



Energy
Transition Institute
UH ENERGY

Shell
FOUNDING
PARTNER

ANNUAL REPORT



2024





TABLE OF CONTENTS

5	Letter from the Director: Joe Powell
6	Mission and Vision
8	Board Members
10	Faculty Appointments
14	Faculty Research
18	Student Involvement
21	Student Success
27	Speakers and Events
33	Educational Programs
36	Press and News
39	Buildings and Facilities
41	ETI Funding Model

INTRODUCTION



Letter from the Director: Joe Powell

The UH Energy Transition Institute built upon its fast start in Year 1 by sponsoring a student Circular Plastics Challenge with \$13,500 in prize money. Additionally, it allocated over \$10,000 to student innovation contests, which resulted in multiple external competition awards, patent filings and the initiation of startup companies. More than \$150,000 was allocated to fund student research projects and scholars fellowships at both the undergraduate and graduate levels. Scores of UH campus events, class lectures and symposia were held monthly to provide broad exposure and student engagement for Shell as a founding partner and other emerging industry members to articulate challenges and needs in the energy transition, focusing on the themes of hydrogen, circular economy and carbon management.

More than \$10 million in grant applications were submitted with industry partners, resulting in over \$3 million in grants being awarded to UH faculty and students. Industry-driven research projects have also been initiated, focusing on bridging gaps in technology development, reducing risks and facilitating deployment by leveraging UH faculty and a broad network of engineering talent from the Houston area. The seed fund grants expanded from 11 to over 25 highly-valued projects, enabling faculty to align their research portfolios with emerging needs in the energy transition and gain access to state and federal funding.

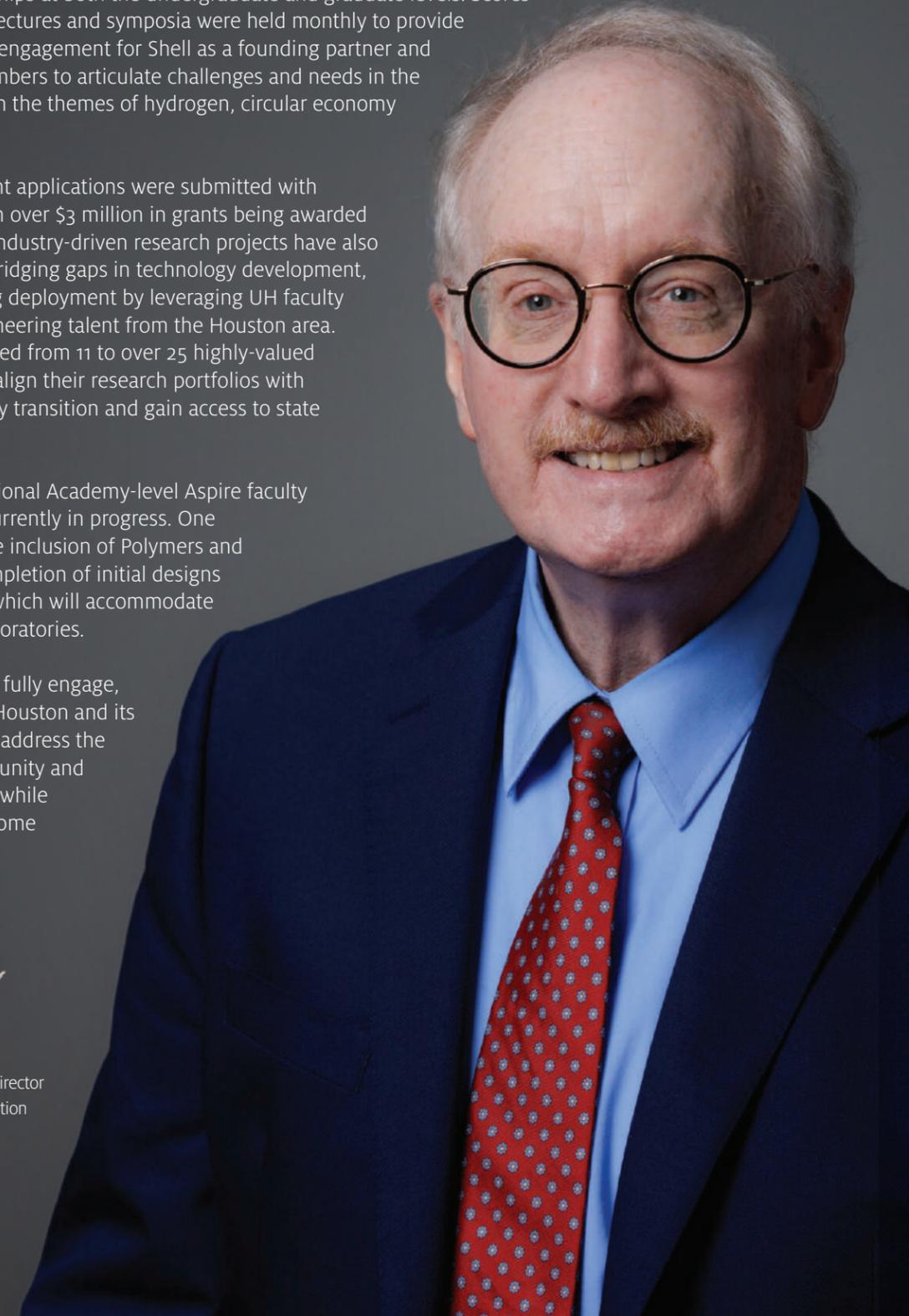
Presidential Frontier and National Academy-level Aspire faculty hiring and recruitment are currently in progress. One announcement highlights the inclusion of Polymers and Circularity, as well as the completion of initial designs for the UH Innovation Hub, which will accommodate the expanded faculty and laboratories.

We hope you will join us and fully engage, leveraging the University of Houston and its resources and networking to address the industry's needs, local community and broader global stakeholders, while empowering students to become tomorrow's leaders in the energy sector.

A handwritten signature in cursive script, reading "Joe Powell", is located below the main text block. The signature is written in a dark color, likely black or dark blue ink.

JOE POWELL, PH.D.

Aspire Initiative Endowed Executive Director
Shell Endowed Chair for Energy Transition
Professor, William A. Brookshire
Department of Chemical and
Biomolecular Engineering





Mission

The University of Houston Energy Transition Institute empowers the next generation of energy leaders; develops and accelerates energy solutions, including hydrogen, carbon management and circular materials at scale and informs policies to address our most pressing challenge to provide secure, reliable, affordable and sustainable energy for all.

Vision

To be the global academic leader for the energy transition.

Why University of Houston?

LOCATION: We are located in the energy capital of the world, providing students with real-world experiences and numerous career opportunities in a thriving industry.

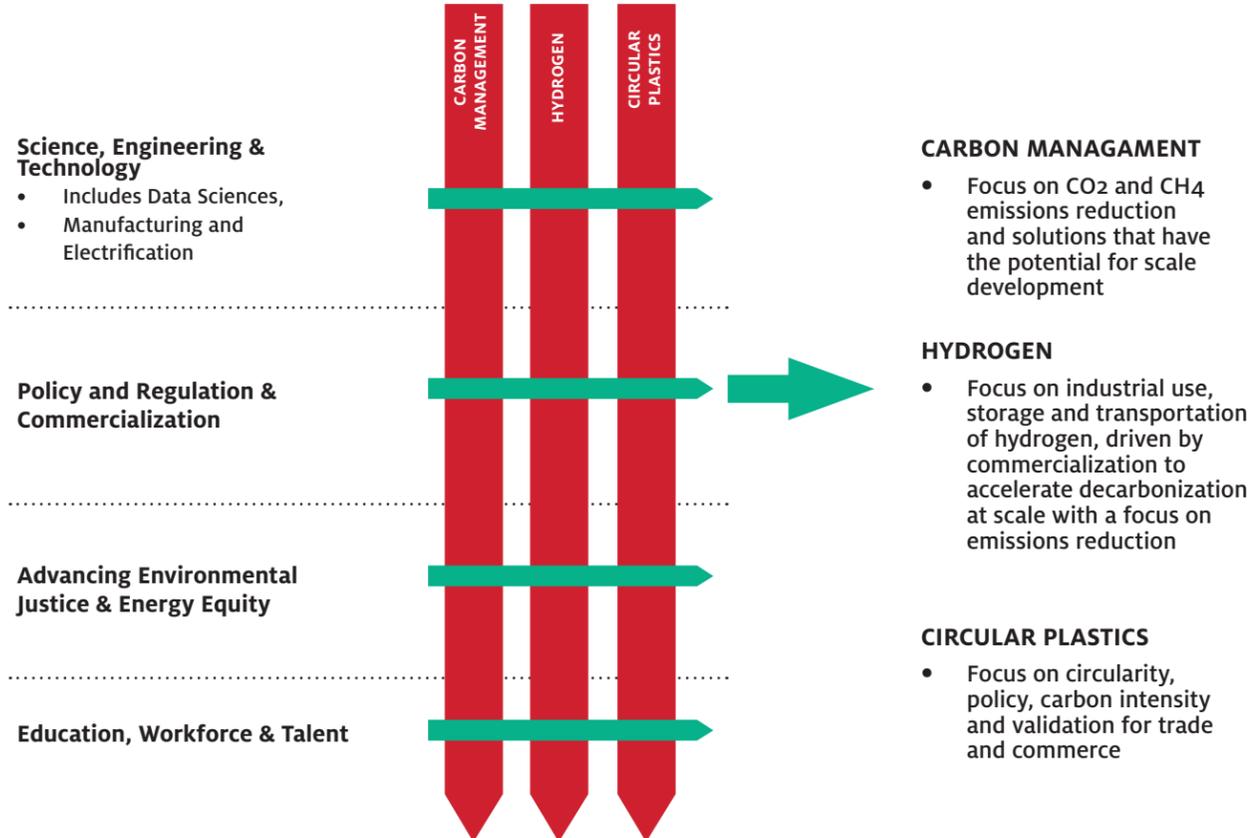
RESEARCH AND INNOVATION: We are a leader in energy research, particularly in the areas of hydrogen, carbon management and circular materials. Our faculty and students work on cutting-edge projects, contribute to important developments in the field and engage in the commercialization of these advancements.

WORKFORCE DEVELOPMENT: Our students are the future workforce of a broad energy ecosystem, including industry, academia and government.

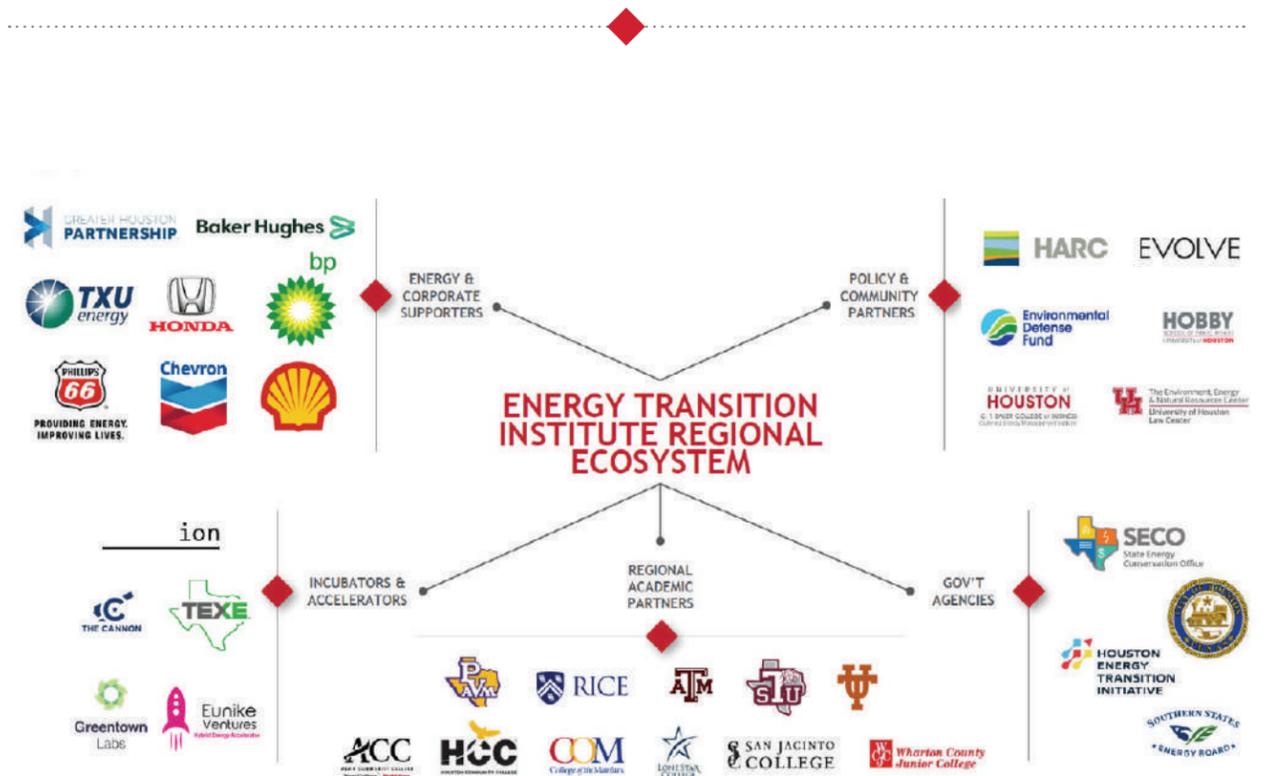
BROADENING PARTICIPATION: We are one of the most diverse public research universities in the country. We provide a unique, inclusive and real-world centric learning environment that prepares students for success in the global economy.

ENTREPRENEURSHIP: Our focus on entrepreneurship and innovation encourages faculty and students to transform their ideas into viable solutions and new ventures.

DETAILING THE ENERGY TRANSITION INSTITUTE



The Energy University



Energy Transition Institute Advisory Board



SCOTT ANDERSON
Senior Director,
Energy Policy, Oxy



WEI CAI, Ph.D.
Chief Technology Officer,
Technip Energies



HANNEKE FABER (M.B.A. '92)
Chief Executive Officer,
Logitech



PETER F. GREEN, Ph.D.
Deputy Laboratory Director for Science
and Technology, Chief Research Officer
National Renewable Energy Laboratory



SELDA GUNSEL
President,
Shell Global Solutions



SCOTT NYQUIST
Advisory Board Chairman
Senior Advisor, McKinsey & Company



MARVIN E. ODUM
President, Shell Oil Company (Retired),
Director, Cullen Foundation
Board of Directors



ANDREY SHULALOV
Vice President of Energy Transition,
Shell USA



DARRYL WILLIS
Corporate Vice President,
Energy & Resources Industry
IPS, Microsoft

FACULTY AND RESEARCH APPOINTMENTS



Faculty Appointments

FUNDED ASPIRE FACULTY POSITIONS

The UH Energy Transition Institution, part of the University's Aspire Fund program, was created through the foundational gift from Shell and gifts from several other private donors to establish endowed faculty chairs and professorships. These positions are expected to be filled by 2025.

In 2019, the University of Houston launched a transformational initiative aimed at propelling our academic enterprise to unprecedented levels of distinction. Founded by an anonymous donor, the Aspire Fund matches contributions to the University's bold future in research and scholarship. Gifts, combined with a one-to-one match from anonymous donors and potential matching funds from the state of Texas, will allow the University to recruit and retain top-tier faculty, fueling our learning environment by fostering increased knowledge, innovation and discovery in areas with worldwide impact.

ASPIRE FUND FACULTY

Shell Endowed Chair for Energy Transition	Professor Joseph Powell
2nd Shell Endowed Chair for Energy Transition	<i>Search underway</i>
Panos Family Endowed Chair in Mechanical Engineering	<i>Search underway</i>
Anuradha Rani Agrawal Industrial Engineering Endowed Professorship	<i>Search underway</i>
Durga D. Sushila Agrawal Industrial Engineering Endowed Professorship	<i>Search underway</i>
[Hari and Anjali] Agrawal Endowed Professorship in Engineering	<i>Search underway</i>

Donor	Gift Description	Gift Amount
Shell USA	2 chairs @ \$2M, Institute Launch Funds @ \$1M	\$ 5,000,000
Shell USA	Research paid @ \$2M, \$2M, \$1M	\$ 5,000,000
Panos Estate	Chair in Mechanical Engineering	\$ 2,000,000
D. Agrawal	Anuradha Agrawal Professorship in Industrial Engineering	\$ 1,000,000
D. Agrawal	Durga and Sushila Agrawal Professorship in Industrial Engineering	\$ 1,000,000
H. Agrawal	Hari and Anjali Endowed Fellowship in Engineering	\$ 1,000,000

CHIEF OPERATING OFFICER: DEBALINA SENGUPTA



Debalina Sengupta started as the chief operating officer of the Energy Transition Institute on July 1, 2024. In this role, she is responsible for supervising the institute's main goals and objectives. She works closely with the executive team and the ETI advisory board to create and execute strategic initiatives that enhance the institute's competitiveness. Sengupta establishes and manages internal processes to enhance coordination between departments, leading to improved efficiency, operational structure and cost savings. Additionally, she collaborates with the executive director and internal stakeholders to advance the institute's goals through University procedures. She also oversees research activities, manages programs such as undergraduate energy leadership and graduate fellowships and builds relationships with external partners to support ETI's external objectives, particularly in the Houston area.

HIRING PRESIDENTIAL FRONTIER FACULTY

In addition to the Aspire Fund faculty appointments, the University is investing in the Presidential Frontier Faculty program, a university-wide integrated interdisciplinary faculty hiring campaign supported by President Renu Khator. Currently, in its interview stages, the Presidential Frontier Faculty is actively recruiting a large cohort of convergence research faculty to respond to federal priorities and societal challenges.

PRESIDENTIAL FRONTIER FACULTY

Assistant Professor, Energy Security and Transition	Professor Ben Xu
Assistant Professor, Energy Security and Transition	Professor Steffen Hitzemann
Assistant Professor, Energy Security and Transition	Professor SriBala Gorugantu
Assistant Professor, Energy Security and Transition	Professor Chinonso Anozie
Assistant Professor, Energy Security and Transition	Professor Valentine Gilbert
Assistant Professor, Energy Security and Transition	Professor Jiaxuan Li

The University successfully recruited four additional Presidential Frontier Faculty members for the ETI will start in fall of 2024. The faculty members will be multi-disciplinary and will balance their work between a primary (1) and secondary (2) college appointment:



PROFESSOR STEFFEN HITZEMANN

C. T. BAUER COLLEGE OF BUSINESS / CULLEN COLLEGE OF ENGINEERING

Professor Hitzemann's research is in the area of macro-finance, asset pricing and derivatives markets. A central part of his work especially focuses on the financial economics of energy and climate change.



PROFESSOR BEN XU
CULLEN COLLEGE OF ENGINEERING

Professor Xu's research focuses on developing novel numerical and experimental techniques to investigate the multiphase transport phenomenon in advanced energy systems and advanced manufacturing processes. Current research focuses on the multiphase flow and heat transfer in porous structures, modeling and experiments of laser additive manufacturing process and bubble/jet generation in laser-assisted 3D bioprinting.



PROFESSOR SRIBALA GORUGANTU
CULLEN COLLEGE OF ENGINEERING

Professor Gorugantu's research expertise lies in chemical kinetics, reaction engineering and advanced characterization techniques. This research integrates comprehensive experimental and computational methods to understand the kinetics of complex reaction systems, with the goal of advancing the development of sustainable processes.



PROFESSOR CHINONSO ANOZIE
UH LAW CENTER

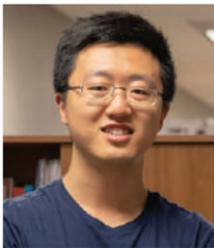
Professor Anozie teaches property law and various energy and environmental law classes, including a global environmental justice class that incorporates environmental harms and just energy transition in the least developed economies.



PROFESSOR VALENTINE GILBERT
HOBBY SCHOOL OF PUBLIC AFFAIRS

Professor Gilbert he is an applied economist. His research focuses on housing affordability and the geographic and distributional consequences of changes in housing supply and costs. In his job market paper, he uses large-scale administrative data and economic theory to understand what patterns of residential mobility between housing sub-markets reveal about the price and welfare effects of new housing construction.

He received his doctorate from Harvard University. Before his doctoral studies, he was a researcher at the University of Chicago Crime Lab in New York. He received his bachelor's degree in economics from the University of Rochester.



PROFESSOR JIAXUAN LI
COLLEGE OF NATURAL SCIENCES AND MATHEMATICS

Professor Li's machine learning fracture imaging aims to find discrete fracture network and reduce the cost of geothermal energy exploration, a painful bottleneck in the current scenario. His Ph.D. work solved major scientific problems in earth sciences. He also provided novel solutions to tackle important applied problems.

Throughout his education, Li has won many awards, including the 2019 EAS Graduate Student Excellence Award. He is grateful for the scholarships and fellowships he was awarded.

RESEARCH AND GRANTS



Faculty Research and Seed Grants Funded under ETI and CCME

LIGNIN VALORIZATION WITH EARTH-ABUNDANT METAL CATALYSIS

ROBERT COMITO, COLLEGE OF NATURAL SCIENCES AND MATHEMATICS-CHEMISTRY

COMPUTATIONAL PREDICTION OF SURFACE STABILIZED OXIDE NANOPARTICLES AS HIGH-PERFORMANCE OXYGEN EVOLUTION CATALYST

JIEFU CHEN, CULLEN COLLEGE OF ENGINEERING-ELECTRICAL AND COMPUTING ENGINEERING

LARS GRABOW, CULLEN COLLEGE OF ENGINEERING-CHEMICAL AND BIOMOLECULAR ENGINEERING

ADVANCING SUSTAINABILITY IN HYDROGEN SUPPLY CHAINS (HSC):

AN AI-ENABLED APPROACH FOR DIGITAL TRANSFORMATION IN HYDROGEN TRANSPORTATION AND LOGISTICS IN THE STATE OF TEXAS

JIAN SHI, CULLEN COLLEGE OF ENGINEERING-ENGINEERING TECHNOLOGY/ELECTRICAL AND COMPUTING ENGINEERING

KAILAI WANG, CULLEN COLLEGE OF ENGINEERING-CONSTRUCTION MANAGEMENT

HYDROGEN ECONOMY:

TRANSPORTATION, MONITORING, UTILIZATION AND SUSTAINABILITY

SASHA DONG, CULLEN COLLEGE OF ENGINEERING-CONSTRUCTION MANAGEMENT

MENG LI, C.T. BAUER COLLEGE OF BUSINESS

CIRCULAR ECONOMY FOR MATERIALS AND PLASTICS:

CENTRALIZED AND DECENTRALIZED APPROACH

ZHEYONG BIAN, CULLEN COLLEGE OF ENGINEERING-ENGINEERING/CONSTRUCTION MANAGEMENT

SASHA DONG, CULLEN COLLEGE OF ENGINEERING-ENGINEERING/CONSTRUCTION MANAGEMENT

REPURPOSING U.S. GULF COAST OIL AND GAS ASSETS FOR THE HYDROGEN ECONOMY

GREG BEAN, C.T. BAUER COLLEGE OF BUSINESS

MIKE HAROLD, CULLEN COLLEGE OF ENGINEERING-CHEMICAL AND BIOMOLECULAR ENGINEERING

TRACY HESTER, UH LAW CENTER

COMPETITION VERSUS COOPERATION:

EXAMINING THE DYNAMICS OF GREEN HYDROGEN ECONOMY GROWTH AND A RENEWABLE-DOMINATED TEXAS POWER GRID

LEI FAN, CULLEN COLLEGE OF ENGINEERING-ENGINEERING TECHNOLOGY/ELECTRICAL AND COMPUTING ENGINEERING

JIAN SHI, CULLEN COLLEGE OF ENGINEERING-ENGINEERING TECHNOLOGY/ELECTRICAL AND COMPUTING ENGINEERING

SYSTEMATIC REPURPOSING OF DECOMMISSIONED WIND TURBINE BLADES (DWTB) FOR CIVIL INFRASTRUCTURE

YI-LUNG MO, CULLEN COLLEGE OF ENGINEERING-CIVIL AND ENVIRONMENTAL ENGINEERING

GANGBING SONG, CULLEN COLLEGE OF ENGINEERING-MECHANICAL ENGINEERING

SEAWATER ELECTROLYSIS

ZHIFENG REN, COLLEGE OF NATURAL SCIENCES AND MATHEMATICS /PHYSICS

GREEN SYNTHESIS OF BATTERY-GRADE CARBONS FROM PETCOKE

ZHENG FAN, CULLEN COLLEGE OF ENGINEERING-TECHNOLOGY DIVISION

FRANCISCO ROBLES HERNÁNDEZ, CULLEN COLLEGE OF ENGINEERING-TECHNOLOGY DIVISION

A COMPREHENSIVE STUDY OF BIO-REACTIVE TRANSPORT PROCESSES FOR UNDERGROUND HYDROGEN STORAGE USING MULTI-PHASE PORE-SCALE SIMULATIONS

BIROL DINDORUK, CULLEN COLLEGE OF ENGINEERING-PETROLEUM ENGINEERING

GUAN QIN, CULLEN COLLEGE OF ENGINEERING-PETROLEUM ENGINEERING

NEW LINER AND LINER APPLICATION TECHNOLOGY FOR REPURPOSING EXISTING NG PIPELINES FOR HYDROGEN TRANSPORT

STANKO BRANKOVIC, CULLEN COLLEGE OF ENGINEERING-ELECTRICAL AND COMPUTING ENGINEERING

PRODUCED HYDROGEN PURITY FROM STORAGE IN REPURPOSED METHANE STORAGE FACILITY

CHRISTINE EHLIG-ECONOMIDIES, CULLEN COLLEGE OF ENGINEERING-PETROLEUM ENGINEERING

PRODUCING LONG-CHAIN HYDROCARBONS AND HYDROGEN FROM CO₂ AND WATER USING PHOTOELECTROCHEMICAL CATALYSIS

JIMING BAO, CULLEN COLLEGE OF ENGINEERING-ELECTRICAL AND COMPUTING ENGINEERING

COMPOSITE AMINOPOLYMER-ENABLED LOW-COST DIRECT AIR CAPTURE:

FROM LAB TO PILOT SCALE STUDIES

PRAVEEN BOLLINI, CULLEN COLLEGE OF ENGINEERING-CHEMICAL AND BIOMOLECULAR ENGINEERING



JUMP-STARTING THE CLEAN-HYDROGEN ECONOMY IN TEXAS: ASSESSING THE ECONOMIC EFFECTS OF THE INFLATION REDUCTION ACT ON CLEAN HYDROGEN PRODUCTION IN THE LONE STAR STATE

JIAN SHI, CULLEN COLLEGE OF ENGINEERING

SWARMING OF BIO-INSPIRED ROBOTIC FISH FOR UNDERWATER CO₂ LEAKAGE MONITORING

ZHENG CHEN, CULLEN COLLEGE OF ENGINEERING

ROBUST OPTIMIZATION OF A U.S. BLUE HYDROGEN SUPPLY CHAIN FOR THE TRANSPORTATION SECTOR USING ARTIFICIAL INTELLIGENCE

CHRISTINE EHLIG-ECONOMIDES, CULLEN COLLEGE OF ENGINEERING

ENHANCED GAS RECOVERY FOR BLUE HYDROGEN (EGRBH) GENERATION

DIMITRIOS G.HATZIGNATIOU, CULLEN COLLEGE OF ENGINEERING-PETROLEUM ENGINEERING

UH-GeoSEP: THE UNIVERSITY OF HOUSTON GEO-INFORMATION SERVICE PLATFORM FOR CARBON SEQUESTRATION AND EMISSIONS MANAGEMENT

PIETRO MILILLO, CULLEN COLLEGE OF ENGINEERING-CIVIL ENGINEERING

TOWARDS DEVELOPMENT OF ELECTROCHEMICAL SYSTEMS FOR CARBON CAPTURE

MOHAMMAD (MIM) RAHIMI, CULLEN COLLEGE OF ENGINEERING-CIVIL ENGINEERING

DEEP LEARNING BASED LEAKAGE DETECTION OF UNDERGROUND CO₂ STORAGE USING MULTIPHYSICS DATA V.2

XUQING WU, CULLEN COLLEGE OF ENGINEERING-ENGINEERING TECHNOLOGY

LOW-COST, MEMBRANE-FREE, ELECTROCHEMICALLY DRIVEN DIRECT OCEAN CO₂ CAPTURE PROTOTYPE DEVELOPMENT BASED ON SOLID-STATE QUINONE-ENABLED PH SWING

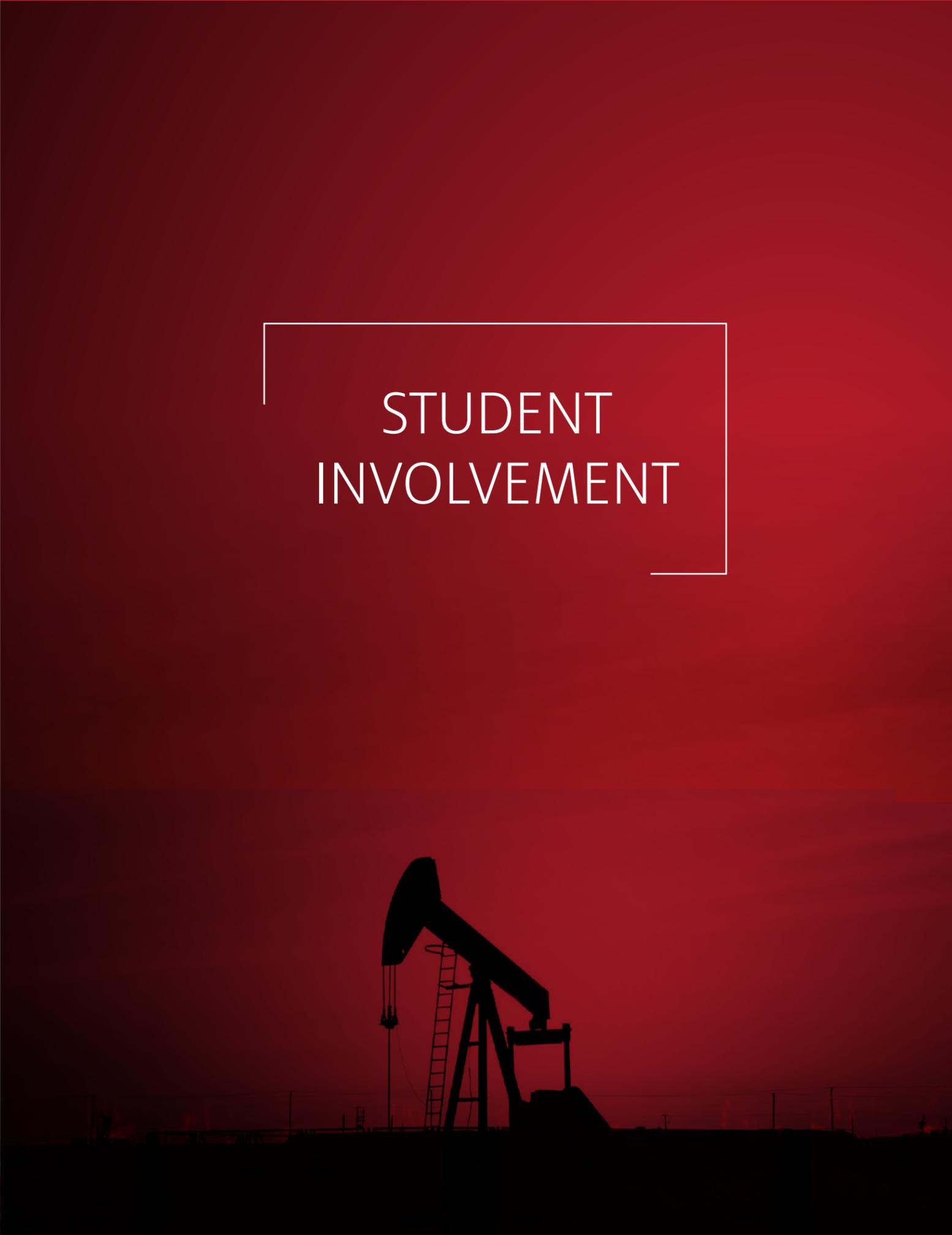
YAN YAO, CULLEN COLLEGE OF ENGINEERING-ELECTRICAL AND COMPUTING ENGINEERING

A SCALABLE COST-EFFECTIVE TURNKEY SOLUTION FOR GCS MONITORING OF FLUID MIGRATION THROUGH CAPROCKS USING ROCK PHYSICS BASED SEISMIC METHODS

YINGCAI ZHENG, COLLEGE OF NATURAL SCIENCES

MORE THAN 10 PATENTS FILED AND SUBMITTED
BASED ON FUNDING FROM ETI AND CCME

STUDENT
INVOLVEMENT



Student Involvement

CHEVRON ENERGY GRADUATE FELLOWS PROGRAM

The University of Houston Chevron Energy Graduate Fellows Award seeks outstanding graduate candidates engaged in energy-related research across the campus. The program will fund eight fellows with a one-year, \$12,000 graduate fellowship. The program had a kickoff reception in August 2023 and will have a year-end presentation in July 2024.



ENERGY SCHOLARS PROGRAM

Established in 2023, the Energy Scholars program provides UH undergraduate students the opportunity to work on energy research projects under the guidance of a UH faculty mentor. This initiative provides a constructive forum for students from multiple disciplines across the University – engineers, architects, writers, chemists and economists to name a few – to advance discussions and ideas related to energy at the highest academic levels.



THE UH ENERGY CAREER FAIR

Fair, the collaboration between UH Energy, the Energy Coalition student organization, and University Career Services, provides a platform for energy companies and nonprofits to attract and recruit skilled UH students. While the fair is open to all majors, its primary aim is at business, engineering, technology and science students interested in the energy sector. Represented energy industries include fossil fuels, electrical power, nuclear power, renewables, as well as non-profits, government agencies and startups.



UH ENERGY SPRING SYMPOSIUM THE FUTURE OF MOBILITY PROMISES AND BOTTLENECKS

UH Energy's Critical Issues in Energy Symposium Series continued with "The Future of Mobility Promises and Bottlenecks," a discussion on advancing sustainable, affordable and universally accessible transportation. Margaret Kidd, associate instructional professor and director of the supply chain and logistics technology program at the University of Houston, moderated the panel. Panelists included Ben Shapiro from the Rocky Mountain Institute, Mary Holing from Los Angeles Cleantech Incubator and Catherine McCreight from the Texas Department of Transportation.



ENERGY COALITION ENERGY 101

The Energy Coalition is a student organization dedicated to strengthening UH's global reputation as the Energy University. It was established to unite students from different colleges and organizations interested in pursuing careers in the energy sector. The coalition promotes communication and collaboration among students who may not otherwise have the chance to work together or learn from each other despite sharing similar career goals. As the largest student group on campus, the Energy Coalition comprises 34 member organizations and over 5,000 student members, including undergraduates and graduates from six colleges. Additionally, the Energy Coalition's Executive Board acts as Energy Ambassadors for UH Energy.



ENERGY DAY FESTIVAL

Energy Day, Houston's largest annual family festival, is hosted by the Consumer Energy Education Foundation and the Consumer Energy Alliance. This free event is a celebration of science, technology, engineering and mathematics (STEM), offering nearly 70 interactive demonstrations and exhibits. Energy Day aims to educate students and families about different forms of energy and related industries, emphasizing STEM fields, efficiency and conservation. It provides a fun and engaging environment for attendees to learn about the importance of energy and its impact on our daily lives.



UH ENERGY FALL SYMPOSIUM

PLASTICS, CHEMICALS, CIRCULARITY

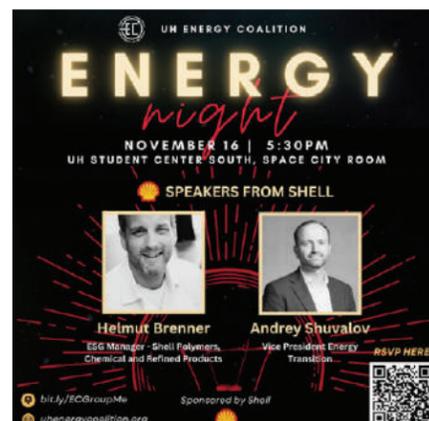
The University of Houston Division of Energy and Innovation and UH Energy Transition Institute jointly hosted a symposium titled “Plastics, Chemicals, Circularity: What’s Next?”

This event, part of a broader multidisciplinary research initiative ensuring affordable, reliable and sustainable energy for all, will delve into the concept of circularity, future material production and consumption, sustainable meeting of consumer demand and the role of new technologies, standards and regulations in reducing emissions and waste. The panelists included Aura Cuellar from LanzaTech, Jill Martin from Dow and Scott Pasternak from Burns & McDonald; Tracy Hester from the University of Houston Law Center moderated. They discussed challenges, potential pathways and analyses of proposed solutions for achieving circularity and sustainability in the energy industry and facilitating the transition to a circular economy.



ENERGY NIGHT

Energy Night at the University of Houston, organized by the Energy Coalition, highlighted the concepts of circularity and innovative approaches to utilizing clean, renewable energy sources. The Energy Coalition, a student organization dedicated to enhancing UH’s global reputation as The Energy University, hosted the event. Industry representatives from Shell and X, the moonshot factory, were among the attendees, sharing insights into various initiatives aimed at addressing the ongoing global climate crisis. The event served as a platform to explore potential future energy scenarios and to discuss collaborative efforts to advance sustainable energy practices.



ENERGY RESEARCH DAY

Over 60 graduate and doctoral students showcased their innovative research from various UH labs at the 2023 Energy Research Day, a collaborative event by UH Energy, UH Graduate School and the UH Division of Research. The presentations covered a wide range of energy topics, such as energy poverty, carbon capture and storage, solid-state batteries and robotics. The event demonstrated the industry’s advancing ingenuity and introduced the future energy leaders who will shape the industry in the years ahead.



STUDENT SUCCESS

WINNERS OF THE CIRCULAR PLASTICS CHALLENGE

“

WE WANTED TO
PROVIDE A
SIMPLE SOLUTION
TO A GROWING PROBLEM

— Emma Nicholas
and Sarah Grace Kimberly



STUDENT SUCCESS – WINNERS OF THE CIRCULAR PLASTICS CHALLENGE

University of Houston's Energy Transition Institute (ETI) challenged students to address the critical issue of dealing with plastic waste and creating a real-world circular economy. Over 60 students participated in the first Circular Plastics Challenge. The field of competitors was pared down to six finalist teams, who presented their solutions at the 2023 Energy Night hosted by the UH Energy Coalition. The final pitches ranged from renewable packaging and replacing plastic products with more sustainable materials to using drones to reduce excess packaging, transportation emissions and more.

"If you look at the wide variety of proposals and approaches, you can see the complexity of the problem and all the different things that society must consider to find solutions," ETI Founding Executive Director Joe Powell said. "I think circularity in plastics and chemicals is as difficult to address as the net-zero issue within the energy sector, if not more. We have a unique opportunity here to tackle both, and it's really great to see our students thinking ahead."

BeadBlocker, a team of two students — Sarah Grace Kimberly and Emma Nicholas — was the challenge winner. The team proposed using a liquid-based membrane filter inserted into household drains to combat microplastics found in many personal care products, such as makeup and hygiene items. The membrane would function as a magnet of sorts, attracting and capturing microplastics from wastewater in showers and sinks.

The filter, according to Kimberly and Nicholas, not only shines a light on one of the world's more unheralded yet damaging waste sources, but it effectively stops pollution at the source and could significantly curtail the 5.4 million metric tons of microplastics that enter water annually.

"We wanted to provide a simple solution to a growing problem," Kimberly said. "Before we did this project, we didn't know that microplastics existed, let alone in our makeup. I didn't know I was basically putting plastic on my face every single day and washing it off into our drains. Because it's an unseen problem, it's hard to address."

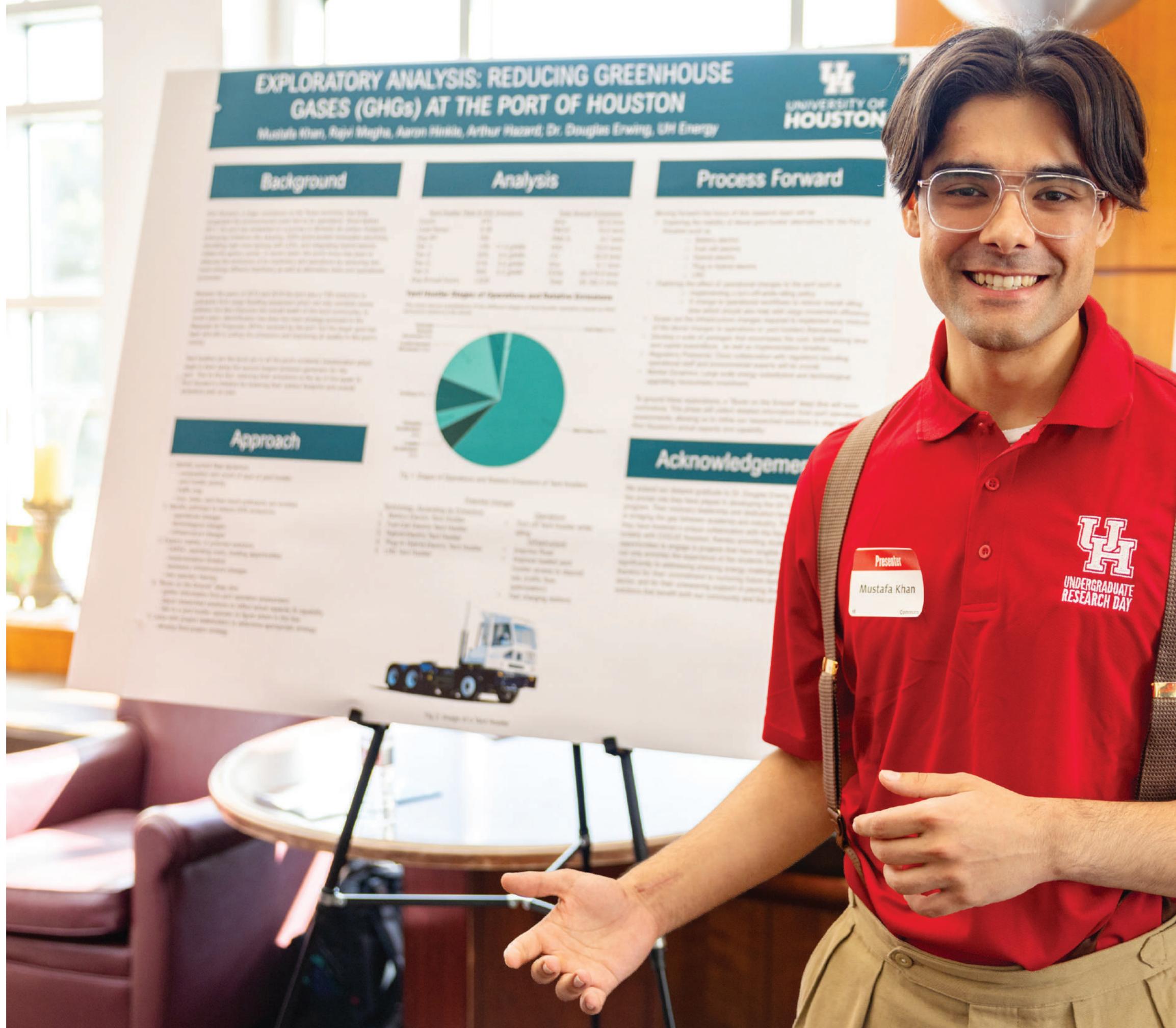
The idea was so well received that the duo, both juniors at the C. T. Bauer College of Business, also won the viewer's choice award from their peers, a sign that this could be a small yet highly practical tool in developing a circular economy.

"We'd love to explore any possible options into making this a real thing as opposed to just a concept or idea," Nicholas said.

“

The 2024 UH Undergraduate Research Day, hosted by the Office of Undergraduate Research and Major Awards and Honors College, featured a special section showcasing innovative energy-related projects by Energy Scholars.

They joined over 360 UH students presenting research findings across various disciplines and offering promising solutions.



SPEAKERS AND EVENTS

Speaker and Events

UNITED STATES BUSINESS COUNCIL FOR SUSTAINABLE DEVELOPMENT

Joe Powell was invited to speak about hydrogen at the executive committee meeting in the context of energy transition. Other thematic areas covered throughout the day included Carbon Collaborative, energy transition and sustainability in health care. The agenda included presentations from various speakers, including Andrey Shuvalov from Shell on energy transition and Dr. Faisal Masud from Houston Methodist Hospital on the Green ICU Initiative. The day also featured updates on the Carbon Collaborative, carbon, capture, use and storage, small landowners' initiatives, carbon forestry credits, micronuclear plant developments and community engagement efforts.

SHELL DIRK SMIT GEOLOGIC HYDROGEN SEMINAR

Dirk Smit, a part-time senior advisor at MIT and the former chief scientist at Shell, led a panel discussion on geologic hydrogen during the UH H₂ Symposium on April 17. Following the symposium, he participated in an in-depth conversation with UH faculty on April 18 at Bates Law Center to explore the possibilities and impacts of geologic hydrogen as an energy source.



GHP-ARGONNE MOU SIGNING DURING CERAWEEK

A meeting between Dick Co, director of Chain Reaction Innovations, and Valerie Mathieu, senior director at the Greater Houston Partnership (GHP), sparked discussions on accelerating Houston's decarbonization efforts toward a zero-emission goal by 2050. After initial discussions, a collaborative plan was drawn up, which led to several visits and a Memorandum of Understanding (MOU). On March 19, 2024, the MOU was recognized with a signing ceremony attended by key leaders from Argonne, GHP, Houston energy businesses and the Department of Energy, highlighting significant efforts to translate words into action. Three of Argonne's scientists have been awarded joint appointments with the University of Houston, with further plans underway to leverage Argonne's research capabilities to advance decarbonization efforts in partnership with Houston energy businesses.



CERAWEEK DAC PANEL

Joseph B. Powell, Ph.D., from the University of Houston, spoke at the S&P Global Executive Conference on March 21, 2024, for a session titled "Direct Air Capture: Moving Forward." Given its potential to capture carbon dioxide directly from the atmosphere, direct air capture (DAC) was highlighted as a crucial technology for achieving global climate goals by 2050. Powell led discussions, exploring the business case, market growth potential, cost reduction opportunities and challenges facing DAC.

INTERNATIONAL CONGRESS ON SUSTAINABILITY SCIENCE & ENGINEERING (ICOSSE '24) AND RAPID ROADMAPPING WORKSHOP

The AIChE Institute for Sustainability (IFS) and RAPID® hosted a special edition of the International Congress on Sustainability Science and Engineering (ICOSSE '24) on industrial decarbonization at the University of Houston, supporting the roadmapping efforts for the new phase of RAPID®. Participants from industry, academia, national labs and other stakeholders attended, learned, networked, presented and joined in the roadmapping efforts. This event was dedicated to advancing ambitious industrial decarbonization objectives within the U.S. fuels and chemical industries, leveraging RAPID® principles of process intensification and modularization. RAPID® has been renewed as a National Manufacturing Institute and updated its roadmap through this conference and workshop, which took place from June 3-5, 2024. The event featured invited speakers, panels and discussions focusing on decarbonization, with insights gathered to inform the first RFP of the renewed RAPID® in the second half of 2024.

SHELL UH CRAWFISH BOIL SPONSORSHIP

Over 600 attendees enjoyed a vibrant day on campus, bridging the energy sector with the Cullen College of Engineering and Technology Division and fostering connections among alumni, faculty, students and professionals through networking and entertainment. The community event was supported by Shell, a leadership committee and volunteers, raising funds for the multidisciplinary senior capstone fund aimed at improving the professional readiness of engineering and technology students. Guests enjoyed culinary delights and live music while engaging in STEM activities and exploring a student showcase featuring representatives from various student organizations.



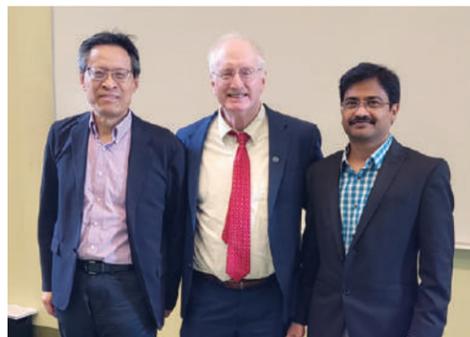
SHELL HYDROGEN VISIT TO UH

Frank Geuzebroek and others from Shell on April 12, 2024 to see results from Year-1 seed funds. Photo in front of Chemical Engineer; photo of Zhifeng Ren, Stanko Brankovic and Mike Harold's e-SMR labs.



MICHAEL WANG AND KRISHNA REDDI (ANL)

Michael Wang, the creator of the Argonne Greenhouse gas Regulated Emissions and Energy use In Transportation (GREET) model and Krishna Reddi, the developer of Hydrogen Delivery Scenario Analysis Model (HDSAM), gave introductions and tutorials on Life Cycle and Techno-economic Analysis in energy and transportation systems. Wang presented on the GREET mode, while Reddi discussed the HDSAM model. The event was open to University of Houston students, faculty and industry partners, aiming to facilitate discussions about potential partnerships with Argonne National Labs.



CINDY JIA (ING) AND ERIC MCFARLAND (UCSB)

Cindy Jia, director of sustainable finance at ING, delivered a presentation on financing the energy transition on Thursday, April 18. Next, Eric McFarland, from UC Santa Barbara, discussed hydrogen generation using methane pyrolysis and introduced his startup, CZero. These sessions were available to University of Houston students, faculty and industry partners.



UH PRESENCE IN SHELL, BANGALORE

Shell welcomed the University of Houston to the Shell Technology Centre in Bangalore, and Renu Khator, UHS chancellor and UH president, shared her remarkable journey. Insights were also shared from Ramanan Krishnamoorti, vice president of energy and innovation, and Suresh Khator, associate dean for graduate programs and computing facilities.

Joe Powell represented UH Energy as a partner at Shell's AI conference, discussing the role of AI in discovering new materials.

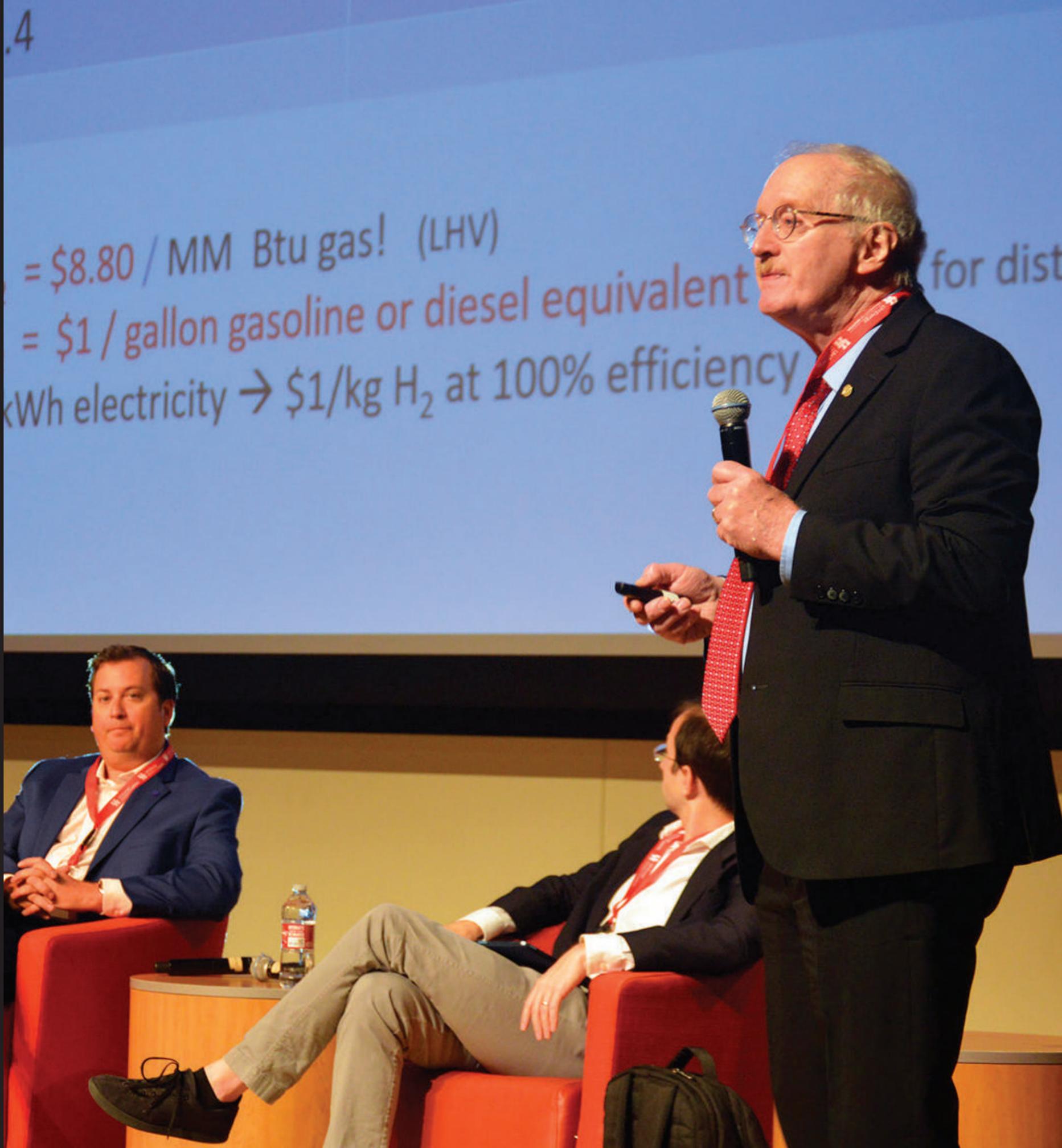


SHELL PRESENCE AT UH

Oscar Herdocia from Shell was a speaker at Energy 101 in September. Energy 101 is an opportunity for students to learn about the Energy Coalition, energy fundamentals and the industry's current state, including an exploration of the themes, topics and events that the Energy Coalition covered throughout the 23-24 academic year."

Cynthis Ginestra from Shell was a speaker at UH Energy Research Day in August 2023. Th event showcased innovative energy-related research projects from graduate students and research scholars across all academic disciplines. The event is co-hosted by the Division of Research, Division of Energy and Innovation and the Graduate School at UH. VP of Energy Transition Andrey Shuvalov and Environmental, Social, and Governance Manager Helmut Brenner also presented at the Energy Night.





UH ENERGY AND UH ETI DRIVE CRITICAL CONVERSATION ABOUT HYDROGEN'S POTENTIAL

UH Energy and UH ETI recently organized a symposium called "The Gulf Coast Hydrogen Ecosystem: Opportunities and Solutions," which brought together more than 400 experts from industry, academia, government and the community. Among attendees was Steven Libbrecht, interim executive director of the Hydrogen Council.

The symposium focused on developing a successful hydrogen ecosystem in the Gulf Coast region by exploring the opportunities and challenges of integrating hydrogen into the energy landscape.

The Gulf Coast, home to the world's largest concentration of existing hydrogen production and assets, several universities and the DOE HyVelocity Hydrogen Hub and other large-scale efforts, is at the center of a burgeoning global clean hydrogen ecosystem.

"The energy transition is a complex interdependent challenge," UH Vice President for Energy and Innovation Ramanan Krishnamoorti said. "Hydrogen is a significant component of the solutions that the energy transition requires. We must find ways to engage in a detailed discussion on all the key challenges and opportunities in driving the use of hydrogen especially along the Gulf Coast to ensure that we remain the energy capital of the world."

Key takeaways from the event:

1. Holistic Approach Needed:

- Clean hydrogen deployment is accelerating but falls short of global net-zero targets by 2050.
- Emphasis is needed on demand, distribution and research to commercialize hydrogen in mobility, energy export and green ammonia sectors.
- Emissions reduction requires verification and certification of carbon intensity for hydrogen sources.
- Technology advancements are crucial, including leak detection, pipeline repurposing and efficient electrolyzers.

2. Community Engagement is Vital:

- Bridging the gap between industry and community is essential.
- Effective community engagement adds value to business models and fosters social impact.
- Strategies are required to engage with impacted communities and address workforce development, which is a critical need.

3. Safety is Paramount:

- Hydrogen safety is crucial for market protection and public confidence
- Expansion requires harmonized safety regulations at federal and state levels.

EDUCATIONAL PROGRAMS

Educational Programs



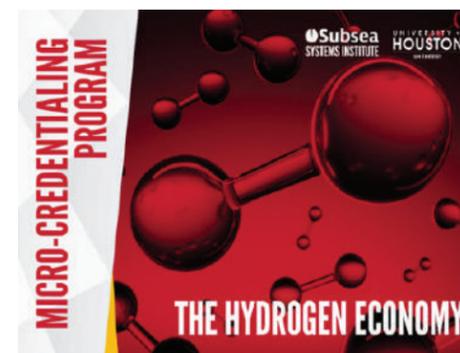
HYDROGEN PIPELINES: Facts, Opportunities & Solutions

This program will offer a broad overview of the history of hydrogen and its pivotal role in the need for decarbonization, including the different production methods and uses of hydrogen. Specifically, the need for hydrogen pipelines and the differences between hydrogen and natural gas pipelines, will be covered. Additionally, this course will explore the embrittling effects of gaseous hydrogen and aspects such as risk management, the requirements for a holistic hydrogen conversion and integrity management process and more.



ESG IN ENERGY PROGRAM

The energy industry faces challenges in the ESG area that include increased public expectations and actions amidst a global pandemic, growing environmental and climate actions, worker and community health and safety acknowledgement of basic human rights for all and more principled corporate governance. For this reason, UH Energy, at the University of Houston, has developed the ESG in Energy Program, to equip current and aspiring professionals in the energy industry to further their skills in this ever-evolving field.



THE HYDROGEN ECONOMY PROGRAM

This interactive, online educational program shares insights into the technology, economics, policy and business drivers and barriers for hydrogen, both in the short term and in the long term. It examines hydrogen's production, transportation, safety, use and commercial opportunities. It also includes a capstone project to consolidate the learnings and to better equip you — the rising energy professional — with skills, knowledge and expertise to thrive in the Hydrogen Economy.

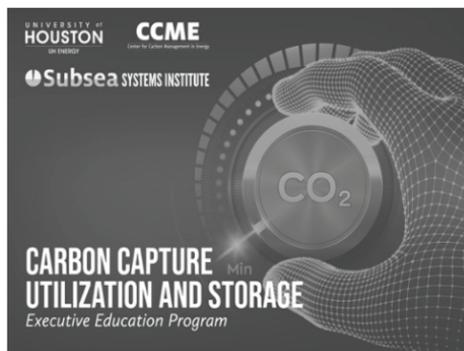
The material developed for this course was partially paid for with federal funding from the Department of the Treasury through the state of Texas under the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act). The statements, findings, conclusions and recommendations are those of the author(s) and do not necessarily reflect the views of the state of Texas or the Department of the Treasury



SUSTAINABLE ENERGY DEVELOPMENT PROGRAM

Online-only session opening: spring 2024 The world of energy is changing. Society today has a few key fundamental expectations for our energy future: It must be affordable, secure and reliable and environmentally responsible — all of which make up the Energy Trilemma. Advancing solutions that simultaneously satisfy all elements of this complex combination are the foundation and essence of the Sustainable Energy Development Program developed by UH Energy.

This online program is designed to provide essential skills, knowledge, and expertise to emerging energy professionals, enabling them to address the significant energy challenges facing our world. It is funded by the Department of the Treasury through the state of Texas under the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE). The opinions expressed in the program are solely those of the author(s) and may not reflect the views of the state of Texas or the Department of the Treasury.



CCUS EXECUTIVE EDUCATION PROGRAM

Carbon capture, utilization and storage (CCUS) is recognized by the International Energy Agency and the U.S. Department of Energy as a necessity for the de-carbonization of our society. Markets such as oil and gas, petrochemicals, electric power, hydrogen and the circular plastics economy all ride on the shoulders of the broad commercial deployment of CCUS. If you are working in industry or if energy is a significant part of your activities and interests, this course is a must. Participants will understand the technology and economics of the value proposition impacts — as well as the challenges to overcome.

The material developed for this course was partially paid for with federal funding from the Department of the Treasury through the state of Texas under the Resources and Ecosystems Sustainability, Tourist Opportunities and Revived Economies of the Gulf Coast States Act of 2012 (RESTORE Act). The opinions expressed in the program are solely those of the author(s) and may not reflect the views of the state of Texas or the Department of the Treasury.

PRESS AND NEWS



Press and News

UH'S ENERGY TRANSITION INSTITUTE LEADER

APPOINTED TO DEPARTMENT
OF ENERGY COMMITTEE

Joe Powell, founding executive director of the Energy Transition Institute at the University of Houston, has been appointed by U.S. Energy Secretary Jennifer Granholm to join the U.S. Department of Energy's Industrial Technology Innovation Advisory Committee (ITIAC). This 18-member committee aims to accelerate the advancement of technologies to reduce carbon emissions in the American industrial sector, which currently contributes one-third of the energy-related greenhouse gas emissions in the U.S. Powell, a distinguished member of the National Academy of Engineering and former chief scientist at Shell, brings 36 years of industry expertise to the committee. Its objectives include evaluating the Department of Energy's efforts to reduce carbonization and advance initiatives such as the Clean Fuels & Products Shot™ and the Industrial Heat Shot™.

The Energy Transition Institute at UH, established with support from Shell, focuses on hydrogen, carbon management and circular plastics, aiming to position Houston as the global "Energy Transition Capital." The Energy Scholars program, founded in 2023, offers UH undergraduate students the chance to participate in energy research projects under the guidance of UH faculty. This initiative creates a collaborative environment for students from various disciplines — including engineering, architecture, writing, chemistry and economics — to explore and advance energy-related discussions and ideas at the highest academic levels.

At the 2024 UH Undergraduate Research Day, hosted by the Office of Undergraduate Research and Major Awards and the Honors College, a special section highlighted innovative energy projects by Energy Scholars. These students were among over 360 UH participants presenting research across multiple disciplines, offering promising solutions to current challenges. Doug Erwing, director of UH Energy Leaders, emphasized that the diverse research within the Energy Scholars program allows students to interact with senior professionals, broadening their perspectives and uncovering numerous opportunities.



BUILDINGS & FACILITIES

Buildings & Facilities

INNOVATION HUB

The UH Energy Transition Institute will operate out of the Innovation Hub building, which will open in 2025. This 75,000-square-foot building will be located in the center of campus and will house innovation and entrepreneurship programs. On the first floor, there will be a maker's space for collaborative student research. The third floor of the building is dedicated to the Energy Transition Institute.



CORE FACILITIES

Because ETI researchers will be multidisciplinary, their labs will be located in different parts of the University of Houston campus. In addition to the equipment and resources that will be dedicated to individual faculty labs, UH has committed \$22 million to purchase equipment for new core facilities in five national priority research areas: Advanced Manufacturing, Advanced Materials, Imaging and Scanning, Data and Sensing and Automation and Autonomy.

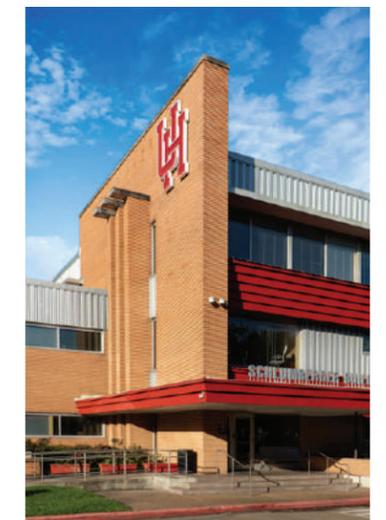
The investment will provide equipment for our research community to compete effectively for research awards and excel at delivering the goals and objectives of their research projects. Core facilities optimize investments in equipment and make them available to the UH research community at competitive rates.

UH TECHNOLOGY BRIDGE

The UH Technology Bridge is adjacent to the UH campus, providing a rich synergy between University classrooms and labs, the developing Innovation Hub and the innovation community at the park. The proximity of these components within the University community makes UH a powerhouse for innovation, providing a support system for students, faculty, industrial partners and startups alike.

The University of Houston secured nearly \$3 million in federal funding for infrastructure improvements at its Technology Bridge in 2023. The majority of the award will benefit the UH Industry and International Innovation Hub, a planned center for industry partner engagement, complete with an investor and mentoring studio and innovation event space. It will also increase onsite industry and startup capacity, establish workforce development training rooms and provide a satellite office for UH's Small Business Development Center.

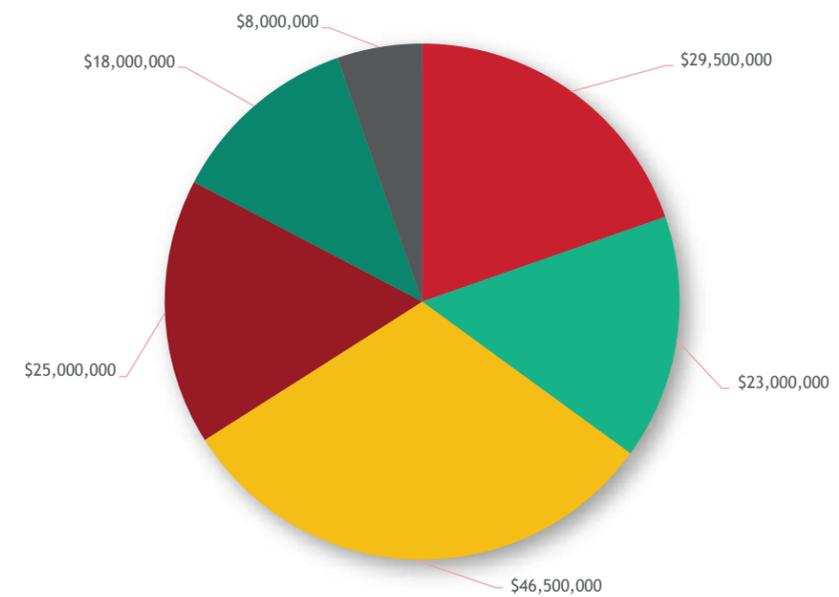
The remaining funds will establish The Deck Innovation and Coworking Center. Eight new private offices will be added, increasing lease revenue by a projected 150%. There will also be additional lockers available for startups needing a physical address, new sound suppression systems and improved acoustics. The project is expected to increase capacity by more than 20 companies.



ETI FUNDING MODELS

ETI Funding Models

FUNDING GOAL OF \$150 MILLION BY 2031



- **FACULTY \$29.5M**
 Aspire Chairs
 Aspire Professorships
 Other Faculty Support
 Professors of Practice
- **STUDENTS \$23M**
 Graduate Fellowships
 Post Docs
 Undergraduate Research Projects
- **RESEARCH \$46.5M**
 Faculty Seed Grants (Multi-Year)
- **PROGRAMMING \$25M**
 Innovation Competition
 Mentorship/Experiential Learning
 Programmatic Sponsorships
- **FACILITIES \$18M**
 Lab Remodels/Enhancement
 Core Facility Equipment Funding
- **OPERATIONS \$8M**
 Start-Up Funds
 Events and Communications
 Support Staff





THANK YOU

FOR MORE INFORMATION:

Rabbiya Nagra

Assistant Director, Corporate Relations
Division of Advancement & Alumni
University of Houston

713.743.6340
rknagra@central.uh.edu

Debalina Sengupta

Assistant Vice President, Energy Transition Institute
Chief Operating Officer
Division of Energy and Innovation
University of Houston

713.743.6258
dsengupt@central.uh.edu



UNIVERSITY OF **HOUSTON**