

GEOTHERMAL UPDATE

By Lorraine A. Manz

In North Dakota

Earlier today I reviewed and recommended approval for North Dakota's 142nd geothermal energy extraction permit application for 2008. Coincidentally, this brings to 500 the number of geothermal energy extraction systems installed in the state since the introduction of the geothermal regulatory program in 1984 (fig. 1). Three hundred forty (68%) of these 500 systems have been installed in the last four years.

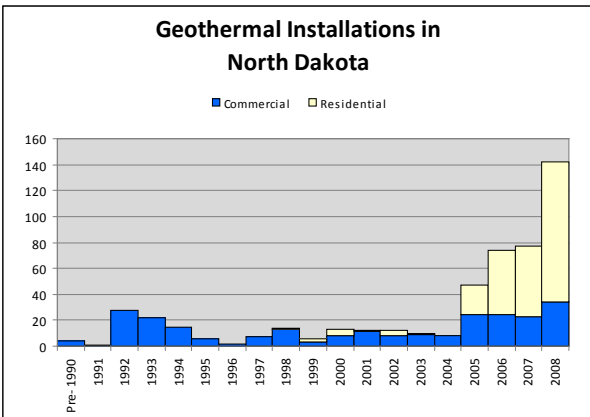


Figure 1. Geothermal energy extraction systems installed in North Dakota since 1984. Approximately two-thirds of these systems have been installed in the last four years.

This remarkable increase in the popularity of geothermal energy extraction systems in North Dakota, particularly by homeowners, is almost certainly a reflection of the nation's growing interest in renewable energy resources as alternatives to fossil fuels. The upswing that began in 2005 continues and has now been enhanced by new legislation

that went into effect on April 13, 2007, which eliminated a long-standing permit waiver for residential geothermal energy extraction facilities. Far more exciting, however, is the simple fact that, across the state, more and more North Dakotans are using geothermal energy to heat and cool their homes and businesses (fig. 2).

Geothermal energy extraction systems transfer heat to and from the subsurface via a vertical or horizontally configured series of pipes or "loops" through which water or a non-toxic antifreeze solution is circulated. With only a handful of exceptions, all the permitted loop fields in North Dakota are vertical, with each u-shaped loop installed in its own well and connected to a horizontal "header" to form a continuous, closed circulatory system. Regardless of their number, wells are typically drilled to a depth between 150 and 200 feet – a compromise between geology, available space and economics. The number of wells, i.e. the size of the loop field, depends on the size of the building(s) to be heated and cooled. For most residential properties five to seven wells is sufficient but a large commercial operation may require several hundred.

Installed earlier this year, the 704-well geothermal energy extraction facility for Microsoft's Fargo campus expansion is the largest in the state. This 500-ton system will provide most of the heating and cooling requirements for approximately 120,000 square feet of office space and a 65,000 square-foot commons building. It is the second geothermal energy extraction facility to be installed at this location. The first, which was completed in 1998 when the campus was owned by Great Plains Software, Inc., continues to serve the main office building. Between them, the loop fields of these two facilities consist of 1,109 wells drilled to a combined depth of more than 207,000 feet or 39 miles.

New Federal Tax Incentives

The Emergency Economic Stabilization Act of 2008, H.R. 1424 has created new, long-term federal tax incentives for homeowners and businesses who install geothermal energy extraction systems. This new law, which went into effect on October 3rd, 2008 grants qualifying homeowners a tax credit of up to \$2,000 to offset the purchase of an Energy Star geothermal heat pump system. The bill also

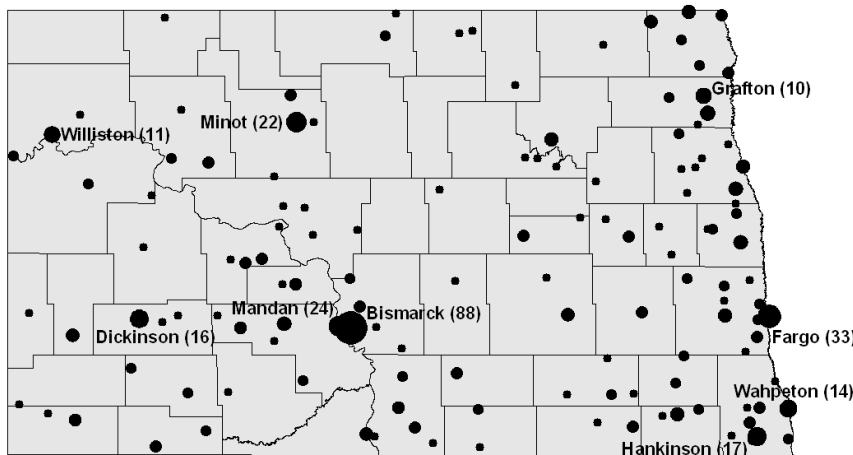


Figure 2. Location of geothermal installations in North Dakota by towns and cities. The size of the symbols is proportional to the number of installations. Towns and cities with more than ten installations are highlighted with the number of installations shown in parentheses.

provides federal tax credits equivalent to 10% of the total cost for commercial geothermal systems. Both credits will remain in effect until 2016.

Did you know?

There are more than 1,000,000 geothermal energy extraction facilities in the U.S., which have resulted in:

- The elimination of more than 5.8 million metric tons of CO₂ annually
- The elimination of more than 1.6 million metric tons of carbon equivalent annually
- Annual energy consumption savings of nearly 8

billion kWh and nearly 40 trillion Btus of fossil fuels

- A reduced electricity demand of more than 2.6 million kW

The environmental impact of 1,000,000 geothermal energy extraction facilities is equivalent to:

- Taking almost 1,295,000 cars off the road
- Planting more than 385 million trees
- Reducing U.S. reliance on imported fuels by 21.5 million barrels of crude oil per year

Source: Geexchange Fascinating Facts (<http://www.geoexchange.org/geothermal/publications.html>)

Shallow Gas Presentation at the 2008 Rocky Mountain Unconventional Gas Conference

The NDGS was recently included in an informative program of presenters at the 2008 Rocky Mountain Unconventional Gas Conference, held on the campus of the South Dakota School of Mines and Technology, in Rapid City, South Dakota this past October. More than 80 participants from industry, government, and academia attended the conference. The topics under discussion were coalbed methane, shale gas reservoirs, and unconventional shallow gases. There were 11 presentations given over the two-day conference along with an optional one-day short course on the optimization of fracture designs. NDGS geologist Fred Anderson presented on Shallow Gas Exploration and Production in North Dakota. He provided an overview of current shallow gas production in southwestern North Dakota along with highlights from recently completed shallow gas investigative work elsewhere in the state. The information contained in the NDGS presentation is available as Geological Investigations No. 72 (GI-72) (see page 31).



Survey geologist Fred Anderson field screening for shallow gas (methane) in shallow ground-water observation wells in southern Burleigh County during the 2008 field season. Recent results and highlights from this investigation were presented this fall at the 2008 Rocky Mountain Unconventional Gas Conference in Rapid City, South Dakota.

BSC Geology Students Visit the Geological Survey

Students from Bismarck State College's fall semester physical geology class were special visitors to the Department of Mineral Resources this past October. The class was provided with a timely and insightful presentation on recent oil production activity in the Bakken Formation by Survey geologist, Steve Nordeng. The group of 19 students also received a tour of the Survey offices, the rock, fossil, and mineral displays, and work areas. Students were provided with a brief demonstration of the Oil and Gas Division's Smart Board. Survey geologist Fred Anderson presented an informative introduction and overview of the North Dakota Geological Survey and its ongoing geologic mapping projects. In November, State Paleontologist John Hoganson gave this physical geology class a tour of the paleontology laboratory.



Survey geologist Steve Nordeng talking to BSC geology students about potential source rocks related to the Bakken Formation in North Dakota during their recent field trip to the Department of Mineral Resources.