Will lasers drill oil wells in 2050? Will there even be wells?

Innovation fuels new drilling technology

By David Hunn | October 26, 2016 | Updated: November 3, 2016 3:10pm

Photo: Courtesy Of The University Of Texas

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Researchers at the University of TexasÂs Advanced Energy Consortium tested this summer the use of electromagnetic injection materials to illuminate hydraulic fracture patterns in an oil well at a university ... more

The future of oil and gas drilling won't look anything like the present.

Industry scientists imagine lasers, not rotating drill bits, cutting well holes. They envision computers so small they can be injected underground like grains of sand to log well pressure and chemical makeup in real time. They contemplate, one day, the end of oil drilling and the start of oil mining, with robots sent down shafts, two miles deep, to recover oil and gas.

In 50 years, today's cutting-edge drilling technique, hydraulic fracturing, "could be rendered quaint and obsolete," said Jim Krane, an energy fellow at Rice University. "Energy technology advances pretty quickly."

Since the first oil rush in Pennsylvania more than 150 years, oil and gas companies have survived and prospered through innovation, finding ways to extract oil and gas from the most inhospitable and challenging places, from Arctic tundra to open seas to previously impenetrable shale rock. Over the decades, the industry has defied predictions of peak oil, dwindling supplies and dire shortages, not only discovering new reserves, but also new ways to exploit them.

Come 2066, however, the greatest challenge facing the industry may not be technological, but rather political as the quickening pace of climate change leads to stricter limits on greenhouse gas emissions, a product of burning fossil fuels - and possibly a world without oil.

MORE INFORMATION

The future of oil and gas drilling?

Smart particles – Computers the size of sand grains injected into wells to monitor, in real time, pressure, temperature and chemical make-up.

Lasers – Powerful, concentrated lasers replace rotating drill bits to "cut" wells.

Carbon dioxide – A semi-liquid form of carbon dioxide replaces fracking fluid while helping to slow global warming.

Subsurface mining – Robot miners pulverize shale, delivering liquids to the surface and leaving rock in the mine.

International leaders have begun to agree on cutting carbon dioxide and other greenhouse gases, most recently with the groundbreaking Paris accords. Meanwhile, solar panel prices are dropping dramatically. Wind generation is increasingly competitive with traditional power plants. And electric vehicles can drive much farther on a single charge that ever before.

"We could actually see a major pivot away from oil and gas in the next decade," said Dominic Boyer, an anthropology professor at Rice University who studies the relationship among humans, energy and the environment.

But most analysts don't expect fossil fuels to disappear anytime soon. The oil giant BP estimates the world has 1.7 trillion barrels of oil in proven reserves, enough for 50 years of consumption at current rates. The world's population is expected to grow by half, to 10.5 billion, by 2050. And with car sales and energy use rising exponentially in developing countries like China and India, industry leaders say demand for petroleum has no peak in sight.

"The reality is it's going to be a long, slow transition away from liquid fuels," said Scott Tinker, director of the University of Texas Bureau of Economic Geology. "And I mean long."

For more than a century, companies madly hunted for huge reservoirs of oil, drilled a lot of dry holes, and found a lot of gushers. Today, we know oil is not only in isolated subterranean pools, but also boxed up, molecule by molecule, in shale rock underground all around us.

To get those molecules of gas and oil out of the rock, companies drill thousands of feet deep, and pump water into the wells with such force the rock cracks, opening up passageways that release the oil and gas from tiny pores. This process is known as hydraulic fracturing, or fracking.

Fracking, combined with horizontal drilling, spurred a revolution in oil production, transforming the United States into the world's largest oil producer, shifting the energy balance of power from the Middle East, and reshaping global geopolitics.

Unlike traditional drilling, which bores wells straight down, horizontal drilling cuts across shale formations, following the deposits of oil and gas and dramatically increasing output. The United States last year produced 9.4 million barrels of oil a day, according to the Department of Energy, just below the record reached in 1970.

Engineers, scientists and researchers believe they can get ever more oil from the ground by constantly working to increase drilling efficiency. Exploration and production companies currently recover less than 10 percent of the gas trapped in shale and less than 5 percent of the oil.

The yield is so low in large part because as fracturing fluid leaves the rock, the cracks close. Companies add sand, called "proppant," to keep the cracks open and let more oil and gas escape.

A group of energy companies and academics at UT's Bureau of Economic Geology in Austin are now pioneering a "smart particle" that drillers can inject down well with the sand, said Tinker, who leads the consortium. The computer chip, 1 cubic millimeter, or about the size of a large grain of sand, is designed to run on its own power, withstand heat and pressure, and send data back to the surface.

If pumped into wells with proppant, those chips could read pressure, and tell drillers they need to pump in more fluid to drive out the oil and gas, for instance. Or they could read the chemical makeup of the liquids underground and tell drillers in exactly which pockets hold oil, and which don't.

That's just the beginning, Tinker said. Laser technology is quickly advancing - the

devices are growing more powerful, more concentrated and more portable. Lasers may soon be large enough and portable enough to "dig" the wells of the future, melting away the rock and earth.

Instead of using water to fracture rock, companies could use carbon dioxide. Drillers now pump water, sand and chemicals down hole at pressures at times surpassing 10,000 pounds per square inch - more than 250 times the pressure inside a car tire. But carbon dioxide, Tinker said, could be just as or more effective than water.

The gas, when warmed and pressurized, becomes something between a gas and a liquid. When pumped into wells, it expands to fill the hole, and yet has the density of a liquid - a perfect combination for fracking. Better yet, the well would eventually be cemented and capped, capturing the greenhouse gas underground and preventing it from rising into the atmosphere.

And there may come a time, Tinker said, when wells won't be needed at all.

Coal mines now tunnel sometimes thousands of feet below ground, build mines 100 feet across, or more, and, with trucks and heavy machinery, scrape out the minerals. Oil drilling could adopt a similar model, and shift to true subsurface mining, Tinker said. Remote-controlled robots could dig out earth, shale, oil and all, pulverize the rock underground, deliver the liquids to the surface and leave the shale in the mine.

"It's not far away," Tinker said.

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