specialist, businessman, attorney, and lecturer.

Since his time as a graduate student and, later, faculty member at Penn State, Donohue has continued to give back to the University over the years.

Donohue, along with his son Timothy Donohue, who received a master of science in geosciences from Penn State in 1993, made a \$1 million gift on behalf of their family to endow a professorship in the John and Willie Leone Department of Energy and Mineral Engineering in 2015.

David Donohue and his wife, Pamela, previously established the David and Pamela Donohue Trustee Scholarship in the College of Earth and Mineral Sciences to provide financial assistance to undergraduates who demonstrate need for funds to meet college expenses.

“I’ve always had an affinity for Penn State, serving on various committees and different advisory boards,” he said. “I met many graduate students I knew or taught there later in life in different settings and there was always a great deal of pride among them and within the industry for Penn State. Its reputation for the University and the college is strong and widespread.”

Read full story: bit.ly/3P6FTxC

Steadfast supporter and role model for students earns Payne alumni award



David Payne, who earned a petroleum and natural gas engineering (PNGE) degree in 1981, spent his forty-year career traveling the globe in search of energy hotspots to locations including Trinidad and Tobago, Indonesia, Vietnam, and Thailand. After decades in drilling operations, he shifted from vice president of drilling and completions for Chevron Corporation to corporate vice president of health, environment and safety within the company.

His work at Chevron—and his outreach in support of Penn State students—earned him the Graduates of Earth and Mineral Sciences (GEMS) Alumni Achievement award in 2021. The EMS Alumni Society gives this award annually to a graduate of the college who has excelled in their field.

“I feel like I have an obligation to give back because I don’t think that I would be where I am today without my experiences at Penn State,” Payne said. “I was able to make mistakes in a safe environment and that taught me a lot. I feel like I owe Penn State something in return for allowing me to have what has been a career for which I have no regrets.”

Payne spent his career focused on advocating for Penn State students, improving opportunities for underrepresented people, and increasing access to affordable energy.

Read full story: bit.ly/3RB59h9

Celebrating
125
YEARS
 1896 – 2021

In 2021 the College of Earth and Mineral Sciences began celebrating its 125th anniversary and reflected on the how the success and reputation of the college is defined by the achievements of its graduates. In recognition of their accomplishments, alumni from each department of the college were selected as 125th Anniversary Fellows.

Fellows are graduates who are at the prime of their careers in academia, the private sector, government, and public service. Of particular attention are those graduates who have demonstrated strong leadership in their respective communities, who have been pioneers in diversity, and who have contributed substantially to the welfare of humanity using the skills and knowledge the college equipped them with upon graduation.

The John and Willie Leone Family Department of Energy and Mineral Engineering is proud to have thirty-seven alumni recognized for the award.

Angelique Adams, CEO, Angelique Adams Media Solutions, LLC, B.S. 1997, chemical engineering, M.S. 2002, fuel science), Ph.D. 2004 fuel science

HE Eng. Saad Sherida Al-Kaabi, Minister of State for Energy Affairs, Qatar, B.S. 1991, petroleum and natural gas engineering

Raul Benavides, Board of Directors, Buenaventura Mining Company Inc. Lima, Peru, M.S. 1987, mineral engineering management

Jerry Berkebille, Founding Partner, Augustin Exploration, LLC, B.S. 1977, petroleum and natural gas engineering

Ashis Bhattacharjee, Professor, Department of Mining Engineering, Indian Institute of Technology, Kharagpur, India, Ph.D. 1991, mining engineering

James Bryja, President, Gimme Foundation, Inc., B.S. 1979, mining engineering

Barton Cahir, President of XTO Inc and Senior Vice President for Unconventionals, ExxonMobil, B.S. 1994, petroleum and natural gas engineering

Elana Chapman, Senior Fuels and Biofuels Engineer, General Motors, M.S. 2002 and Ph.D. 2008, fuel science

Mark Clemans, President and Chief Executive Officer, Carrier Energy Partners, B.S. 1987, petroleum and natural gas engineering

Martin Craighead, President and Chief Executive Officer, Baker Hughes, (retired), B.S. 1982, petroleum and natural gas engineering

Turgay Ertekin, Professor Emeritus of Petroleum and Natural Gas Engineering, Penn State, Ph.D. 1978, petroleum and natural gas engineering

Kelly Hamilton, Environmental Manager, NRG Energy Inc., B.S. 1999, geo-environmental engineering



Guangwei Haung, Principal Owner and Chief Executive Officer, HJI Group Corporation, Ph.D. 1990, fuel science

Keith Heasley, Professor Emeritus of Mining Engineering, West Virginia University, B.S. 1981 and M.S. 1988, mining engineering

Eunnyeong Heo, Professor, Department of Energy Systems Engineering, Seoul National University, Ph.D. 1996, mineral economics

Christopher Jablonowski, Principal Technical Expert for Cost Engineering and Analytics, Shell Exploration and Production Company, Ph.D. 2002, mineral economics

Linda Jones, Professor of Materials Science and Engineering, Western New England University, M.S. 1984 and Ph.D. 1987, fuel science

Jeffery Kohler, Professor Emeritus of Mining Engineering, Penn State, B.S. 1974, M.S. 1977, Ph.D.



1983, mining engineering

Trevor Lauer, President and Chief Operating Officer, DTE Energy, B.S. 1987, mineral economics

Carlos Leon y Leon, Lead, Materials Science Team, Morgan Advanced Materials, B.S. 1981, M.S. 1988, chemical engineering, and Ph.D. 1993, fuel science

Christopher Mark, Principal Roof Control Specialist, Mine Safety and Health Administration, B.S. 1981, M.S. 1982, and Ph.D. 1987, mining engineering

David Mazyck, Head, School of Engineering Design, Technology, and Professional Programs, Penn State, B.S. 1995, civil engineering, M.S. 1996 and Ph.D. 2000, environmental engineering, graduate minor in fuel science

Nsakala Ya Nsakala, Project Leader, ALSTOM Power Inc. (retired), M.S. 1973 and Ph.D. 1976, fuel science

David Payne, Vice President Health, Safety and Environment, Chevron Corporation (retired), B.S. 1981, petroleum and natural gas engineering

Emery Petrof III, Chief Operation Officer, Silver Energy Partners LLC., B.S. 2000, environmental systems engineering and M.S. 2003, materials science and engineering

Raja Ramani, Professor Emeritus of Mining and Geo-Environmental Engineering, Penn State, M.S. 1968 and Ph.D. 1970, mining engineering.

Nicole Reed Fry, Associate Director, Guidehouse, B.S. 2005, environmental systems engineering and M.S. 2008, energy and geo-environmental engineering

Nancy Ryan Gray, President and Chief Executive Officer, Gordon Research Conferences, Ph.D. 1985, fuel science

Lori Schell, Founder and President, Empowered Energy, Ph.D. 1988, mineral economics

Lawrence Shadle, Director, Thermal Sciences Division, National Energy Technology Laboratory, Ph.D. 1985, fuel science

Nuntawan (Lynn) Silpngarmlers, Reservoir Characterization Section Leader, Chevron Nigeria, M.S. 1994 and Ph.D. 2002, petroleum and natural gas engineering

Shyam Singh, President and Chief Marketing Officer, Thermoplastec Inc., M.S. 1979, fuel science

Shree Vikas, Director, Market Intelligence and Business Analysis, ConocoPhillips, M.S. 1996, environmental pollution control, and Ph.D. 1996, petroleum and natural gas engineering

Richard Wagner Jr., Director, Bureau of Mine Safety, Pennsylvania Department of Environmental Protection, B.S. 2003, mining engineering

Judy Wakhungu, Kenyan ambassador to France, Portugal, Serbia, Monaco and the Holy See, Ph.D. 1993, energy resources management

Rebecca Lea Wolfrom, Methods Compliance Specialist, Particle Technology Labs, 1999 B.S. 1999, geo-environmental engineering, and M.S. 2002, mineral processing

Charles Zebula, Executive Vice President, Portfolio Optimization, American Electric Power, B.S. 1982, mining engineering, and M.S. 1990, mineral processing

Fellows will be honored at the Celebration of Accomplishment: 125 Years of Earth and Mineral Sciences weekend festivities scheduled for October 14-15, 2022.

Battery metals from mine waste: Potential economic benefits for the commonwealth

New findings by a team led by Penn State researchers suggest potential economic opportunities from the domestic production of critical minerals from the byproducts of mining and metallurgy from past industrial activities.

Critical minerals are vital components in powering the clean energy economy, where supply chains are transformed to meet the demand for low-carbon energy technologies. The shift to a clean energy economy is expected to cause a massive increase in the demand for critical minerals.



Credit: Pixabay

“Cobalt and manganese are two battery metals that are crucial to battery performance, longevity, and energy density in the lithium-ion batteries that power electric vehicles,” said Sarma Pisupati, professor

of energy and mineral engineering and director of the Center for Critical Minerals.

The researchers reviewed byproducts of the mining and metallurgical industries in Pennsylvania and found that cobalt resources in the commonwealth could be significant. Their preliminary estimates also indicate that more than 5,500 metric tons of manganese are being discharged through acid mine drainage, with the untreated portion reaching the commonwealth’s waterways each year.

“Recovery of these elements could provide domestically-sourced materials for the lithium-ion battery industry in the United States,” Pisupati said. “In addition to the expected economic benefits, this can help remediate the environmental degradation caused by previous mining activities.”

Read full story: bit.ly/3O5jUWw

Grant to reduce, eliminate toxicity of coal mine dust

Increases in lung diseases have been related to respirable coal mine dust. Penn State has been awarded \$327,849 from the National Institute for Occupational Safety and Health (NIOSH) to fund research targeting ways to reduce or eliminate the toxicity of respirable coal mine dust.

Recent reports from NIOSH, which has tracked the burden of black lung disease in underground coal miners since 1970, show a steady increase in respiratory disease for miners who have worked for at least twenty-five years underground. NIOSH estimates 10% of miners are affected, with one in five coal miners from Central Appalachia showing evidence of the disease—the highest level recorded in twenty-five years.

Barbara Arnold, professor of practice in mining engineering and principal investigator on the project, said the goal of the team’s research is to conduct foundational research to reduce the trend.

According to Arnold, finding and understanding what to turn off has been a challenge for researchers as respirable coal mine dust is a complex mixture of ultrafine particles. Despite the dynamic variables, previous research hints at a potential culprit for toxicity: hydroxyl radicals, charged molecules that when attached to lung tissue may be the first step towards developing respiratory disease.

This project will investigate the use of chemical additives to reduce or eliminate dust toxicity.

“One application might be something like flypaper,” Arnold said. “Can the dust be trapped with a nonhazardous chemical that will turn off the toxicity so miners can work safely and turn around this alarming rise in respiratory disease?”

Arnold hopes the expanded focus on pyrites and crystalline silica from quartz will build the groundwork for wider applications such as metal and non-metal mining, and even to construction where crystalline silica dust is generated when working with brick or concrete. Read full story: bit.ly/3AP0HoQ

Integrated modeling of climate impacts on electricity demand and cost

Energy systems, especially the electric-power system, are increasingly impacted by the natural stressors of a changing climate such as wildfires, severe storms, extreme temperatures, and long-term disruptions of the hydrological cycle.

A team of researchers led by Penn State has developed a model to capture the compounding effects of climate-related water stress and temperature changes and how they can cascade through energy systems which are composed of many overlapping and intersecting networks

“Our study is the first to look at how water stress, in a detailed representation, ripples through the

power system all the way to economic losses,” said Mort Webster, professor of energy engineering. “Our coupled model framework captures interactions across water, power, and economic systems while retaining spatial, temporal, and sectoral detail.”

The team’s analysis of the impacts demonstrated that higher water temperatures can lead to a causal chain of events, from electric-power generators being offline because of the cooling-water intake-temperature limits, to higher electricity costs and unmet electricity demand, to economic adjustment and productivity reductions in electricity-using sectors. The team found that many climate patterns that result in generator outages from higher water temperatures do not result in any significant impacts.

The results underscore the importance of accounting for feedbacks between overlapping and interacting system networks. Importantly, this type of coupled model approach allows investigators to retain the spatial, temporal, and sectoral richness represented in each of these individual models that would be unachievable in one comprehensive model where detail is usually sacrificed for computational tractability.

Read full story: bit.ly/3P3ysai

Shale gas development in PA increases exposure of some to air pollutants



Air pollution levels may have exceeded air quality standards during the development of some Marcellus Shale natural gas wells in Pennsylvania, potentially impacting more than 36,000 people in one year alone during the drilling boom, according to Penn State scientists.

“The construction and drilling of these wells are a relatively short-term thing, and assessment of the impact on air quality is something that often falls through the cracks,” said Jeremy Gernand, associate professor of industrial health and safety. “But there are thousands and thousands of wells drilled depending on the year, and we wanted to see what the impact would be if we added it all up.”

More than 20,000 unconventional Marcellus Shale gas wells have been drilled since Pennsylvania’s boom began around 2005. Large diesel-powered equipment and gas turbines used during the drilling and hydraulic fracturing stages of shale gas development emit air pollution, and these emissions can affect air quality

within the vicinity of shale well sites and farther downwind, the scientists said.

The scientists found emissions at some of the sites could have impacted air quality for people who live beyond the 500-foot setbacks required by state regulations due to the increased number of wells per well pad which extends the development time. The scientists said drilling activity has also moved closer to populated areas as Marcellus development progressed in Pennsylvania.

“I think the main message is that a one-size-fits-all policy to constrain the impacts of industry probably isn’t the most effective approach,” Gernand said. “In this case, there are real benefits to making some alterations to setback regulations. We only need to push certain sites back farther from inhabited areas to see a big reduction in the number of people whose air quality is affected by this.”

Read full story: bit.ly/3c2Fq0A

Seed grant to explore using AI to model subsurface rock formations

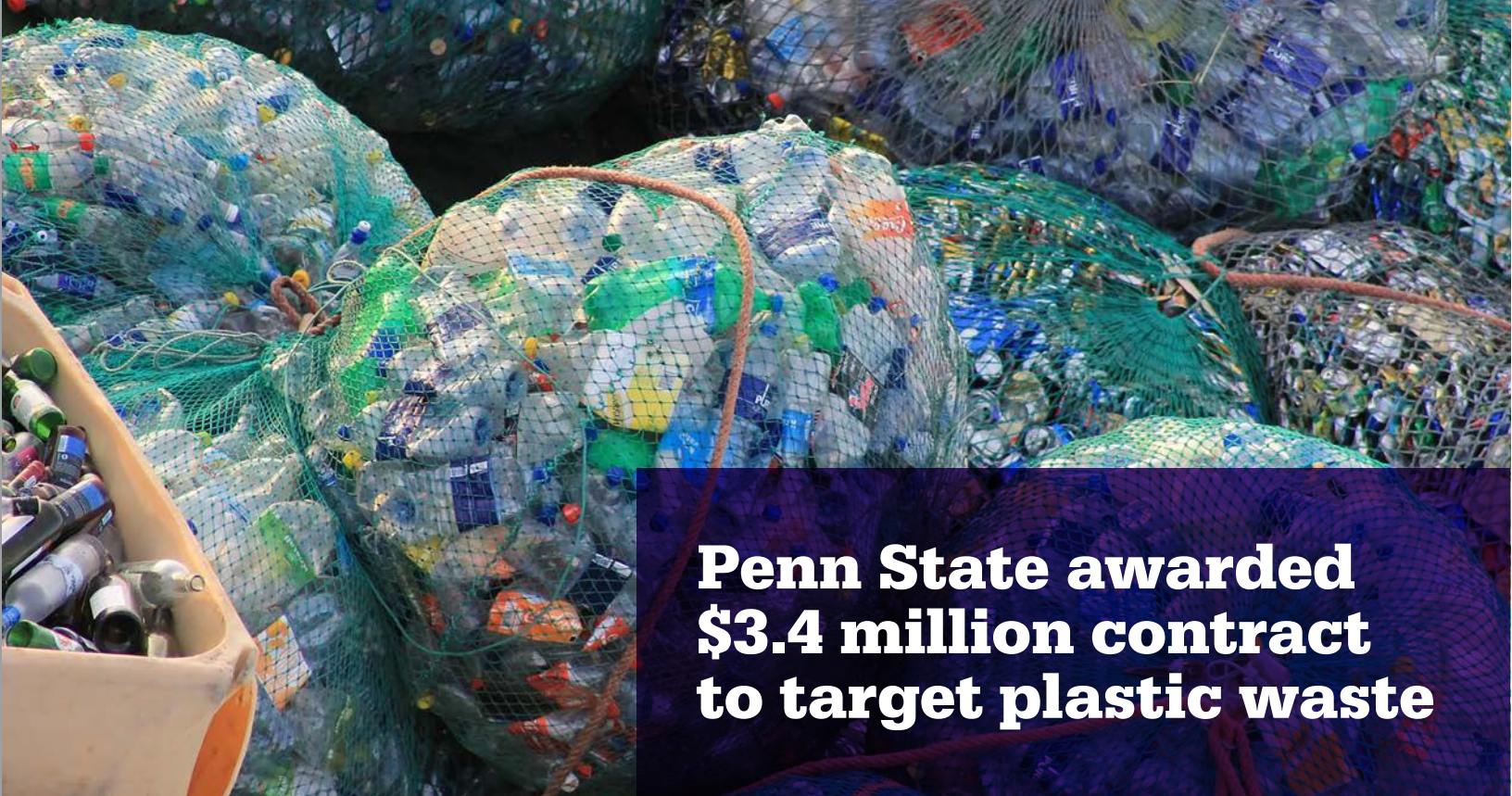
It is difficult for geoscientists to map sedimentary rocks’ compositional and mechanical properties at high resolution because the instruments available either lack resolution or are too expensive to use on new, previously unobserved sections of a subsurface formation, according to Yashar Mehmani, assistant professor of energy and mineral engineering. He recently received a seed grant from Penn State’s Institute for Computational and Data Sciences to investigate using artificial intelligence (AI) to develop a new method to model the Earth’s subsurface.

“The potential lies in extrapolating data from small to large and translating ‘cheap but less useful’ information to ‘expensive but more useful’ information. The speed with which this could be done opens up extraordinary possibilities,” said Mehmani.

The proposed approach only needs to occur once to build the initial database for the formation. The entire process of producing the infrared spectra and mapping them to a high-resolution mechanical property could take only a few hours. This reduction of time and cost could dramatically change how subsurface formations are analyzed.

“When deployed, AI would instantaneously translate data from a few lab samples into meter-scale information,” said Mehmani. “AI is that bridge. You train it on a few small samples and when you deploy it, you get something that no instrument can measure on its own.”

Read full story: bit.ly/3z5z49N



Penn State awarded \$3.4 million contract to target plastic waste

Penn State was awarded a \$3.4 million contract from the REMADE Institute, a public-private partnership established by the United States Department of Energy, to fund research targeting the inefficient methods currently used to process and upcycle mixed plastic waste. The project is one of twenty-two projects funded by REMADE. The project will receive \$1.7 million in federal funds with an additional \$1.7 million in cost-share by the project partners.

A global analysis of all mass-produced plastics found that a total of 8.3 billion metric tons of virgin plastics is estimated to be generated worldwide to date. As of 2015, 79% of plastic waste, which contains numerous hazardous chemicals, has been left to accumulate in landfills or natural environments with approximately 12% incinerated and only 9% recycled.

Upcycling is a process of recycling where the resulting product is of a higher value than the original item that was discarded. The research team led by Hilal Ezgi Toraman, assistant professor of energy engineering and chemical engineering, is developing a flexible, two-stage chemical recycling process that decomposes multiple types of plastic and then converts to valuable chemicals that can be used to create new products.

Through the funding, “Chemical Recycling of Mixed PET/Polyolefin Streams Through Sequential Pyrolysis and Catalytic Upgrading,” the interdisciplinary team will simultaneously assess the financial and environmentally viability of bringing the proposed process from the lab to the industrial scale based on integrated techno-economic analysis and life cycle assessment tools.

“Current commercial processes either operate below the necessary scale or are only applicable for single plastic types, not mixed plastics,” said Toraman, who also holds the College of Earth and Mineral Sciences’ Virginia S. and Philip L. Walker Jr. Faculty Fellowship. “When you consider the sheer amount of plastic, the development of a process that minimizes the steps needed for commercial implementation by accepting mixed, dynamic plastic inputs—there is immense potential to significantly affect the U.S. economy and environment.”

The first step to developing the new upcycling process hinges on a better mechanistic understanding of how dynamic plastic waste mixtures decompose and interact in chemical recycling processes. Built on Toraman’s past work, decomposition of plastic waste will be instigated via high temperatures in micro-pyrolysis setups. The study focuses on two of the most common plastics, polypropylene (PP) and polyethylene terephthalate (PET), which are found in multilayered packaging, carpeting residue, and films.

In the proposed two stage process, the second step is to convert the PET, PP mixture pyrolysis products using low-cost, stable catalysts to valuable chemicals such as benzene, toluene, xylene, and olefins.

Toraman noted several plastic upcycling approaches for mixed plastics failed due to the inability to handle the compositional complexity. However, the team’s modular approach will aim to provide the necessary flexibility to succeed and can even be optimized through kinetic reaction models and simulations.

“This two-stage process has the potential to revolutionize plastic recycling,” Toraman said. “System designs can then be tailored to a broad range of plastic waste streams, and predictive design decisions can be implemented to reduce energy demand and greenhouse gas emissions.”

REMADE awarded a total of approximately \$32.6 million dollars in new technology research to twenty-two projects, from its fourth request-for-proposal solicitation aimed at accelerating the nation’s transition from the current linear “make-consume-discard” economy to a more sustainable, circular economy focused on reuse, recycle, upcycle.

“Our mission is to reduce energy consumption and decrease emissions, while increasing the United States’ manufacturing competitiveness,” said Nabil Nasr, REMADE’s chief executive officer.

Toraman hopes this research overcomes the critical barrier of labor-intensive sorting and handling practices and forwards the John and Willie Leone Family Department of Energy and Mineral Engineering’s mission of environmental responsibility in the recovery, processing, and utilization of earth resources.


REMADE was established by the U.S. Department of Energy in 2017 with member organizations from industry, academia, national laboratories, trade associations, and non-profit entities to accelerate the U.S.’s transition to a circular economy.

Other members of the team include Penn State professors: Konstantinos Alexopoulos, assistant professor of chemical engineering; Michael Janik, associate department head and professor of chemical engineering; Prasenjit Mitra, professor of information sciences and technology; Robert Rioux, Friedrich G. Helfferich Professor of Chemical Engineering; and Rui Shi, assistant professor of chemical engineering. From Northwestern University, Linda Broadbelt, associate dean and professor of chemical and biological engineering is also a team member.

Additional contributors to this project include Siemens Process Systems Engineering and Shaw Industries Group Inc.

As of 2015, 79% of plastic waste has been left to accumulate in landfills or natural environments with approximately 12% incinerated and only 9% recycled.





Penn State to lead critical minerals consortium powered by \$1.2 million from DOE

A region famous for the coal that once fueled a growing nation is now the focus of a \$1.2 million project, led by Penn State researchers, aimed at establishing domestic supplies of critical minerals needed to produce modern technology from cell phones to fighter jets.

Penn State will lead the Consortium to Assess Northern Appalachia Resource Yield (CANARY) to measure and catalog northern Appalachian-basin critical mineral resources and waste streams; develop strategies to recover the materials from these streams; and identify potential supply-chain or technology gaps that will need to be addressed. The project, funded by the U.S. Department of Energy (DOE), is part of a broader, national effort to produce rare-earth elements and critical minerals.

“Penn State has world-class faculty and facilities to help lead the effort to meet the country’s critical mineral needs,” said Lora Weiss, Penn State’s senior vice president for research. “This funding will allow the University and its consortium partners to further leverage our considerable technical resources and established relationships with stakeholders to realize the full potential value of our natural resources.”

Rare earth elements are a group of metals considered critical because they are vital to a high-tech economy and needed for medical and defense applications and because they are produced almost entirely by foreign countries. China alone produces about 85% of the world’s supply.

The minerals are found in low concentrations in the ground and harvesting them comes at a high financial and environmental cost. However, coal and its waste products offer potential as an environmentally friendly and affordable source of the materials.

“CANARY will build on the prior work and current expertise of Penn State and its partners to evaluate the critical mineral production potential of the Northern Appalachian basin,” said Lee Kump, John Leone Dean in the College of Earth and Mineral Sciences. “Extracting critical minerals from coal waste has the potential to catalyze regional growth and create jobs while simultaneously remediating long-standing environmental problems, reclaiming abandoned mines, and helping the country meet its raw-material needs for future development of an advanced, technology-driven society.”

The two-year project will allow Penn State and its university and industrial partners to gain a fuller understanding of what resources are available in the region and how to best utilize them. To achieve this, CANARY will collaborate with U.S. and state Geological Surveys and state environmental agencies to review databases of historic mining and processing sites.



“We really don’t have a database or an assessment of what is out there and how much of our demand can be met with these secondary resources,” said Sarma Pisupati, professor of energy and mineral engineering and director of the project. “That’s what’s missing. This is very crucial for industry to have a strategy for developing these

resources and making them commercially extractable and available. We are very excited about this project.”

The project is one of thirteen recently funded with \$19 million from the DOE. CANARY focuses on the northern Appalachian basin, including much of Pennsylvania and parts of Kentucky, Maryland, Ohio, and West Virginia.

“We have a lot of resources and waste streams because of our history of coal mining,” Pisupati said. “Our job is to help reclaim and remediate some of the environmental problems created by those waste streams while also producing valuable materials that are important in terms of national security. We are addressing three problems in one.”

Also collaborating on the project are the University of Kentucky, Virginia Tech, and Colorado School of Mines, and industry partners including Tetra Tech, American Resources Corporation, Materia USA, Texas Mineral Resources Corp., and USA Rare Earths. Penn State and Colorado School of Mines also entered a memorandum of understanding related to critical minerals.

“We are excited to add to Penn State’s rich history of mineral resource development with our project, identifying basinal carbon ore, rare earth elements, and critical mineral resources and key components of the supply chain and leading our consortium toward increased economic prosperity in the commonwealth, our region, and the nation,” said Barbara Arnold, professor of practice in mining engineering and managing director of CANARY.

“Our job is to help reclaim and remediate some of the environmental problems created by those waste streams while also producing valuable materials that are important in terms of national security. We are addressing three problems in one.”

- Sarma Pisupati



Credit: Pixabay



Energy ‘crisis’ provides EME students leadership experience

The subpoena arrived at 9:45 p.m. on Friday, ordering the fictitious Wolfhelm Mining Ltd. executive team to appear in court. Their presence was requested to testify on an unfolding crisis that began a few hours earlier when a dam containing mining waste was breached on a remote Asian-Pacific island, flooding several villages, claiming the lives of hundreds and contaminating the region’s drinking water supply. It wasn’t until 11 p.m. that the students got any good news—that a Penn State research team rumored to be in the area had been found unharmed.



The roller coaster evening was part of the Energy Crisis Leadership Challenge, designed as the capstone project for an energy business and finance course focused on crisis management.

The challenge designed by Peter Rigby, a 1979 Penn State graduate in petroleum and natural gas engineering and energy expert, is meant to be a pressure cooker for the students to strengthen their team-working and leadership skills.

“Today’s employers want people entering the workforce who can solve multidisciplinary problems together and know how to collaborate and cooperate with people of very different backgrounds,” said Rigby.



Shreya Manoj, who graduated with a degree in energy engineering, said the entire class is an excellent opportunity for STEM students to dive into the leadership mindset and prepare for working on a team.

“It’s hard to visualize yourself in that situation. You’re not thinking ‘what would I do’ when you’re just reading case studies,”

said Manoj.

When watching the student executive teams work together, Rigby was impressed and sees success in many of the student’s futures because of their ‘crisis’ leadership experience.

Read full story: bit.ly/3PaS3Wf

Penn State takes first in Collegiate Wind Competition

The Penn State Wind Energy Club won big at the 2021 United States Department of Energy (DOE) Collegiate Wind Competition, taking home first overall in the competition and first in the project development contest. It is their fifth overall win, the most of any team that has participated in the competition.

Penn State competed against thirteen teams from universities around the country, all of whom were invited by the DOE to participate.

Each team was charged with designing and managing several real-world projects related to wind energy production, which they developed over the course of the academic year. The competition theme was adaptability, and the students were tasked with researching, designing and building a wind turbine “for deployment in highly uncertain times, with a large degree of unknown risks and delays,” according to the DOE’s specifications.

“Our student club members did an incredible job this year,” said Mark Miller, Penn State assistant professor of aerospace engineering and co-adviser of the club. “The fact that new and innovative ideas and designs were successfully pursued, despite most of the students never meeting in person, is a testament to their passion and work ethic.”

Read full story: bit.ly/3O2Nk7r



EME Connect Launched to Promote Diversity and Inclusion

A student outreach and engagement program aimed at increasing undergraduate enrollment and strengthening departmental diversity and inclusiveness was launched in Fall 2021 with the selection of eight students.

EME Connect students are called upon to organize and participate in events like study sessions, community-building activities, campus tours for prospective students, meetings with visiting alumni, and other varied outreach and recruitment efforts. In particular, students are set to participate in engagement across the campuses with fellow students who have indicated a preference for EME majors.

The program is one of several efforts in EME to further the College of Earth and Mineral Sciences’s mission to support diversity, equity, and inclusion (DEI) since the appointment of DEI associate heads within the departments. The newly created positions will lead department DEI efforts and coordinate with the college to support and deepen the work being done by the college’s Office of the Associate Dean for Educational Equity.



Paige Gallotta

Chiara Lo Prete, associate head for the John and Willie Leone Family Department of Energy and Mineral Engineering, was encouraged by the outreach potential of students within the programs.

“I think students can really foster a sense of belonging among fellow students,” said Lo Prete, associate professor of energy economics, “They can better speak to students interests and provide a lot of insight for how we can build a stronger sense of community among faculty, staff and students.”

The first slate of students selected to represent EME Connect include:

- Nicholas Boras, Mining Engineering
- Hannah Chop, Environmental Systems Engineering
- Paige Gallotta, Energy Engineering
- Alexis Gogola, Energy Engineering
- Mohammad Al Hoaimi, Petroleum and Natural Gas Engineering
- Patrick Rother, Energy Business and Finance
- Claire Souder, Environmental Systems Engineering
- Jordan Thibodeaux, Petroleum and Natural Gas Engineering

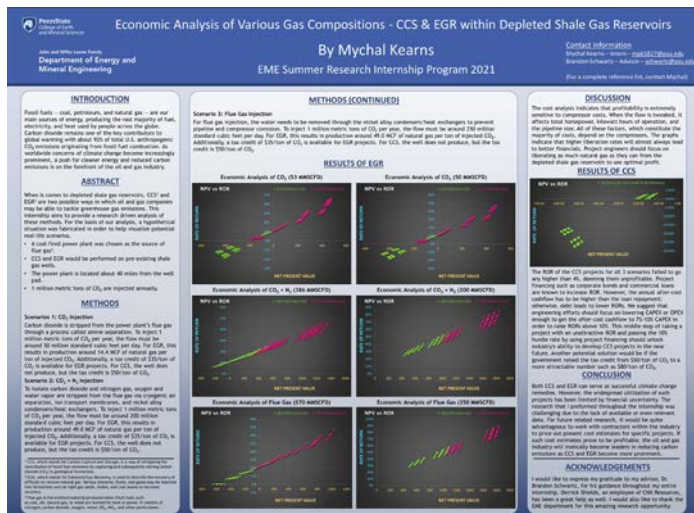
Meet the EME Connect students at: bit.ly/3aBRQfw

EME Summer Internship Program opens eyes to the rigors of research

When Covid-19 hit in the spring of 2020, many students seeking employment or summer internships saw opportunities disappear as businesses recalibrated during the early stages of the pandemic. The John and Willie Leone Family Department of Energy and Mineral Engineering (EME) responded by launching the EME Summer Research Internship, a ten-week program designed to introduce students to industry partners and the rigors of research—virtually.

After a successful inaugural year, the program was renewed with the goal to help students gain a deeper understanding of their options in the mineral and energy engineering fields.

“This internship opened my eyes,” said Mychal Kearns, who had just completed their first year at Penn State and is studying natural gas engineering. “I was interested in engineering, and I chose petroleum without much background knowledge. Just being introduced to, to get my feet wet in a sense, to all I’ll be undertaking in the next couple of years and in my career was very beneficial.”



During the application process prospective students were asked to identify areas of interest to align students with the most applicable research project and mentor. Duc Nguyen, a major in energy engineering with a minor in environmental engineering, believed finding the right advisor was invaluable.

“It really helped me to learn more about what I wanted to do,” said Nguyen. “Classes don’t cover everything, especially what’s happening in the industry and the trends that are going on right now. We talked a lot about the industry in more specific ways and just being

able to work with someone who is knowledgeable and can guide you gave me very good insight about whether to pursue a job or continue with grad school.”

For many EME students, the program was their first internship experience and introduced them to challenges that required the development of new skill. Research often involved time-intensive activities such as reading 100-page documents, hunting through challenging datasets on obscure websites, and even visiting the various waste management facilities throughout University Park.

Nayana Pandey, majoring in energy business and finance, focused her project on ways to reduce methane

emissions though offsets to meet the University’s goal to reduce greenhouse emissions by 85% by 2050.

“My biggest takeaway was learning the process that goes into data collection. There’s just so many sources out there, and so many different measurements, that pinpointing the exact, relevant information and combining all those pinpoints to get the whole picture, was a real challenge,” said Pandey.

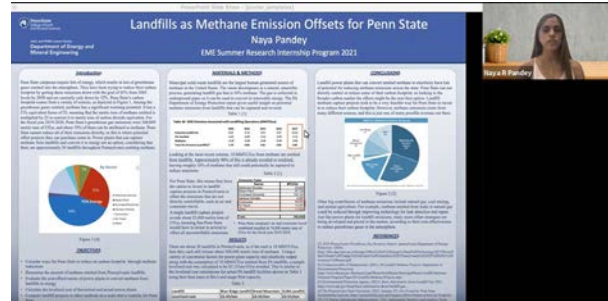
For some, the greatest challenge came with the final presentation and poster showcase.

“Getting the amount of work I’ve done in ten weeks, all the details, into a five-minute video was really difficult. There was so much I wanted to tell,” said Nguyen.

Nguyen’s project, “Stochastic model and techno-economic analysis of integrating large-scale wind power generation with underground hydrogen storage,” involved running 1,056 scenarios with ten variables to determine the economic feasibility of coupling salt cavern hydrogen storage with energy generated from a hypothetical windfarm. It was an eye-opening moment when he was encouraged to submit an abstract on his research to the 2021 Salt Mining Research Institute’s conference.

“I was pretty shocked,” said Nguyen. “I had never done that in my academic career and I never thought the internship would go that far. It made me feel capable of great things.”

View the research posters and presentations of the Summer Research Internship Showcases at: bit.ly/3QV312A



EME Student Photo Contest Winners

The annual EME Student Photo contest returned this past fall, giving students a chance to showcase their school spirit, an industry in action, or how they've let their inner Nittany Lion shine while learning remotely.

Faculty and staff judged the thirty-seven submissions on their technical quality, expression of category theme (Penn State Pride, Energy and Minerals in the World, Roaring Remotely), and creativity for the \$500 top prize. The newly added People's Choice prize opened the voting to the public, allowing students and families to choose a fan favorite.



1st Place: Beautiful Morning in Northern Nevada
Photographer: Morike Sissoko
Program: Mining Engineering
Category: Energy and Minerals in the World



2nd Place: Frozen
Photographer: Adeline Weitknecht
Major: Energy Engineering
Category: Energy and Minerals in the World



People's Choice: Old is Gold
Photographer: Hind Alghuwainem
Major: Petroleum and Natural Gas Engineering
Category: Penn State Pride



3rd Place: Steidle at Sunset
Photographer: Jaeden Mayzel
Major: Environmental Systems Engineering
Category: Penn State Pride

Visit the EME Flickr Account to view all the submissions and previous winners at [flickr.com/photos/emedept](https://www.flickr.com/photos/emedept)



Barbara Arnold,
Prof. of Practice in
Mining Engineering



Grace Choi,
Financial Assistant



Erica Cooper,
Admin Support
Coordinator for
EME



**Suzanna Esther
Duiker,**
Administrative
Assistant to the
Department Head



**Nelson Yaw
Dzade,**
Asst. Prof.
of Energy
and Mineral
Engineering



Abby Gramley,
Industry Recruiting
Coordinator



Molly Hanna,
Academic Adviser



Yashar Mehmani,
Asst. Prof. of Energy
and Mineral
Engineering



Anne Menefee,
Asst. Prof.
of Energy
and Mineral
Engineering



Laura Mikulak,
Graduate Program
Coordinator

Learn more about
our new additions
on their EME
Directory pages
at bit.ly/3PwSWb4



Renee Obringer,
Asst. Prof.
of Energy
and Mineral
Engineering



**Courtney
Robinson,**
Marketing
Communications
Specialist



Samantha Suk,
Academic Adviser



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