



RENEWABLE ENERGY: Oil industry waste could be geothermal treasure (05/20/2010)

Phil Taylor, E&E reporter

For more than a century, oilfield operators have viewed wastewater as a costly byproduct of the drilling process, a nuisance at best and an environmental liability at worst.

But with the advancement of new technologies, and a boost in funding from the federal government, geothermal firms are exploring ways to turn hot oilfield brine into carbon-free renewable electricity.

Universities, research centers and several startups are planning to install low-temperature geothermal units that could extend the lives of thousands of aging or abandoned oil wells while offsetting the need for polluting fossil fuels.

"We could replace the use of an enormous amount of fossils fuels if this proves to be economical," said Will Gosnold, a professor at the University of North Dakota who is leading a \$3.5 million study to assess the use of oilfield wastewater to power drilling operations in the state.

Each barrel of oil that is pumped from the ground generates about 10 barrels of water, according to Energy Department estimates.

The water -- typically 190 degrees Fahrenheit or greater -- can be separated from the oil and used to heat a secondary, organic fluid with a lower boiling point. Steam is produced to drive a turbine that generates electricity. Wastewater can be treated and released into surface waters or reinjected into the ground.

The electricity produced is typically less than 1 megawatt and is considered small compared to commercial geothermal plants. But Gosnold estimates as many as 1,000 wells in the state could be used to co-produce electricity, much of which could be used to power drilling operations in the prolific Bakken field in northwest North Dakota.

"Oil companies are very keen to this," Gosnold said yesterday at a geothermal forum hosted by DOE. "This could be a great boon for us."

The oil firm Continental Resources Inc., for example, spends about \$400,000 a month on electricity in the Bakken, Gosnold said, adding that future drilling in the state will demand an additional 500 megawatts of electricity.

North Dakota and other mid-continent states could potentially produce nearly 6,000 megawatts of electricity from oilfield wastewaters, according to a 2007 geothermal study by the Massachusetts Institute of Technology.

Hundreds of thousands of wells

The Energy Department last week announced \$20 million in new funding for research, development and demonstration projects involving unconventional geothermal technologies to harness power from low-temperature resources, including oil and gas wells.

The funding comes on top of \$21 million the department awarded in October to roll out low-temperature geothermal systems that could be deployed at hundreds of thousands of wells in the United States.

The grants were among \$338 million in stimulus funds designed to support the discovery of 30,000 megawatts of untapped geothermal potential in the West, in addition to supporting the research and development of advanced geothermal technologies.

George Alcorn, a 28-year oilman from Texas, said there are nearly 5,000 aging and abandoned oil and gas wells near the Gulf Coast region that could each produce about 1 megawatt from wastewater.

His firm, Houston-based Universal GeoPower LLC, received \$1.7 million in stimulus funds to install a pair of 250-kilowatt turbines developed by Pratt & Whitney Power Systems at two abandoned oil wells in Liberty County, Texas, on the Gulf Coast.

Alcorn said he plans to eventually acquire about 1,000 wells, many of which have fallen to state ownership after being abandoned by previous operators.

"You're taking a liability and converting it into a generating asset," said Alcorn.

Studies by Southern Methodist University have found that an estimated 37,500 oil and gas wells near the Gulf Coast could be turned into viable sources of electricity, Alcorn said.

The two wells in Liberty will produce about 20,000 barrels of water a day at about 245 degrees Fahrenheit, he said.

While many envision geothermal firms partnering with oil and gas companies on power projects, Alcorn said most oil firms in Texas are not ready to integrate geothermal technologies into their operations. Some are uncomfortable with the prospect of tampering with a functioning well, while others would rather invest in new wells that could generate higher profits, he said.

"The oil and gas industry is going to clue into this eventually," he said. "But nobody wants to be the first."

Proving the concept

In October (2008), DOE announced that it had installed the first-ever low-temperature geothermal unit in an oil field at the federally run Rocky Mountain Oilfield Testing Center in north-central Wyoming ([Greenwire](#), Oct. 6, 2009).

The unit by Ormat Technologies Inc. has produced an average of 217 kilowatts using the wastewater of eight producing oil wells, said Lyle Johnson, project engineer at the center. The unit supplies about 10 percent of the electricity needed to pump oil from the field's aging wells.

Wastewater of nearly 200 degrees Fahrenheit is drawn from the Tensleep formation about a mile underground to heat a secondary fluid, isopentane, which is air-cooled to conserve water, he said. The center is planning to install a second higher-efficiency unit that will tap even hotter water from the deeper Madison formation, he said.

The geothermal units are commercially available and are already in use at wells drilled to tap geothermal reservoirs in Austria, northern Nevada and the Chena Hot Springs in Alaska, and proponents say their simple design could help keep manufacturing and assembly costs low.

"We actually put it together in less than two weeks," he said of the organic rankine cycle unit his team installed. The systems pay for themselves in about five years and last about 20 years, he added.

And because the units are installed at existing oil wells, firms do not have to invest in risky drilling or spend money on new roads or transmission lines.

"The roads are there, the infrastructure is there," Johnson said. "If you're putting it in an oilfield, all your needs are met."

Proponents of the technology envision mounting the units on flatbed trucks in order to promote the technology at other oilfields in the West. Already, at least 30 oil firms have visited the Rocky Mountain center to learn more about the technology, Johnson said.

While the technology is yet to be deployed by private oil companies, Johnson said he believes that will soon change.

"By this time next year, there will be four to five companies with turbines in the field," he said.