Shale energy: A potential game-changer
Implications for the US transportation & logistics industry

At a glance
Each segment of the transportation and logistics industries – railroads, trucking, shipping, and airlines – is experiencing the dramatic impact of the shale energy revolution.
In 2000, shale gas provided only 1% of US natural gas production; by 2011, it was over 34%.

Since 2010, the US has emerged as the largest gas producer in the world.

The shale industry supported 1.7 million jobs in 2012 and contributed $62 billion in state and federal tax revenue.

The U.S. Energy Information Administration (EIA) forecasts that by 2040, 50% of the United States’ natural gas supply will come from shale gas.

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Introduction

The shale energy revolution is gaining speed in the United States, transforming the way we do business. A recent article in The Wall Street Journal called it “one of the biggest forces to hit the US economy in modern history.”

Transportation and logistics companies are experiencing the immediate and dramatic impact of this revolution. They are essential to the movement of people and equipment to the shale fields and the transportation of shale oil and gas from the fields to processing plants. Longer-term, there will be additional opportunities for transportation and logistics companies as the major energy players in the United States look to export liquefied natural gas (LNG) derived from shale. There are currently about 20 applications before the US Department of Energy from companies wanting authorization to export LNG.

Shale energy is also having a major effect on the chemicals and manufacturing industries in this country, with clear ramifications for transportation and logistics companies. This new source of abundant, low-cost energy is proving to be a significant incentive for chemical producers and manufacturers to shorten their supply chain and bring production facilities back to the United States. A revived manufacturing sector would increase the need for rail and trucking to move more products domestically and for shipping exports abroad.

Following is a look at the implications of shale energy for different segments of the transportation & logistics industry.

The shale oil boom is creating significant opportunities for the railroads as a means to transport people, equipment, and oil. Railroads are being used to haul the special sand, known as “frac sand,” pipes, acids, and other chemicals needed in the shale extraction process. After extraction, rail is being used to carry away waste products and shale oil and gas. Rail carloads of crude oil tripled last year to more than 200,000.\(^3\)

The inbound and outbound use of rail has led to a surge in demand for cars that can carry crude oil. At new production sites, which do not have existing pipelines, rail cars are being used to transport oil and gas from the fields to the refineries. Pipelines are costly and time-consuming to build and often subject to construction delays because of the need to obtain various permits. Rail car companies are reaping the benefits, experiencing a backlog of orders for petroleum-carrying cars, and reporting strong financial results.\(^4\)

In some shale-producing regions, the railroads have had to build additional infrastructure to keep up with demand. The Bakken shale field in North Dakota is a good example. By the end of 2010, daily production had grown to the point that it exceeded the capacity of available transportation options, requiring increases in rail infrastructure.\(^5\) This April, Bakken oil output hit a record 727,149 barrels a day, and about 75% of the oil was carried out by trains.\(^6\) Rail has become the favored mode of transport in the area because it is cheaper than trucking and more flexible than pipeline.

With the movement from coal to shale as an energy source, the rail industry will increasingly move shale-related products. Based on the US Energy Information Administration’s estimates of shale oil, shale gas, and coal production, and conservative assumptions about rail’s market share of shale oil transportation, the increase in shale-related carloads should more than offset the decline in carloads of coal by 2020 (see chart).

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**Forecasted net impact of shale and coal production on Class I carloads**

Railroads are also getting a boost from the positive effects of shale on the US chemical industry, which has been transformed into a low-cost producer of petrochemicals. Rail is essential to the movement of chemicals in the United States; nearly a quarter of US shipments of chemicals are transported by rail.\(^8\) A recent American Chemistry Council study found that, as of March 2013, more affordable domestic energy has contributed to the announcement of 97 new chemical industry projects in the United States with an approximate value of $72 billion.\(^9\) As production at these new plants comes online, rail carloads of chemical products are expected to increase as well.

In addition to the increased demand for rail transport, the natural gas derived from shale deposits has the potential to provide a cheaper source of fuel. BNSF Railway, one of the biggest US consumers of diesel fuel, plans to test the use of natural gas to power its locomotives this year.\(^10\) If successful, this could result in a significant cost reduction for rail companies.

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8 http://www.americanchemistry.com/Policy/Rail-Transportation
9 http://chemistrytoenergy.com/shale-study
The low price of liquefied natural gas (LNG) prices relative to the more expensive diesel fuel has led many companies to switch to vehicles run on natural gas. UPS is a case in point with its large fleet of more than 2,700 vehicles that use alternative fuel, including liquefied natural gas and compressed natural gas engines.\(^1\) FedEx also uses a large number of alternative-fuel vehicles in Asia, Europe, and Latin America.\(^2\)

However, in order for trucking companies to expand their use of more affordable fuels, there needs to be infrastructure support. Clean Energy, the largest provider of natural gas for transportation, is building a network of LNG truck fueling stations on interstate highways. As part of the first phase of this initiative, known as America’s Natural Gas Highway\(^*\) (ANGH), approximately 150 stations are scheduled to be in operation by the end of 2013.\(^3\)

In addition to changing fuel dynamics, trucking activity has increased as a result of shale production. Trucks are used to haul fresh water, frac sand, waste products, and heavy equipment. Longer-term, trucks will benefit from the shale-related manufacturing renaissance in the United States.

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3. www.cleanenergyfuels.com/buildingamerica.html
Shipping: poised to grow

The North American shipping industry may become a major exporter of natural gas, thanks to the aggressive drilling of shale. There are more than 20 proposed LNG export terminals in the United States seeking permits to allow total processing of about 30 billion cubic feet a day, according to the United States Department of Energy. If currently pending applications are approved, US exports could result in approximately 3,600 new LNG tanker departures per year.

The shipping industry could benefit from the shale boom in other ways as well. Recently, it was announced that gas drillers in West Virginia had made inquiries regarding the shipment of shale waste by barge, since it is less costly than using trucks for transport. (At this time, however, no shipments are being allowed until the US Coast Guard determines how to ensure environmental safety.) Also, shipping is expected to play an increasing role in the transportation of machinery and other products needed for exploration and production.

Furthermore, shipping will play an increasingly important role in the export of chemicals and manufactured goods. The United States is becoming a major global player in petrochemical production, with half of new investment coming from firms outside the United States, and producing many chemicals and plastics for the export market. Longer-term, the chemical advantage will also result in more manufactured goods available for export.

14 http://www.eia.gov/todayinenergy/detail.cfm?id=811
Airlines: short- and long-term opportunities

Airports and airlines are benefiting from the increased traffic to and from the major shale gas regions.\(^{17}\)

The high price of jet fuel, the single largest cost component for airlines, coupled with the volatility of crude oil prices, is spurring a search for cheaper alternatives, such as those based on natural gas. Qatar Petroleum and Shell (RDSA) have completed an $18 billion gas-to-liquid (GTL) plant that produces jet fuel from natural gas.\(^{18}\) Shell is now exploring a similar facility on the US Gulf Coast.\(^{19}\) In addition, Sasol, a South Africa energy company, announced in late 2012 that it would build a new GTL plant in Louisiana that will be the second largest GTL plant in the world, second only to the plant in Qatar.\(^{20}\)

In 2009, Qatar Airways conducted the first commercial flight to be powered by fuel derived from natural gas.\(^{21}\) The following year, United Airlines conducted the first US commercial flight using a synthetic jet fuel blend derived from natural gas.\(^{22}\) In 2012, Boeing submitted a design proposal to NASA for a plane designed to run on liquefied natural gas.\(^{23}\)

The use of natural gas for jet fuel is still years away from widespread commercial use. Much depends on its pricing in relation to the price of crude oil as well as other possible alternative fuels. Certainly, the impetus is there for additional development, given today’s environment concerns around \(\text{CO}_2\) emissions.

In the nearer-term, airports and airlines are benefiting from the increased traffic to and from the major shale gas regions. For example, flights originating in North Dakota airports serving the Bakken shale field have experienced an increase in load factors of almost 10% over the last five years as traffic has nearly doubled (see chart).

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\(^{19}\) http://www.shell.com/global/future-energy/natural-gas/gtl.html
**Domestic load factors higher at North Dakota airports**

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<thead>
<tr>
<th>Year</th>
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<tr>
<td>2008</td>
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<td>2009</td>
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<td>2012</td>
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Source: US Bureau of Transportation Statistics, PwC Analysis
This is an exciting time for US transportation & logistics companies. As production of shale gas and oil continues to grow, so, too, do the opportunities. In addition to serving shale energy production during the drilling and completion stages of new wells, transport is needed to move gas, oil, and waste by-products.

Railcars, planes, and trucks are all serving the major shale regions in North Dakota, Ohio, and Pennsylvania. But there are significant shale deposits in other areas of North America that present additional opportunities. The Marcellus Shale, most actively being drilled today in Pennsylvania, spans West Virginia, New York, Ohio, and Maryland and is considered to have a great deal of unrealized potential. It may be the second largest natural gas field in the world. Under the Marcellus Shale is the Utica Shale, which is thicker and even more extensive than the Marcellus, and covers much of the Appalachian Basin. The number of active oil and natural gas rigs in the Utica Shale formation doubled from 2011 to 2012, and seven processing plants and four delivery pipelines valued at more than $7 billion are under construction. Additional major shale plays are the Barnett Shale in North Texas and the Haynesville Shale in Louisiana and Texas. The latest examples of potentially abundant deposits are the Antrim Shale that covers most of Michigan and the Eagle Ford Shale in South Texas.

25 anga.us/why-natural-gas/abundant/shale-plays#.UeL1PHTs  
26 http://www.eia.gov/todayinenergy/detail.cfm?id=8850  
27 www.ohio.com/blogs/drilling/ohio-utica-shale  
28 anga.us/why-natural-gas/abundant/shale-plays#.UeL1PHTs
The shale plays in Canada are for the most part in an earlier stage of development than in the United States. There are large, rich deposits in Alberta and British Columbia, with the most intense focus to date on the Duvernay formation in Alberta.29

While pipelines may eventually move the bulk of shale oil and gas, it will take time to develop the infrastructure; and rail, trucks, and planes will still be needed to transport people and equipment. In the not-too-distant future, ships will carry LNG to other parts of the world. And, as shale energy helps to revive the US manufacturing industry, it will help most transportation modes, as they will be needed to move products domestically and abroad.

Transportation and logistics executives should consider the opportunities currently presented by the rapid growth of shale energy. The “winners” will develop strategic plans that consider the impact of shale on the overall economy and the potential it presents for the growth of their businesses now and for the foreseeable future.

To have a deeper conversation about how this subject may affect your business, please contact:

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