

16th Annual Freight and Logistics Symposium

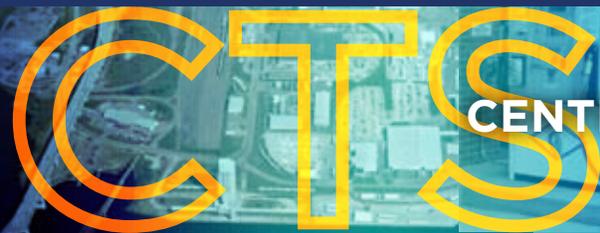
The New American Energy Revolution

A Summary Report | December 7, 2012 | Minneapolis, Minnesota

New energy sources—such as shale oil and natural gas—are having a seismic impact on Upper Midwest transportation networks and goods movement.



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Bill Gardner, director of the Office of Freight and Commercial Vehicle Operations at the Minnesota Department of Transportation, provided the symposium opening remarks.

U.S. rails carried about
200,000
tank-car loads of crude
oil last year, up from
9,500
in 2008, according
to the Association of
American Railroads.

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second quarter of
2014.”

— Robert Henry

Symposium moderator: Gina Baas, Associate Director, Center for Transportation Studies, University of Minnesota

Keynote:

Re-Revolution of Crude by Rail

Robert Henry, Vice President of Operations, Dakota Plains Holdings Inc.

Horizontal drilling and hydraulic fracturing, or fracking, techniques have transformed shale deposits from marginal sources of hydrocarbon fuel into “global game changers” in the production of oil and natural gas, Robert Henry said—and the transformation is having a seismic impact on rail transport.

The Bakken shale formation is one of the largest contiguous deposits of oil and natural gas in North America, occupying an area of about 200,000 square miles in parts of northwestern North Dakota, northeastern Montana, and southern Canada. Since 2008, when the use of modern fracking really took off, the Bakken formation has become one of the most active shale oil fields in the United States. Currently more than 7,500 active wells produce nearly 730,000 barrels of oil per day. At this rate, North Dakota—which earlier in 2012 surpassed Alaska and California in oil production—will soon overtake Texas for the number one spot, Henry said.

Although several oil pipelines run through North Dakota, these conduits are near or at capacity by the time they reach the Bakken area, Henry continued. And, since much of the Bakken oil is destined for the East Coast, where there are no crude oil pipelines, rail has emerged as the preferred transport mode. “Today, pipelines take 39 percent of oil to market, with 51 percent going on rail. A year ago, 67 percent of crude went by pipeline and a measly 17 percent by rail,” he explained.

Along with this rapid gain in market share, the Bakken oil boom has created significant challenges for the rail industry. One major issue is the lack of tank-car availability. “The current order backlog for tank cars extends to the second quarter of 2014,” Henry said. “This tight market has also led to tank-car lease rates four to five times higher than [those of] any other rail car.”

The number of crude-by-rail facilities being built has also increased significantly: five years ago, none of the 16 current facilities existed. Even pipeline companies have made substantial investments in crude-by-rail terminals. “Bakken Oil Express, for example, has approximately \$100 million invested in [its] facility,” Henry said.

Dakota Plains Holdings Inc. is focused on developing and owning transloading facilities, Henry reported, as well as marketing and transporting crude oil and related products to various oil refineries. Through its wholly owned subsidiaries, Dakota Plains currently participates in three joint ventures to market, transload, and transport crude oil. In 2013, Dakota Plains expects to transload 11 million barrels of Bakken oil, truck 5.5 million barrels, and market 13 million barrels. “Our next step is to get into pipelines so we are covering the entire crude oil supply chain,” Henry said.



Crude oil is brought to rail terminals by truck, then put on trains with tank cars stretching more than a mile.

Panel:

Implications of New Energy Resources on Freight Transport in the Upper Midwest

Moderator: *Mark Berndt*, Associate, CDM Smith

Understanding and Calculating Shale-Oil-Related Traffic

Jack Olson, Assistant Director, Planning and Asset Management Division, North Dakota DOT

Getting a single Bakken oil well up and running takes a lot of material and a tremendous amount of activity. The impact of this activity on area roads, and other resources, will only increase if in addition to the nearly 7,500 active Bakken wells currently operating, 35,000 to 50,000 more wells are drilled in the next 15 to 20 years as experts predict. “Already, there is an unbelievable amount of traffic moving 24 hours a day [in the drilling areas],” Jack Olson said.

Fracking a shale oil well requires approximately 1,150 one-way truck trips to bring in—and then remove and relocate—thousands of tons of sand and millions of gallons of water and chemical solvents, Olson explained. Approximately 25 percent of the truck movements involved in the process exceed legal road weight limits. These heavily laden semi-trucks do, on average, 26,000 times more damage to the road surface than a passenger vehicle.

Bakken oil drilling sites are primarily accessed by county highways and local roads that were designed for local and farm-to-market traffic. “Nearly 95 percent of the Bakken wells are more than a quarter mile off the state highway, so definitely, all of this traffic and extra heavy loads are having quite an impact on the area road system,” Olson said. If all the oil produced by a Bakken oil well is trucked to a rail transload facility (rather than transported via collection pipeline), the well will generate another 3,000 truckloads during its first 20 years. “Some wells are predicted to be in production for 45 to 50 years,” he said.

Upgrading North Dakota’s transportation infrastructure, much of which was originally constructed in the 1950s, has become a priority at the state level. The North Dakota DOT is developing a regional traffic model for the 17 northwestern counties of the state that have been the most overwhelmed by the current oil and gas boom. The DOT will later extend the traffic model statewide. “This model will help us predict highway project timing and investments,” Olson explained.

Thanks largely to its booming oil business, North Dakota’s economy is surging—and because of it, the state has money available for road infrastructure improvements. In North Dakota’s last legislative session, \$226.8 million was designated for state highway projects, \$140 million for county and township roads, and \$60 million for other miscellaneous projects above and beyond the normal amounts coming from the North Dakota highway distribution fund and federal aid. All totaled, a billion dollars of state money will be put into North Dakota roads in the next biennium. “This is way beyond anything we anticipated,” Olson said. “Our federal aid program is about \$240 million a year, so we’re looking at \$500 million a year in roads in North Dakota above the levels at which we used to fund them.”



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— Maria Hart

Frac Sand Mining in the Upper Midwest

Maria Hart, Researcher, Center for Freight and Infrastructure Research and Education, University of Wisconsin-Madison

For the process of hydraulic fracturing, not just any old sand will do—and Wisconsin has some of the best frac sand in the country. “Wisconsin has more than 100 frac sand mines with issued operating permits; about one-third of those are in operation,” Maria Hart said. “Wisconsin frac sand is being transported all over.”

Moving all of this sand to market exacts a heavy toll on Wisconsin’s rural roads. To understand the impacts of frac sand mining on roads, Hart said, one has to understand how and where frac sand is processed. Before shipment, the sand is washed, sorted, and dried. Each of these operations has different roadway impacts. For example, an operation with the sand mine, processing plant, and rail access all in one place has less impact. “On the extreme side, there may be a mine in one location with a processing plant somewhere else, and a rail loadout facility in yet a different location, which will obviously cause more road impacts,” she said. “And these movements may not be contained in one single county, but rather spread across two or three counties.”

Specific Wisconsin state statutes give local governments the tools necessary to manage roadway impacts associated with the construction of traffic-generating enterprises such as sand mines, Hart explained. Several counties have programs to shift the burden of road upgrades and maintenance to the frac sand companies. In Chippewa County, for example, new businesses go through a traffic impact assessment and pay the county upfront for needed road improvements, she said.

Because frac sand trucks are tough on roads, Chippewa County also charges companies for exceptional maintenance; that is, work that goes beyond what the public normally pays for, such as increased snowplowing or more frequent pavement repairs. These details are spelled out in road use and maintenance agreements (RUMAs), she said. Such agreements made with the sand companies were the result of extensive research examining experiences in other states. Chippewa County has now become a model for road agreements in other Wisconsin counties affected by the growing frac sand industry.

Despite the general success of road use agreements in getting sand mining companies to pay for many road upgrades and repairs, these agreements do not cover every roadway. Hart described the case of one sand mine whose processing plant was not operational, so the mining company was trucking its sand from Chippewa County to Minnesota for processing. “No one was really watching those haul routes, and the impact from all of the added traffic fell off the radar,” she said. “The question is, how do we assess and keep track of roads affected by the frac oil boom that are ruled by different jurisdictions?”

The state of Ohio, which is also experiencing significant new development in areas thought to be rich in gas and oil, addressed this issue in part by developing a model RUMA that can be applied statewide. This model agreement was developed with input from county and township officials, railroads, the oil and gas industry, ODOT, ODNR, the Ohio Emergency Management Agency, and other stakeholders. “The group took the model agreement to their legislators who in turn created legislation that became part of the checklist to be included in the conditional use permits,” Hart said. There is some pending litigation around this model agreement; it’s not perfect, she added, but the main point is that all of the parties came together to discuss what would be fair and workable to all of the stakeholders.



Energy-Related Cargo at the Port of Duluth-Superior

Ron Johnson, Director, Duluth Seaway Port Authority Trade Development

The Port of Duluth-Superior has established a global reputation for seamless transport of oversized cargo, including energy-related cargoes such as wind turbine components, Ron Johnson said. By volume, logistics experts rank the port among the top 10 in North America for transloading wind turbine components. With blades half the length of a football field, towers rising hundreds of feet in the air, and motors weighing in the tons, the turbines are difficult to transport. “Minnesota aims to be a model for moving these products,” he explained. “We work closely with MnDOT to help us coordinate movement and get the turbine parts delivered. MnDOT has a good model for working with both the carriers and the Port Authority.”

In addition, increased numbers of gas turbines and generators are being moved through the port. “We’re moving more and more of these turbines, which are huge and heavy; they require special trucks and special rail,” Johnson said.

The Duluth-Superior port, which is at the crossroads of three major highway systems and four Class I railroads, is ideally situated for moving shale-oil-related cargo in and out of the heartland as well. The port handled some Russian ceramic proppant (pellets that prop open fissures in shale) about a year ago. “It came in by ship and was transported by rail to western North Dakota,” Johnson explained.

“We’re also handling calcium chloride, which...is being used in the North Dakota oil fields as part of the fracking fluid,” Johnson said. Previously, this calcium chloride was sent by rail from a plant in Michigan to North Dakota, and the rail cars were sent back to Michigan empty. “That meant a lot of lost transit time,” he said. “But really, an intermodal approach makes the most sense, and today, the calcium chloride is sent from Michigan via huge tank barge, then run via rail from Duluth-Superior to North Dakota and back.”

“Minnesota aims to be a model for moving these [wind turbine] products.”

— Ron Johnson



Turbine equipment being moved on a Duluth street

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— Richard Stewart

Panel:

Impacts and Innovations of Energy Resources to the Private Sector

Moderator: *Dan Murray*, Vice President of Research, American Transportation Research Institute

Greener Fuels for the Shipping and Rail Industries

Richard Stewart, Professor, Business and Economics Department, and Director, Transportation and Logistics Research Center, University of Wisconsin-Superior

Greener fuels are gaining steam in the shipping industry. One reason is a long-planned environmental regulation requiring ships to use cleaner, low-sulfur fuel while operating off U.S. coasts, Richard Stewart said. The regulation, which took effect on August 1, 2012, imposes sulfur limits on marine fuel, typically the most polluting of all oil products. Ships are now required to use fuel containing no more than 1 percent sulfur when within 200 miles of the coast. (The previous level was 3 percent.) Beginning in 2015, sulfur limits will be further reduced to 0.1 percent, he said.

These changes will necessitate ship operators either to switch to low-sulfur fuel and incur the associated operating costs to do so, or to install post-combustion exhaust gas cleaning equipment (scrubbers) on their vessels to clean heavy fuel exhaust gases. “I understand putting scrubbers on a large merchant ship will run into the millions of dollars,” Stewart said, “plus the cost of disposing the hazardous material generated from the scrubbing process.”

Another option is modifying ship engines to consume liquefied natural gas (LNG). According to Stewart, Europe has used LNG-fueled ships for more than a decade. “These ship engines burn cleaner and have reduced maintenance costs by 20 percent,” he explained. “And the reduction in nitrogen oxide emissions from these ships equals the removal of 160,000 cars running for one year.”

The rail industry also has looked into using LNG, but without much success thus far, Stewart continued. “In the 1990s, BNSF experimented with LNG and estimated [it] could save \$200 million a year in fuel—even at the more expensive LNG prices of the past—by converting its entire locomotive fleet of engines. However, because the LNG supply chain was not mature, BNSF could not get fuel and did not make the move to LNG.”

Even today, the LNG supply chain is relatively immature. Generally, existing natural gas liquefaction plants are not designed to sell to the transportation industry as a whole year-round. “We’ve been working with the Duluth Seaway Port Authority to determine what is necessary to establish a liquefaction plant in the Twin Ports area that could take advantage of the existing pipeline, transit, mining, trucking, rail, and marine transportation infrastructure there,” Stewart said.

About 60 years ago, both the marine and rail industries changed from coal to oil—a shift that required a new supply chain. “When these industries switched from coal to oil, there were a lot of public and private incentives to do so,” Stewart said. “In order for companies to adopt a fuel change today, there must be incentives in the form of tax relief or grants.”

And while most shippers support greening their respective supply chains, Stewart added, “We need them also to offer some sort of preferred carrier program or provide another sort of incentive that recognizes the high upfront capital costs to do this. Otherwise there will be no reason for carriers to shift to the cleaner, greener, cheaper fuel, and shippers will go for the low-cost carriers and destroy the market base.”



Compressed vs. Liquefied Natural Gas for Fleets

Don Horning, Vice President of Sales, Clean Energy Fuels Corporation

While some are calling natural gas “the next big thing...a revolution in energy...a game changer,” its use is really not new to transportation, Don Horning said. Clean Energy Fuels Corporation started using compressed natural gas (CNG) in 1997 in taxis, airport shuttles, transit buses, and refuse vehicles. “Today, we have more than 400 public and private fueling stations and serve nearly 700 fleet customers with about 25,000 vehicles a day running on natural gas,” he said. “We’re on a run rate to do about 200 million gallons of natural gas this year.”

As a service, Clean Energy offers fleet operators the ability to run multiple simulations using different parameters to determine which fuel type—CNG or LNG—is best for their needs. “We can plug in a number of different factors and create different scenarios to show [fleet operators] how switching from diesel to natural gas would impact their business, how much it would cost to do so, and when the company could see a return on its investment,” Horning said.

Driving range is an important consideration in the decision making. Approximately 70 percent of the fuel Clean Energy sells is CNG, which is a good choice for fleets that return to base each day. In contrast, Horning said, “LNG is a better fuel for the over-the-road market, partially because it takes half the space that CNG does for the same range. It also weighs less, so it’s not displacing revenue-producing shipments, and trucks can carry more payload.”

Infrastructure is another factor. “There is a larger CNG infrastructure for light- and medium-duty vehicles, with simple fuel systems that work very much like gasoline systems,” Horning said. There are two types of CNG filling stations: a fast fill that matches the 12- to 15-minute diesel fueling rate, and a time fill that costs less but takes 8 to 12 hours. “The higher the cost of the fuel, the faster it will dispense,” he added.

On the flip side, Horning continued, there is a much larger LNG infrastructure for over-the-road trucks, and stations can provide a faster fueling experience that does not affect hours of service. “LNG also is typically cheaper and cleaner than CNG,” he said. However, LNG fueling is a bit more complicated and requires some special handling and use of personal protective equipment.

In January 2012, Clean Energy announced that it would build 70 LNG fueling stations across the country, and it has plans for another 80 stations in 2013. “We’re looking at stations every 250 to 300 miles on the major interstates, and [we will] continue to build that out even further around the distribution center clusters around the U.S. and even around the intermodal yards,” Horning said.

Kwik Trip’s Plans for Natural Gas

Joel Hirschboeck, Superintendent of Transportation Operations, Kwik Trip, Inc.

The Kwik Trip, Inc. convenience chain is a leader in fueling solutions, including the use of alternative fuels. Natural gas “is now coming on board for transportation because it is domestically abundant,” Joel Hirschboeck said. “It is an environmentally friendly, safe, and economically viable fuel. Since fuel costs are a transportation provider’s number one challenge, [switching to natural gas] is one way to significantly reduce those costs, sometimes by as much as 50 percent.”

North America holds the largest-known reserves of natural gas in the world, Hirschboeck continued. “Looking at natural gas shale, claims are there is at least a 100-year supply. Those predictions are driving natural gas prices way down. From 2009, when hydraulic fracturing started going strong, there was a decoupling of natu-

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— Don Horning



“Many...fleet operators are beginning to understand the economic and environmental benefits of natural gas and starting to make a move in that direction.”

— Joel Hirschboeck



“We ... have streamlined the flow of materials to reduce product transit miles wherever possible.”

— Judy Ohannesian

ral gas prices from the petroleum products,” he said.

As diesel prices continue to climb, natural gas has maintained a national average of \$2 per gallon. “Kwik Trip is selling CNG at a gasoline gallon equivalent for \$1.79. Convert that to a diesel gallon equivalent, and that’s about \$1.99 compared to more than \$4 per gallon for diesel,” Hirschboeck said. Several prominent fleet operations, including Fastenal, DART Transit, Mills Transfer, and Menards, are already using Kwik Trip natural gas. “Many other fleet operators are beginning to understand the economic and environmental benefits of natural gas and starting to make a move in that direction,” he said.

The Kwik Trip natural gas program comes down to a retail experience that must meet or exceed diesel experiences with similar fill times, a similar point-of-sale/dispenser, and easy truck access, Hirschboeck continued. “Kwik Trip is getting into the public market and really trying to make a difference to what’s available to the end user,” he said. “We currently have eight CNG stations open in Wisconsin and Minnesota...By this time next year, we plan to have 30 CNG stations up and running in Minnesota, Wisconsin, and Iowa. We’re really focused on connecting the dots—taking every sizable market, every sizable corridor running through our operating area, and putting CNG stations where necessary to enable regional fleet operators to start doing en route fueling.”

Kwik Trip is already fueling a portion of its own fleet vehicles with CNG, Hirschboeck said, adding that the company does not plan to purchase any more diesel equipment. From March 2012 through September 2012, Kwik Trip’s original 10 CNG-fueled vehicles realized a fuel savings of more than \$100,000, he reported. “So far we’ve displaced more than 78,000 gallons of diesel; our ROI on these vehicles is about 1.5 years. Over the life of these original 10 trucks, we expect \$1.2 million in savings,” he said.

Environmental Sustainability at Deluxe Corporation

Judy Ohannesian, Fulfillment and Sustainability Director, Deluxe Corporation

Deluxe Corporation in St. Paul, one of the top check producers in North America, is a \$1.4 billion company with locations in the United States, Canada, and Ireland. The company now offers a wide range of products and services for small businesses, financial institutions, and personal check consumers. In addition to diversifying and expanding its range of services, Deluxe also has been working toward achieving a level of environmental sustainability. “We have many plants and call centers around the country,” Judy Ohannesian said, “so we need to consider our energy management and the way we move things into and out of our plants...Since 2007, we have reduced our energy use by nearly half.”

Deluxe first started its drive toward green by making some investments in more efficient lighting systems. In other cases, Deluxe capitalized on what Ohannesian called the “opportunistic decisions” a company can make, such as when it replaced a facility’s black roof with a white material that reflects about 90 percent of the sun’s rays. “We’ve also made a lot of the obvious changes regarding logistics directly,” she said. “We have entirely a third-party strategy and do not own a private fleet. We converted from truckload only to intermodal where feasible on our high-volume lanes, primarily from the Midwest to the East and West Coasts, and have partnered with carriers who are making sustainable investments in their equipment.”

“We also have streamlined the flow of materials to reduce product transit miles wherever possible,” she continued. “In 2007, we changed the format of our personal check products from a three-dimensional parcel to a flat parcel. This has helped dramatically reduce our logistics spending, packaging costs, and energy related to packaging use.”