GEOTHERMAL ENERGY UPDATE

"We use a flame that burns at approximately 3,000°F to heat our homes when we only need 76-80°F. Why do we do that?"
Dr. Xiaobing Liu, GHP technologies researcher, Oak Ridge National Laboratory

Why the Numbers are Down

By Lorraine A. Manz

We didn't know it then, but in 2011 North Dakota's geothermal (ground source) heat pump (GHP) industry was riding the crest of a wave that was about to break. Beginning in 2012, the number of geothermal energy extraction permit applications submitted to the NDGS began to dwindle. By the end of last year it had fallen to just 38, an 85% decrease from the 2011 record high of 239 and the lowest annual total since 2004. The figures for 2017 look worse yet (fig. 1).

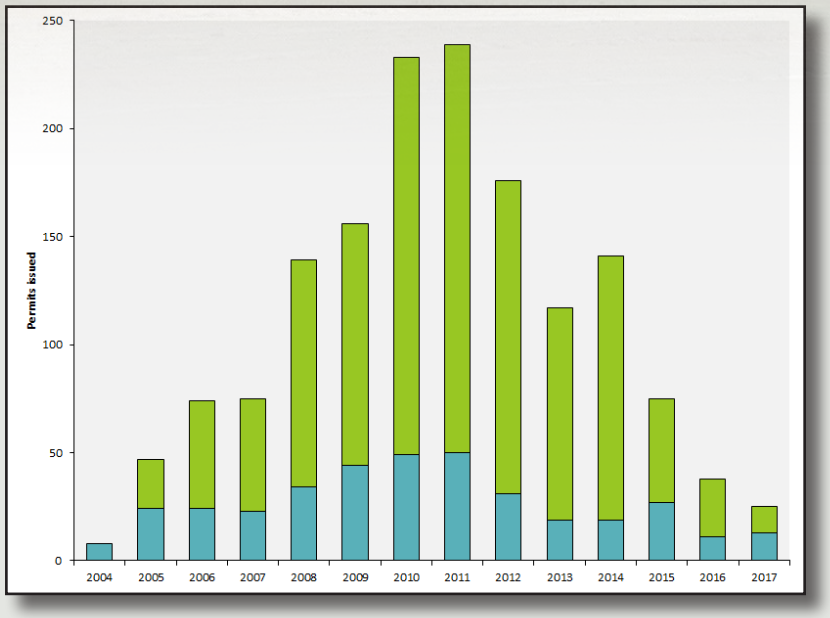

Figure 1. Green and blue stacked columns represent the number of residential and commercial geothermal energy extraction permits, respectively, issued annually by the NDGS between 2004 and 2017. Residential systems installed prior to the introduction of comprehensive permitting in April 2007 are based on completion report counts. 2017 numbers as of 10/31/17.

North Dakota is not the only state witnessing such a dramatic downturn. Others, including Iowa and Minnesota, have observed similar trends over the same fourteen-year period, although judging by the number of GHP shipments through 2015 this does not appear to be a nationwide problem (Lapsa and others, 2017a).

The decision to install a GHP heating and cooling system is affected by a variety of demographic, economic, and regulatory considerations but more than anything else; the overriding concern is cost. GHPs are the most efficient and environmentally friendly heating and cooling systems in the world, capable of reducing energy consumption by as much as 65% compared to conventional heating, ventilation, and air conditioning (HVAC) systems (Liu and others, 2015, 2016). Yet in spite of this and their numerous other benefits, (see box) the high up-front cost of GHP systems is the main reason (closely followed by lack of consumer awareness) why their share of the HVAC market remains so small (≈1%) (Hughes, 2008; EIA, 2017a; Lapsa and others, 2017b).

To help defray this high price tag and encourage consumer investment in the technology, GHPs are eligible for a wide range of federal, state, and utilities financial incentive programs. There are several available in North Dakota (DSIRE, 2017) but in recent years, two significant tax credits expired and have not been extended or superseded. The first to go was a renewable energy income tax credit, introduced under Section 57-38-01 of the North Dakota Century Code in 2001, that entitled corporations (and individual taxpayers after December 31, 2008) to a 15% tax break on the cost of purchasing and installing a GHP system. The credit expired at the end of 2014.

Benefits of geothermal heat pumps

- GHPs use stored solar energy from below the earth's surface, which is ubiquitous and renewable
- Efficient – energy savings as much as 65% over conventional HVACs
- Reduce CO_2 emissions
- Safe alternative to fossil fuels – no risk of fire, explosion, or CO poisoning
- Reliable (low maintenance, more even temperature distribution throughout the building)
- Quiet and unobtrusive – little to no visual impact
- Create jobs – most components are made in the USA, installation requires a skilled, local labor force
- Help reduce peak power demand in summer and winter
- Last a long time (heat pump: 25 years, ground loop: 50+ years)
- Free hot water
- Low environmental impact – do not obstruct flyways or disrupt habitat
- Work 24/7 and are not weather dependent

Sources: https://www.geoexchange.org
https://energy.gov/energysaver/geothermal-heat-pumps

In 2008 the federal government's Energy Improvement and Extension Act expanded a 30% ($2,000 max.) residential tax credit previously reserved for solar systems and fuel cells to include small wind-energy systems and GHPs, and extended its 2008 expiration date to December 31, 2016. The $2,000 cap was removed a year later by The American Recovery and Reinvestment Act of 2009. Credits for solar and wind energy technologies were granted an additional five-year extension with the signing of The Consolidated Appropriations Act in December 2015. All others, including GHPs, are history – a devastating blow to the industry that has been felt across the country (Dougherty, 2016, 2017).

To North Dakota homeowners these two credits represented a minimum saving of 45 % on the purchase and installation of a geothermal system and in terms of initial cost put GHPs on a par with conventional, but less energy-efficient HVAC systems. However, the loss of these credits is not the only reason why North Dakota's GHP market is in trouble. In recent years a clear relationship has emerged between interest in GHP technology and the price of natural gas (Tanguay, 2017), especially in areas where natural gas is readily available and cheap.

The price of natural gas in North Dakota is significantly below the national average (EIA 2017b) and from 2010 onwards shows a strong correlation with permit activity (fig. 2). (Any association prior to this is partly obscured by other factors such as the commencement of various subsidy programs, and a change in state permitting requirements.) With natural gas prices projected to remain low for the next several years (EIA, 2017a) the future for GHPs in North Dakota does not look good. But . . .

I am a firm believer in GHP technology for all the reasons given in the box and because the system that was installed in my own home seven-and-a-half years ago (Manz, 2010) has lived up to expectations in every way except, perhaps, payback time which is going to be longer than we originally anticipated (another consequence of the low price of natural gas). Moreover, I am confident that, in the end, the benefits of GHPs are going to win out – they are too compelling to ignore as the demand for clean, efficient energy continues to rise. The federal government recognizes this and, in spite of axing consumer subsidies, continues to invest in GHP technologies through grants and programs like the U.S. Department of Energy's GeoVision Study (DOE, 2014). Under the direction of the Geothermal Technologies Office (GTO) GeoVision is a comprehensive assessment of the growth potential of GHPs and all other forms of geothermal energy through 2050. The aim is to develop strategies and technologies that will bring down the barriers of cost and market skepticism that currently hamper its role as a major contributor to reducing energy consumption and greenhouse gas emissions.

Closer to home, the North Dakota Department of Commerce, Office of Renewable Energy & Energy Efficiency recently commissioned a study to evaluate the performance characteristics of existing GHP systems in North Dakota (Yu and others, 2017). Results from the twenty-four case studies included in the investigation are more-or-less consistent with national trends (Hughes, 2008; Liu and others, 2015, 2016) but the local emphasis is invaluable. The final report is an impartial source of reference, based on meaningful data, that will assist North Dakota consumers and policymakers in making well-informed decisions about GHP deployment.

Buildings are America's energy guzzlers and the demand is growing. In the U.S. residential and commercial buildings (offices, retail, schools, hospitals, etc.) are responsible for about 40% of primary energy consumption and total CO_2 emissions (upwards of 2 million tonnes per year), 74% of electricity consumption, and 56% of natural gas consumption. At least 50% of the energy consumed by the average single-family home is for space heating and cooling (DOE, 2012). One of the most cost-effective ways to reduce energy consumption and CO_2 emissions is to target buildings. GHPs can do that, and do it well.

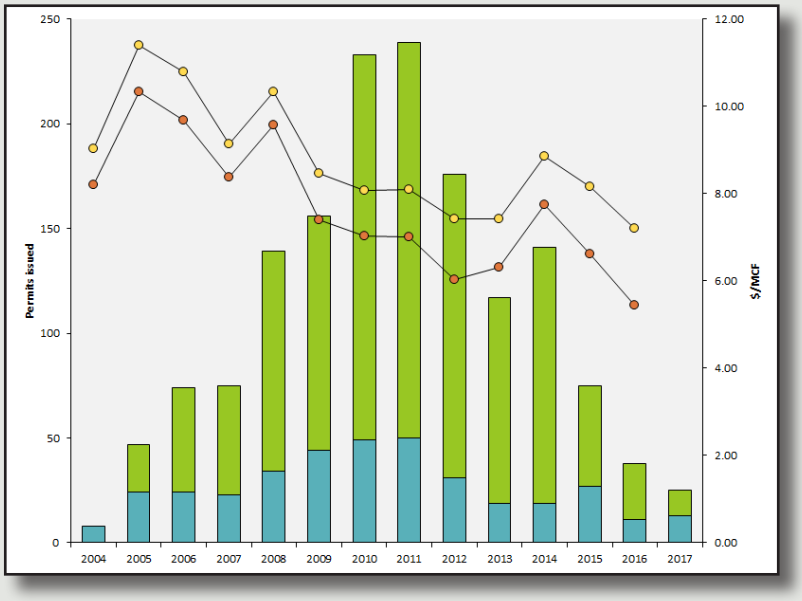

Figure 2. Geothermal permits issued by the NDGS (see figure 1 for explanation) versus North Dakota residential (yellow circles) and commercial (orange circles) annual average natural gas prices in dollars per 1,000 cubic feet (MCF). Source: U.S. Energy Information Administration (2017b).

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GeoNews Short Note:

Central & Eastern U.S. Seismic Network (CEUSN) – Accessibility of Seismic Monitoring Data

In the January 2017 issue of Geo News, geologist Fred Anderson reported on North Dakota's current seismic monitoring capabilities. In this article, readers who were interested in viewing near real-time seismic data from seismometers in North Dakota and around the world were referred to the Rapid Earthquake Viewer website that was being maintained by the University of South Carolina. Shortly after publication of the January issue of GeoNews these monitoring capabilities were discontinued.

Readers are now referred to the University of California San Diego (UCSD) in La Jolla, California where complete and convenient access via the web to the latest 24-hours of seismic monitoring station data for stations in North Dakota, as well as the entire CEUSN, is currently being provided and can be readily accessed by visiting the CEUSN website at: http://ceusn.ucsd.edu/