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OU post-doctoral researcher Wesley Honeycutt uses a portable sensing device to demonstrate one method of detecting methane leaks.

Pinpointing the Problem

AN OU SENSING SYSTEM WILL IDENTIFY THE COSTLY DANGERS OF METHANE LEAKS VIA LAND, DRONE AND CAR.

By Chip Minty

BINBIN WENG AND an interdisciplinary cadre of researchers are leading the way to reducing methane emissions from oil and gas fields in Oklahoma, across the nation and around the world.

Funded through federal and corporate sources, the $8.5 million research project could deliver technology to revolutionize the way energy producers monitor the emission of methane, one of the world's most potent greenhouse gases.

"This could be very beneficial in two ways," says Weng, an assistant professor of electrical and computer engineering who was recently named OU's Gerald Tuma Presidential Professor. "From a community standpoint, we can find leakage earlier and address it, reducing the environmental impact. Companies will benefit economically and more easily comply with federal policy."

Weng and OU research colleagues from meteorology and multiple engineering disciplines are developing technology that could continuously monitor large oil and gas field areas, allowing producers to check for leaks more quickly.

Their proving ground is a 10-square-mile area within the Anadarko Basin in western Oklahoma. A prototype of the instrument—designed by Weng's team and built on stationary posts placed throughout production sites—was installed at a Devon Energy-owned location in February. Hundreds of the detection devices will be deployed in phases over the next two to three years to form a ground-based, distributed-sensing network for monitoring methane.

To complement the sensor network, the team will add an ultra-high sensitive mobile platform using an electric vehicle supplied by partner Flogistix. It features the creation of an integrated, laser-based sensing instrument and gas-imaging camera. Similar sensor technology will be built into drones for a future U.S. Department of Energy project undertaken by Weng's team.

After carbon dioxide, methane is the most prominent greenhouse gas, and oil production facilities are the top emission source, according to the U.S. Environmental Protection Agency.

The EPA has worked for many years with energy producers to reduce the emission of methane, also known as natural gas. But the task of monitoring emissions from hundreds of thousands of oil and natural gas wells has been a formidable challenge.

Weng says the most prominent method of monitoring has been the use of infrared cameras operated by technicians on the ground or from the air. But that is time-consuming, labor-intensive and inefficient. Because there are so many production sites, there is no way to monitor all of them in a timely way. Major leaks can continue for days, weeks or months without detection.

Not only are leaks bad for the environment—a concern for energy companies that work to be good stewards, Weng says—but they're detrimental from an economic standpoint.

Likewise, the potential for methane discharges from

oil- and gas-production sites is significant, Weng says. Pressure that builds from methane and other volatile organic compounds can be hazardous and disrupt oil production. Energy companies burn off excess gas through flaring. But sometimes, flares fail to ignite, leaving methane plumes to spew into the atmosphere unabated. Leaks can also occur from faulty pressure valves, as well as leaky pipes, tank hatches and other anomalies.

For energy producers, there is more at stake than lost profits. The Inflation Reduction Act, which Congress passed in 2022, contains a new regimen of heavy fines the EPA can levy against energy producers for emitting large volumes of methane. Weng says penalties could range into the millions of dollars for "super emitters."

The project he and his team are working on is the result of OU's "Big Idea Challenge" program, launched several years ago by Vice President of Research and Partnerships Tómas Díaz de la Rubia. It encourages the formation of transdisciplinary research teams that focus on global challenges. Since 2020, Weng's team has been formulating its project plan and working to obtain federal and industry funding.

"We have about 20 researchers on the team, and everyone is working cohesively," he says. "We are developing hardware, firmware, climate models and an integrated data visualization system. Also, we're in close collaboration with multiple companies, such as Devon Energy, Coterra Energy, EnLink Midstream, Flogistix, the Cimarron Electric Cooperative, AT&T and Senseair."

Weng says the methane measurement project will create training opportunities for communities that are underrepresented in STEM fields. The team is designing an internship program focused on serving the economic needs of Oklahoma's Native American nations and underserved rural communities.

"This work is important for the state, the economy and quality of life for the people of Oklahoma and across the country, as well," says David Ebert, associate vice president for research and partnerships. He adds that the project illustrates OU's expertise in both sensing technologies and regional climate modeling research.

"It has placed Oklahoma on the map when it comes to methane monitoring and energy production," Ebert says. "This is a win-win for companies in Oklahoma."

Chip Minty is a Norman-based writer and the principal of Minty Communications, LLC.

Binbin Weng with his team's methane-sensing platform, as featured on an electric vehicle. Sensing tools will soon be built onto drones like that flying overhead.

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