



HDD technology taps vast natural gas deposit underneath DFW Airport

What geologists believe to be the largest onshore natural gas field in the U.S., the Barnett Shale is a geological formation of sedimentary rock dating back some 350 million years. The formation encompasses more than 5,000 square miles (13,000 km²) stretching from Dallas, Texas, to the west and south of sister city Fort Worth. With estimated natural gas resources in excess of 30 trillion cubic feet (850 billion cubic meters), the potential contribution of this formation as an energy source is immense.

Coined an “unconventional” deposit by geologists, the shale that comprises this vast natural gas reservoir is very hard — making the pockets of gas that lie within extremely difficult to extract economically in commercial quantities. As if the geometric composition weren’t challenging enough, development has also been hampered by the fact that major portions of the field lay beneath the most densely populated areas of North Texas — most notably, the Dallas-Fort Worth metroplex. But recent technological improvements in hydraulic fracturing and horizontal directional drilling (HDD) techniques have since changed all that.

Among the largest lease offerings located within the Barnett Shale was an 18,000-acre (7284-hectare) tract encompassing Dallas-Fort Worth International Airport. The airport authority awarded the lease and drilling rights to Chesapeake Energy, one of the nation’s largest producers of natural gas. Chesapeake selected Driver Pipeline of Dallas, Texas, to tackle the complicated task of installing an intricate pipeline system to transport the natural gas produced from beneath the third-busiest airport in the world. Driver Pipeline was well-positioned to complete the pipeline work having more than 800 employees and a fleet of equipment that numbers over 300.

The project involves installing a 24-inch (61-cm) pipeline around the parameter of the airport and a “gathering” line consisting of 8-inch to 24-inch (20.3-cm to 61-cm) lateral lines that serve to channel the extracted natural gas from an estimated 100 wells. The gathering line serves to transport the gas to a compressor station located on the north side of the airport which functions to pressurize the gas before moving on to another pipeline for distribution and delivery to market.

There will also be a 10-inch (25.4-cm) line to take saltwater back to injection wells and both 10- (25.4-cm) and 12-inch (30.5-cm) lines to carry fresh water to the wells.

The entire salt water gathering line is composed of 50-foot (15.2-m) polyethylene links that, fused together using a poly fusion machine, and installed using advanced horizontal directional drilling techniques. The various bores range from 15 to 65 feet (4.6 m to 19.8 m) in depth depending on what Driver's crews encounter underground. When complete, the gathering line plus additional "feeder" lines will total over 100 miles (160.9 km) in length.

"As you can imagine, there are numerous logistical challenges involved with installing such an intricate pipeline system under one of the world's busiest airports," said Scott Driver, vice president of operations for Driver Pipeline. "The only way this project could be completed is by using HDD since what lies on the surface is a network of runways, terminals and cargo facilities. And that just describes the surface. What lies underneath presents us with a whole other set of challenges."

Geological surveys completed prior to beginning the installation showed that the ground conditions and composition of the soils that lie beneath the surface varied a great deal. According to Driver, the project started out in black gumbo-like dirt and moved to red clay with sandstone layers. Opposite the starting point, Driver's crews encountered sandstone with rock ledges along with just basic sand. "The soil conditions were very difficult," he said. "Anytime you have a sandstone layer that's down below the ground that you can't see, it plays havoc with drilling equipment. It takes good equipment and a skilled operator who understands the 'feel' of the rig, and how it is responding to what is being encountered."

Driver credits good employees for the company's ability to take on large and complicated projects successfully and also relies on high-quality equipment to complete the work efficiently. The company is using a fleet of nine Vermeer horizontal directional drills including the D100x120 Series II and D330x500 models to complete the project.

"We use our in-house survey crews to plot each bore," Driver says. Once all utilities and related lines are located we use a Vermeer vacuum excavation machine to uncover all the lines and do a drill profile. Then we plot each utility on the drill profile before the rig ever comes in. We have five or six vacuum excavation machines that we use and they play a very big role in our drilling project on the front end. It is an essential part of the process to ensure that we don't damage any of the existing lines."

The pre-drill process involves running tungsten carbon inserts to start a pilot hole. The size of the hole is determined by the size of pipe to occupy the bore. For example, a 24-inch (61-cm) pipe requires a 24-inch (61-cm) pass followed by a 36-inch (91.4-cm) pass and then a mud or “swab” pass to prep the hole. These passes determine the difficulty of the penetration rate that will be encountered with the cutters. A rule of thumb for over cutting is 1-1/2 times the diameter of the pipe.

“Water is pumped into the shale that is mixed in with some recyclers,” Drivers says. “We also have a mud mixing unit set up beside the drill rig that is mixed with gel. This is pumped down the hole with a triplex pump, anywhere from 85 to 300 gallons (321.8 to 1135.6 L) per minute depending on the rig size. And then we reclaim it and use it again.”

Production rates vary depending on the conditions, but Driver’s crew of between 125 and 150 on-site, average approximately 500 (152.4 m) feet a day to ream and pull pipe through.

High Profile, Installation Challenges

With hundreds of takeoffs and landings occurring daily and the potential for hundreds of thousands of people looking on, Driver admits that this is the most visible and important projects ever undertaken by the company. The company’s vast knowledge and experience, plus the fact that Driver is a locally based company gave them an advantage over other contractors.

“This is our backyard,” Driver says. “We know the terrain, the composition and the geography better than anyone. We’ve done a lot of work in urban- areas that are congested, high visibility and complicated. But this one certainly is the trophy. We are constantly in the forefront of people coming and going, in and out of the airport, so that alone generates a lot of attention. We did a project similar to this a few years ago installing a gas pipeline near the Baltimore/Washington Airport, but nothing of this magnitude.”

Working with a number of different entities for bidding, permits and compliance with FAA regulations and restrictions is also a daunting component of this project. And if that weren’t enough, when work commenced, Driver had to deal with the wrath of Mother Nature.

“We had rain for more than 50 of the first 90 days when we started the work,” Driver recalls. “We needed to get the first five miles (8 km) of 24-inch (61-cm) pipeline in the ground in order to begin production on the initial wells and not have what we call a WOPL (i.e. waiting on the pipeline). We were able to stay on schedule and constructed the first five miles (8 km) using horizontal

directional drilling under two major highways, railroads, water lines and environmental restrictions. It was quite an accomplishment.”

Driver has completed nearly 80 percent of the installation so far and should be close to completion within the next few months. When the infrastructure is complete, this vast underground maze of pipelines will infuse a huge amount of natural gas energy into a system that will eventually be transported from beneath one of the world’s busiest airports, and ultimately, to locations throughout the United States, providing energy for thousands of customers.

####