

# New Tools Pinpoint Natural Gas Leaks, Maximizing a Fuel's Green Qualities

By MATTHEW L. WALD

WASHINGTON — Natural gas is hailed as green and safe, but its environmental benefits and ability to temper climate change are reduced by its tendency to leak into the air undetected. Now, laser technology, some of it borrowed from the telecommunications industry, is giving engineers and scientists crucial new tools to measure leaks and track them to their source.

Pacific Gas & Electric, which operates in northern and central California, has begun training employees to use the technology, a portable gas detector that was recently used in a car driven 785 miles through the streets of Boston.

Natural gas escapes into the atmosphere from two basic sources: natural ones, like swamps and marshes, and human activity, like leaking gas wells and pipelines. The boom in natural gas production, including hydraulic fracturing, has raised concerns about a subsequent boom in leaks, although how much gas escapes remains a mystery. The Environmental Protection Agency has been working on the question for years and "is still operating with guesses," said John C. Bosch, who specialized in that issue before he retired from that agency four years ago.

But whether from man-made or natural causes, methane — the main component in natural gas — is a major contributor to global warming when released in the atmosphere. According to the E.P.A., over a 100-year period, a pound of methane is 25 times more powerful than carbon dioxide in warming the climate. It can also be dangerous: In 2010, one of Pacific Gas & Electric's pipelines leaked in San Bruno, south of San Francisco, and the ensuing explosion killed eight people.

"Leaking methane is becoming increasingly relevant from a greenhouse gas standpoint," said Joseph T. Hodges, a scientist at the National Institute of Standards and Technology, part of the Commerce Department, who helped de-

velop the laser technology used in the new portable gas detector.

The detector, built by Picarro, a manufacturer of scientific instruments that has recently moved into the field of portable methane detection, is able to determine whether the gas originated from wells or was produced by the bacteria in swamps, landfills and sewers. Distinguishing between the two can prevent industrial polluters from plausibly denying that they have leaks.

The system was demonstrated in 2011, when researchers bolted it in the trunk of a car that drove through the streets of Boston, a city with a labyrinth of aging underground gas pipelines. In a peer-reviewed scientific journal last year, the researchers said they had found 3,356 leaks of methane, and some with concentrations 15 times normal methane levels in the atmosphere.

Robert B. Jackson, a professor of global environmental change at Duke and an author of the paper, said Picarro was "pushing the envelope on portability."

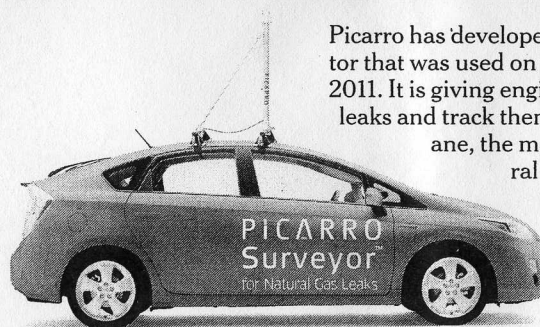
The Picarro detector works like this: An inlet tube takes in air samples, which are sent to a chamber in the trunk of the car. The chamber, about the size of a drum major's baton with mirrors at either end, bounces a laser back and forth between the two mirrors thousands of times, like a fold-up yardstick. The laser's path is ultimately several miles long and so is able to precisely measure concentrations of methane in the range of parts per billion.

An anemometer, an instrument for measuring wind speed and direction, is mounted on top of the car, as is a GPS device. In some models, an inlet pipe samples air from various elevations. The system uses an onboard computer to turn the readings into a three-dimensional model of a gas plume — a funnel-shaped flow of contamination — and calculates the location and size of the origin. Methane molecules incorporate a carbon atom of two different types, one more commonly found in gas from wells and the other in gas from landfills



PICARRO

Picarro has developed a portable gas detector that was used on the streets of Boston in 2011. It is giving engineers a way to measure leaks and track them to their source. Methane, the main component in natural gas, is a major contributor to global warming.



and sewers. Studying the ratio, the instrument can say where the gas came from.

Michael R. Woelk, president and chief executive of Picarro, said the advantage of the detector was that it could be used on public roads to locate leaks on private property.

Pacific Gas & Electric has bought six Picarro systems.

"I see it as a game-changer," said Nick Stavropoulos, the utility's executive vice president for gas operations. "It's amazing how much more effective it is in finding gas leaks on our system than traditional technology." Previously when gas was detected, he said, the utility had to stay on the site until it was determined by a distant laboratory whether the gas was from its pipes or a land-

fill. Now that determination can be made almost immediately.

Other companies use different techniques for gas detection. Physical Sciences of Andover, Mass., has an instrument like a lantern that projects a laser beam and measures what bounces back. About 2,000 are in use worldwide, according to Michael B. Frish, a manager there.

LI-COR Bio-Sciences, of Lincoln, Neb., makes an "open path" model in which air flows naturally through a chamber. The company has deployed instruments at several landfills to measure their emissions, said Dayle K. McDermitt, vice president for research and development for environmental products. Measurement technology is advancing, he said, but modeling plumes is "still a work in progress."

The Environmental Protection Agency, which has a history of requiring new controls as technology improves, intermittently hints that it might regulate methane emissions. It already counts on the presence of large amounts of methane to help spot smaller quantities of toxic gases that are currently regulated. Remote detection is outside the norm for the agency, said Eben D. Thoma, an E.P.A. researcher. More often the agency requires measurements at known sources, like tailpipes and smokestacks. Measuring plumes is easiest in wide-open spaces, and harder in "urban canyons" and wooded areas, where the plume is distorted, he said.

Mr. Bosch, the retired E.P.A. official, who now consults for Picarro, said that the agency had had more success in reducing emissions from smokestacks and vent pipes than from "fugitive" sources like leaky pipes and valves.

But Mr. Woelk, of Picarro, said his technology could locate leaks and prioritize them, and that the majority of the gas was generally escaping from a small fraction of the sources.

"Natural gas is the new green energy, supposedly," he said, but finding and fixing the leaks would make it greener.