Virginia Tech Awarded $1.3 Million Grant to Spearhead Hydrogen Innovation Hub in Southwest Virginia

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Virginia Tech has secured a $1.3 million grant from the Appalachian Regional Commission (ARC) to lead groundbreaking research focused on converting natural gas into cleaner energy solutions in Southwest Virginia. The initiative aims to establish a premier hydrogen innovation hub, a collaborative network of facilities, industries, and partners, dedicated to the efficient and economically viable production of cleaner products from natural gas.

This strategic project seeks to revolutionize the energy and hydrogen production sectors on a significant scale by leveraging the region's abundant natural gas resources, including reserves in the Marcellus Shale and the Appalachian Basin. The focus will be on producing turquoise hydrogen, a process involving the pyrolysis of natural gas.

"We are leveraging natural gas, a relatively cleaner fossil fuel, to produce hydrogen, which serves as both a clean energy carrier and a crucial feedstock for numerous large-scale industrial manufacturing processes," stated Sheima Khatib, associate professor of chemical engineering and a lead researcher on the project.

The project's core objectives include establishing a leading hydrogen innovation hub in Virginia, specifically advancing turquoise hydrogen production through catalytic methane decomposition. It also aims to foster regional partnerships to drive economic development, diversify the economic base, and stimulate entrepreneurial activities. Furthermore, the initiative will focus on developing a highly skilled workforce prepared for the chemical manufacturing job market and supporting communities in leveraging

their natural and cultural assets to boost local economies. Strengthening local and regional leadership skills to enhance collaboration within the Appalachian region of Virginia is another key goal.

“Current industrial methods for hydrogen production often yield hydrogen mixed with other gases, such as carbon dioxide, necessitating costly and energy-intensive separation processes,” explained Khatib. “Our approach directly addresses this issue, representing a significant step forward in producing clean hydrogen from an existing and plentiful resource.”

Khatib’s research centers on catalytic methane decomposition, a process that converts methane, the primary component of natural gas, into hydrogen and solid carbon using a catalyst. This method offers a direct, carbon dioxide-free pathway to hydrogen production. The resulting hydrogen is vital for fuel cells and various industrial applications, while the solid carbon has potential in advanced materials. The research team’s efforts will focus on optimizing catalyst design and process efficiency to enhance the scalability and economic viability of this clean hydrogen production method.

By transforming a potent greenhouse gas into less harmful, high-value products at the source, the research team aims to mitigate methane and carbon dioxide emissions, converting an environmental challenge into an economic opportunity.

“This project is poised to contribute significantly to economic growth, community engagement, the adoption of sustainable energy solutions, and the bolstering of both regional and national security,” Khatib emphasized.

To achieve these ambitious goals, Khatib has forged partnerships with academic and industrial leaders, including Amy Price Azano, professor of rural education and adolescent literacy and director of the Center for Rural Education at Virginia Tech; Wilson Shafer, assistant professor of chemistry at Asbury University; and Robert Hart, R&D leader at Shepherd Chemical Company.

Robert Hart will lead the business aspects of the initiative, collaborating with Virginia Tech to conduct thorough market, cost, and feasibility analyses to assess the economic potential of the new technology. By establishing collaborations with industries within the Appalachian region, the team will facilitate technology transfer and provide valuable feedback through comprehensive techno-economic analyses, bridging the gap between laboratory research and practical implementation.

“Carbon doesn’t belong in the atmosphere; it belongs in high-value, durable materials that benefit people’s lives,” commented Hart. “Catalytic methane decomposition to produce hydrogen and carbon required a breakthrough to achieve this, and Professor Khatib’s team appears to have found a promising one. We are excited to partner on this project to explore its potential for scale-up into a successful business with significant societal impact.”

Amy Price Azano will lead the workforce development component of the project, focusing on enhancing energy literacy and creating new skills and training opportunities within rural communities. This includes developing K-12 educational modules focused on sustainable energy technologies and designing professional development programs for teachers to educate students on emerging technologies like turquoise hydrogen, ensuring alignment with local educational resources and community needs.

“This grant offers a meaningful opportunity to support teachers in developing place-based lessons that strengthen student learning and rural sustainability,” stated Azano. “Every community is strengthened when rural areas thrive.”