New tool calculates economic costs of methane leak detection

April 20 2016, by Ker Than

Infrared footage of methane gas leak in Southern California's Aliso Canyon neighborhood. Credit: Environmental Defense Fund

A new "virtual gas field simulator" developed by Stanford scientists aims to help companies and government agencies weigh the economic costs and benefits of different methane leak detection technologies and pick the best one for a given situation.

The tool, detailed online in the journal *Environmental Science & Technology*, examines the cost associated with implementing four different detection technologies and calculates the economic benefit from the sale of additional gas saved.

"This tool will help both businesses and government to compare various technologies for mitigating leakage and detecting leaks from a very common standpoint," said study coauthor Arvind Ravikumar, a postdoctoral researcher at Stanford School of Earth, Energy & Environmental Sciences.

In recent years, there has been a growing interest in monitoring and stopping leaks at natural gas wells because of methane's potential for accelerating climate change. The primary component of natural gas, methane is a potent greenhouse gas that is up to 80 times more effective at absorbing heat than carbon dioxide.

The massive natural gas leak near Los Angeles earlier this year—which released more than 97,000 tons of methane into the air—drew national attention and prompted California Governor Jerry Brown to issue a state of emergency. Methane leaks can also pose a hazard to human safety, as demonstrated by multiple recent explosions in New York City resulting from natural gas leaks in aging pipes.

At present, companies are not required to find and repair leaky gas wells, but the U.S. Environmental Protection Agency (EPA) is developing federal guidelines to address the nation's emissions.

Ravikumar and his colleagues hope that their tool will help energy companies determine on a case-by-case basis whether or not a leak detection and repair program make economic sense. For instance, a company that has a very large facility might opt for a technique that is fast but less sensitive. "Right now, the only way that a company can figure out if something works is to try it at their facilities, and this problem is compounded by the fact that companies don't often share their test results," Ravikumar said. "Our tool aims to both streamline and standardize the technology selection process."

FEAST

Dubbed the Fugitive Emissions Abatement Simulation Toolkit, or FEAST, the tool looks at four detection technologies that vary widely in their costs of equipment and labor: distributed detectors (DD), manual infrared (MIR) detection, and flame-ionization detection (FID), and automated infrared (AIR) detection, which is essentially a drone-mounted infrared camera.

"We are taking these four technologies and simulating how much they will cost to operate and how much gas they will save over the course of 10 years," said study coauthor Adam Brandt, an assistant professor of Energy Resources Engineering at Stanford.

Using the tool, the team showed that three of the technologies (AIR, MIR, and DD) save enough gas that a company could still turn a profit of up to $12,000 per well on average. However, FID, the most traditional method of detection and very time intensive, resulted in a net cost to a company, even though it has the potential to save the most gas.

The study also found that selectively targeting the small fraction of so-called "super-emitters" could help mitigate methane leakage at much lower costs than repairing every leak. Super-emitters, which typically spew 10 to 100 times more methane than average, only make up less than 1 percent of the total number of leaks in a field.

"We found that by tuning your methods to detect only the largest leaks, you can eliminate over 80 percent of methane being emitted irrespective of the technology that you're using," Ravikumar said.

Costly, But Effective

Another important finding from the study is that there's a distinction between low-cost technology and low-cost detection. For example, a drone-mounted infrared camera can cost as much as $200,000 to get up and running, but FEAST shows that it is the single-most cost-effective way to detect leaks. "A single drone-mounted camera can cover large areas of gas fields very efficiently in a short time," said Brandt, who is also a Center Fellow at Stanford's Precourt Institute for Energy and an affiliate at the Stanford Woods Institute for the Environment.

In contrast, the equipment cost for FID is only about $35,000, but employing the technology is an extremely slow process that requires hundreds of man-hours for every gas field.

"Our study shows that it is okay to use expensive instruments as long as leak detection can be performed rapidly," Ravikumar said.

More information: Chandler E. Kemp et al. Comparing Natural Gas Leakage Detection Technologies Using an Open-Source "Virtual Gas Field" Simulator, *Environmental Science & Technology* (2016). DOI: 10.1021/acs.est.5b06068

Provided by Stanford University