Shale Industry Intelligence Report: Transportation and Infrastructure Trends

Key Findings

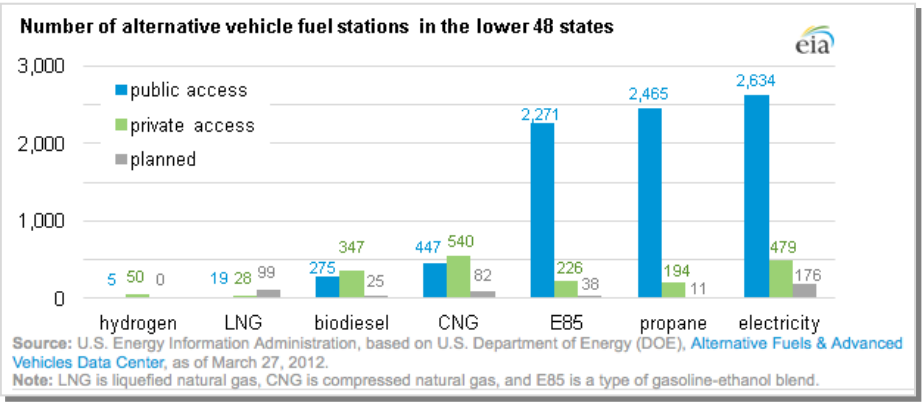
- **NATIONAL: Natural gas increases its cost advantage over gasoline as a transportation fuel, but challenges to more widespread penetration remain**
- **Long-haul & short line railroads servicing shale plays – restoring and expanding transportation capabilities in decline since heights of steel and coal industries**
- **Infrastructure bottleneck for shale development in Ohio**
- **Government's estimates of Utica reserves cause controversy, but contain good news for Ohio**
- **Transit systems and businesses consider natural gas-powered transportation options, and Ohio companies striving to meet the demand**
- **The number of waste disposal wells is increasing—and facing greater scrutiny**

National trends and issues

Natural gas increases its cost advantage over gasoline as a transportation fuel, but challenges to more widespread penetration remain.

Big-name companies such as UPS, AT&T, and Waste Management are adding natural gas vehicles to their fleets in order to take advantage of fuel savings. Natural gas has been cheaper than gasoline as a transportation fuel for years, and the cost advantage of natural gas on an energy-equivalent basis has grown to $1.70 per gallon nationally, according to the most recent report Department of Energy report.

Yet, natural gas vehicles account for just 0.4% of the US heavy-duty vehicle fleet (of 9 million total), and just 0.03% of the light vehicle fleet (of 240 million). Purchasing new natural gas powered vehicles (or conversions of existing stock) involves a significant premium over traditional models, often $10,000 or more per vehicle.



The refueling infrastructure available for CNG and LNG today—though growing—lags that available for other fuels. As of March this year, there were 987 CNG & 47 LNG fueling stations across the US—compared to 3,113 electric stations (non-

residential) and 160,000 gasoline stations. The same report indicates there are currently 82 CNG, 99 LNG, and 176 electric stations in the planning pipeline. [*See chart, inset*] Clean Energy announced this month that it had reached a major milestone in its "America's Natural Gas Highway®" project aimed at long-haul heavy goods movers, but stations geared toward smaller businesses and consumers tend to be built one at a time.

There is an economic case to be made today for businesses to switch from gasoline/diesel to natural gas if they manage a high volume of long-life and/or high-usage vehicles. And the trend in price differentials between CNG and gasoline continues to favor natural gas, making it likely that more large commercial fleet owners will take a serious look at this option in the coming year.

However, the lack of a robust national fueling infrastructure combined with a high incremental cost for CNG and LNG powered vehicles presents a barrier to faster and wider adoption of the technology. So skeptics believe that the primary transportation role for natural gas will be as a growing fuel source for the electricity plants needed to provide power for greater numbers of electric cars. We see evidence of more fueling stations coming online over the next five years, though these are designed primarily for heavy commercial fleets. The options for smaller-scale businesses and individuals are likely to vary greatly from region to region, at least in the near term.

Ohio trends in shale-related transportation and infrastucture

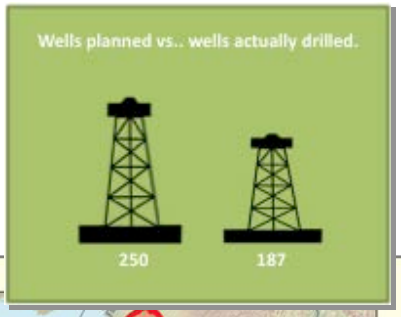
Long-haul & short line railroads servicing shale plays – restoring and expanding transportation capabilities in decline since heights of steel and coal industries

Union Pacific railroad reported a 15% increase in profit in the third quarter of 2012, due to increased shipments of chemicals, sand, and equipment to the Utica, Marcellus, Bakken, and Eagle Ford shales—and its cars are carrying oil to refineries in Texas, California, and Louisiana on the return trips. Growth in shale-related shipments is offsetting a drop in coal shipments for UP, and the railroad also benefits by providing main line links for short line and regional rail companies working in the shale areas.

Meanwhile, the demand for more transportation links from shale operations and the national rail network, as well as links between major shale facilities has driven the growth of those smaller rail lines. The Columbus & Ohio River Rail Road Company (CUOH), a subsidiary of Genesee & Wyoming, has signed a long-term agreement to ship natural gas liquids from the Utica East Ohio Midstream processing plant in Scio, and The CUOH will also serve several other Utica Shale-related projects that have located or are planning to locate on the CUOH. Just over the border in Pennsylvania, MarkWest recently completed a 4.5 mile line to connect its Houston, PA, processing plant to the national rail network. The Allegheny Valley and Southwest Pennsylvania railroads have seen business grow 35% in three years—primarily due to shale-related traffic—and the companies are upgrading track and rolling stock to meet the demand.

The Utica and Marcellus shales are driving the rapid growth of short line and regional rail companies, and the area is witnessing the restoration and expansion of old rail infrastructure, as well as the building of new lines. Once this capacity comes fully online, it will enable more

efficient production and processing of shale oil and gas. One unforseen consequence of this mini rail-boom, however, is the renewed interest in old rights of way and the impact on communities and property owners when those lines are brought back (in some cases having lain dormant for years).



Government's estimates of Utica reserves cause controversy, but contain good news for Ohio

The Utica shale play—primarily covering parts of Ohio, West Virginia, Pennsylvania, and New York—holds 38 trillion cubic feet of natural gas and 940 million barrels of oil, according the first estimate produced by the U.S. Geological Survey. At current market value, that translates to $138 billion and $86 billion worth of gas and oil respectively. Industry players reacted negatively to the estimates, believing that both the stated reserves—as well as the future pricing assumptions involved in the valuation of those reserves—was too low. The CEO of Chesapeake Energy, for instance, believes there is "half a trillion" dollars in the Utica shale.

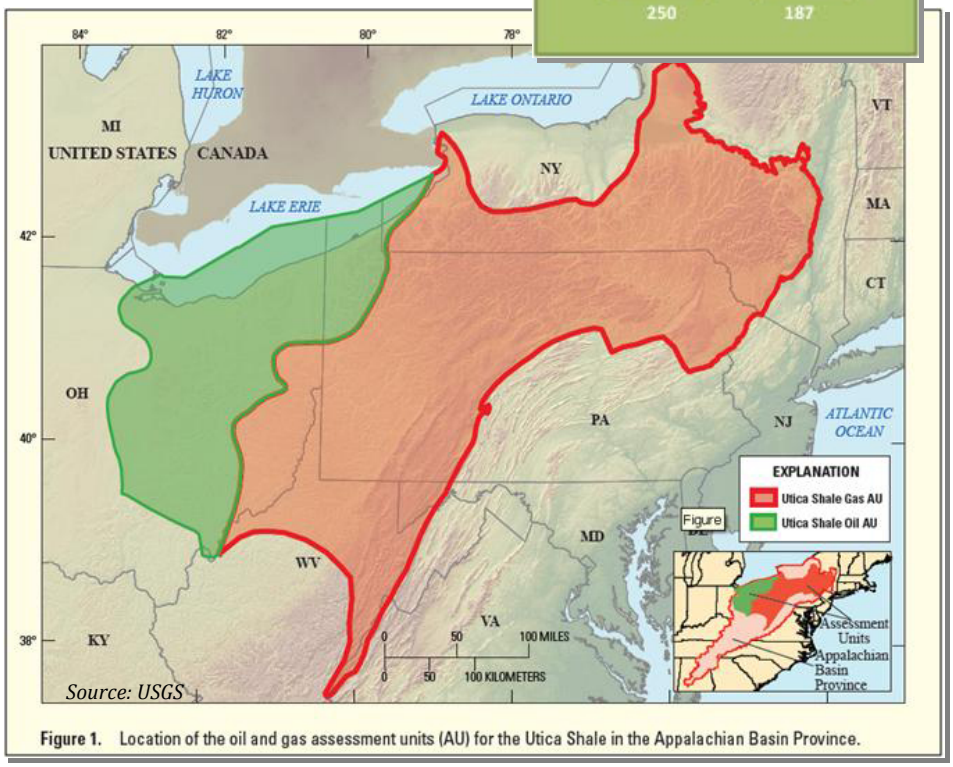


Figure 1. Location of the oil and gas assessment units (AU) for the Utica Shale in the Appalachian Basin Province.

The USGS assessment indicates that much of the Utica play in Ohio contains recoverable oil—which is not experiencing the same kind of price pressure that natural gas is currently facing. This suggests that once a robust pipeline and midstream infrastructure is in place (see below), production of this resource will not be hampered by the low prices that characterize the current natural gas market.

Infrastructure bottleneck for shale development in Ohio?

According to Ohio Department of Natural Resources (ODNR) data, the state is on track to see 187 gas and oil wells drilled by the end of the year—63 (or 25%) short of the 250 the department had predicted as recently as March. Tom Stewart, VP of the Ohio Oil and Gas Association, blames the lagging numbers on a backlog in pipeline and midstream processing infrastructure, as well as lower gas prices. Some of this infrastructure will come on line shortly – MarkWest is building a

processing facility in eastern Ohio (as well as several others in the Marcellus and Utica regions), and NiSource and Chesapeake have recently announced their own projects. Meanwhile, the pace of new companies entering the state and the well permitting process remains steady, according to ODNR. The department's projections for the number of new shale wells for 2013 and 2015 were 750 and 2,250, respectively.

The primary infrastructure bottleneck is the lack of smaller pipelines that connect new wells to processors and/or the national network—currently there are some 114 drilled wells that are not able to move into production because they are not connected. A further drag on the expansion of production is the lack of advanced processing/refining facilities in the region—combined with low market price for gas—that can mean that producers would pay more to transport the gas to a distant processor than they would be paid for it.

We believe this bottleneck is temporary and that the necessary infrastructure will catch up with production capacity over time. In the short term, we see opportunities for agile companies in the oil & gas support sector to step up to meet the pent-up demand.

Transit systems and businesses consider natural gas-powered transportation options, and Ohio companies striving to meet the demand

Natural gas as a mainstream transportation fuel may be facing challenges nationally (see above), but recent press reports indicated it is gaining some traction in Ohio, where businesses and governments are taking a closer look at converting fleets of vehicles from gasoline. This switch requires a large capital expense for engine conversion (or vehicle replacement), but the current low price of natural gas—and the prospect of ample domestic gas supplies for many years—is changing the economic equation.

The transit systems in Canton and Akron are adding busses that run on compressed natural gas (CNG), and businesses with large fleets, such as the Kimble Companies waste disposal firm (60 CNG Mack trucks today, plans to add 160 within 3 years) are also making the switch. Ohio businesses are positioning themselves to take advantage of this trend, for example NatGasCar of Cleveland will sell about 400 kits this year (at $9-$13,000 per kit) to convert Dodge pickup trucks, jeeps and vans to run on both natural gas and gasoline.

Governments and local industries with an interest in the shale sector are promoting the use of natural gas as a transportation fuel. However, as is the case nationally, extending this trend will require additional fueling infrastructure—currently there are just 9 CNG fueling stations in Ohio. Home based refueling options are available for those who use natural gas for heating or cooking, but are too expensive and impractical to facilitate a wider uptake of CNG personal vehicles.

The number of waste disposal wells is increasing—and facing greater scrutiny

Disposal wells—which can be drilled for the purpose or converted from conventional oil and gas wells—are used to dispose of waste byproducts created by the hydraulic fracturing (fracking) process. Ohio currently has 179 of these wells, with more on the way, according to recent press reports, and this increase is occurring despite stricter regulations enacted by the state earlier this year. Some local governments and landowners oppose the proliferation of these wells—

opposition in Mansfield, OH resulted in one company withdrawing its proposal to drill two wells there this summer. And in October, a class action was filed in Arkansas against the operators of six disposal wells in that state, seeking compensation and damages for landowners there.

Disposal wells are a necessary—though often overlooked—element of the infrastructure needed to support an active oil and gas production industry. However, we are seeing an increased awareness of these wells—and an increased risk profile for operators associated with them. It is imperative those operating and utilizing these sites to have a comprehensive understanding of the regulatory and commercial issues involved.

Ohio and regional transportation and infrastructure projects making news (Oct. – Dec. 2012)

Company	Business	Location	Size | Cost | Scope
Columbus & Ohio River Rail Road Company	Rail transport	Ohio, main yard in Newark, OH	Long-term rail service agreement for the $900 mil NGL fractionation hub under construction in Scio, OH
Ergon Incorporated	Oil refinery	Newell, WV	$78 million to add capacity in its refinery processing units and supporting infrastructure. Ergon previously announced (Mar 2012) an expansion of its terminal facilities in Magnolia and Marietta, OH, as well as new assets for its midstream companies in the region.
MarkWest Utica and Gulfport Energy Corp.	Midstream infrastructure	Harrison, Guernesy, and Belmont Counties	140 miles of gathering pipelines by 2014; as well as processing at MarkWest Harrison facility, fractionation, and marketing services.
MarkWest Utica	Natural gas processing	Noble County	Building a new processing complex, with 45 MMcf/d per day plant by 2012 YE. 200 MMcf/d per day cryogenic plant by mid-2013.
Enterprise Products Partners	Gas product (ethane) pipeline	Ohio, West Virginia, & Pennsylvania to Texas	New construction recently started in Ohio, starting in Coshocton County. In Ohio, the 16” pipeline will traverse 261 miles through 13 Ohio counties.
Marathon Petroleum Corporation	Truck to barge loading facility	Wellsville, OH	MPC will build a loading facility to ship oil from the Utica region to its Catlettsburg, KY refinery. Jointly developing infrastructure with Harvest Pipeline Co. to transport hydrocarbon liquids from Ohio and Pennsylvania.

Crestwood Midstream Partners & Enerven Compression, LLC	Natural gas compression and processing	Harrison and Doddridge Ctys, WV	Crestwood (via Crestwood Marcellus Midstream, LLC), will acquire Enerven for $95 million.
Arrohead Utica Pipelines	Gas transfer facility	Wellsville, OH	Arrowhead recently announced plans to build a $20+ million gas transfer facility at the Wellsville Intermodal Park.
Worthington Industries & Westerman Companies	Tanks and pressure vessels	Bremen and Wooster, OH	Worthington's pressure cylinders segment acquired Westerman for $70 million.
FTS International & Phoenix Well Services	Wireline services	Delmont, Westmorland, and Burbank, OH	FTS International, (aka Frac Tech), has acquired wireline company Phoenix Well Services, which serves the Marcellus and Utica shale plays. Financial terms were not disclosed.

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