Shale Play Industry
Transportation Challenges, Changes, and Opportunities

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Wisconsin Department of Transportation
(in association with Minnesota DOT)
Lower 48 states shale plays

Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011
Shale Play Industry

• It is three related, but yet independent industries:
  – Fracture Sand Industry
  – Oil Industry
  – Gas Industry
Transportation: Challenges and Opportunities

• Challenges
  – High volume commodities flows in and out of shale plays
    • Sand In....Oil and Gas Out
  – Remote areas with minimal or no existing infrastructure
  – Existing infrastructure vastly undersized for the success of shale play results

• Opportunities
  – Evolution of needs and solutions
  – Solution to one problem creates opportunity for other successes
  – Multiple layers of economic growth opportunity
Fracture Mining...Where It Starts

Hydraulic Fracturing

Hydraulic fracturing, or “fracing,” involves the injection of more than a million gallons of water, sand and chemicals at high pressure down and across into horizontally drilled wells as far as 10,000 feet below the surface. The pressurized mixture causes the rock layer, in this case the Marcellus Shale, to crack. These fissures are held open by the sand particles so that natural gas from the shale can flow up the well.
HYDROFRACKING A WELL

Fluid pressure fractures the rock, sand grains keep the fractures open
The best ‘frac’ sands are derived from the St. Peter, Jordan, Ottawa, and Wonewac formations in Wisconsin, Minnesota and Illinois, the Oil Creek formation in Oklahoma, and the Hickory sandstone in Texas.

Source: Professional Logistics Group
The district’s sandbox

Existing and proposed frac sand mine operations

Sources:
Mine locations: State and county permitting records; industry contacts / Sand deposits: U.S. Geological Survey / Rail data: Minnesota and Wisconsin departments of transportation
Fracture Sand Industry

- Extracting the sand from the ground.
- Transporting raw sand from mine to processing plant.
- Processing the sand to proper gradations for fracture mining use.
- Possibly resin coating the sand for high strength
- Transporting from processing to transload
- Transporting bulk volume via Class 1 RR or barge to shale plays
Fracture Sand Production and Demand

• Current Wisconsin & Minnesota production at 28-30 Million tons/year (90% Wisconsin)
• Estimated long-term demand, 34-50 MMT/Yr
• Current processing capacity on line in WI and MN already in excess of 50 MMT/Yr.
• Life of current Shale Oil & Gas exploration trend is minimum of 25 year and maximum of ???
• Volume of sand resources – 100+ Years or more
Industry Stabilization 2012

• Rate of new sand production slowed dramatically in 2012 as supply equaled demand.

• Stabilization - Both Demand and Supply Factors
  – Gas and Oil Commodity Pricing
  – Finite Demand
  – Rapid supply side expansion
  – Constantly evolving technology
Stabilization Verification

Correlation of Operating Rig Count with Sand and Crude Shipments

STCC 14413 (sand) and 13111 (petroleum)  Data sources: US Rail Desktop, Baker Hughes
The Business Model

KEY FACTORS

1. Connections within the Energy Market
2. Access to Rail
3. Capital Investment
4. Minimize “First Mile” costs
The Business Model in Real Life
Construction started and completed in 2012
Wisconsin Results

- 2,800 direct jobs – 100 jobs per Million Tons/Year (WisconsinWatch.org)
- Average wage, $18-20 per hour (trucking, maintenance, machine operator)
- Direct Wages - $140 Million/Year or $5M per Million Tons
- Total Cost to Mine and Process = $15 – 40 per ton
Local Investments

- Processing Plants - $20-70 Million each
- Resin Coating Plant - $100 Million
- 150-300 Construction jobs/plant
- Infrastructure (Electric, gas, water, roads, rail)
- Local trucking
- Secondary service jobs
- 6-10 secondary jobs for each primary job
  (Wisconsin Workforce est. – 30,000 new jobs – 2012)
Shale Play Oil Industry
A Look at the Baaken

• 2-3 Unit Trains of Fracture Sand In....Per Day
• 9-10 Unit Trains of Oil Come Out...Per Day
• 1 Million Barrel/Day in near future
• 70% of all oil is trucked from well site to pipeline or railroad transload hub. (FedGazette)
• Baaken crude is ‘discounted’ $5/barrel to make it cost competitive with WTI due to logistic costs. That is $4M/day loss.
Railroad vs Pipeline Oil Race
The Fed Gazette

- Railroads went from hauling 6% of oil in 2010 to 60% in 2013.
- Oil output will outpace pipeline capacity until 2015.
- Shipping oil by rail costs $10-$15/barrel while shipping by pipeline only costs $5/barrel.
- BNSF alone spent $197M in 2012 to increase to 1 Million BPD capacity.
- Pipeline capacity to double by 2012 to 1.2 Million BOPD.
- $10 Billion on pipelines in the past year, which is four (4) times the previous seven (7) year average.
- Enbridge joined with BNSF to increase capacity eightfold at its Berthold pipeline head.
Shale Play – Gas Industry

• Most people assume there is only one thing called ‘natural gas’.
• In truth, ‘natural gas’ is a universal term covering a broad array of carbon based gas products.
• Been a two-edge sword for shale play industry
  – Abundance of natural gas lowered prices to point that fracture mining solely for gas was uneconomical.
  – Help create a renewed market for ‘wet gas’ products
‘Wet Gas‘ vs ‘Dry Gas’

• ‘Wet gas’ is commonly referred to as Natural Gas Liquids or NGL.
• They include propane, benzene, ethane, pentane, and are extracted from natural gas through cooling and pressurization techniques.
• These are critical products in plastics, home heating, synthetic rubber, gasoline refining, and alternative vehicular fuels. i.e. feedstock.
• When ‘wet gas’ has been removed, methane becomes the predominant remaining dry gas and is what is primarily used in power plants.
Shale Play Gas Industry
A Look at the Baaken

- Gas accounts for 25% of energy output but only 13% of well value.
- ND flares 30% of the natural gas from its wells
- NGL make up 8.9% of every barrel of oil
- Profit spread on each barrel of NGL
  - $10 in 2000-2007
  - $26 in 2008-2009
  - $41 in 2011
  - $55-$60 in 2012-2013
- Now a means to help offset logistic costs and eliminate the $4/barrel discount on Baaken crude oil.
- NG prices back up to $4/MBTU from record low of $2/MBTU last year.
Gas In the Baaken
The Fed Gazette

- In last 18 months, # of well selling gas rose 45%
- Oneok, New Frontiers, and Hess along will combine for over $1.1B in NGL production expansion from 2012-2015.
- Pipeline capacity doubling between 2012 and 2014. Although 1/3 of existing pipeline still has capacity.
Gas as Transport Fuel

- LNG
- CNG
- Rail
- Trucks
- Ships
- Ferries
- Buses
- Cars
Challenge: Conversion & Distribution

Proposed Nationwide LNG Fueling Network

Shell and TravelCenters of America plan to develop a nationwide network of liquefied natural gas (LNG) fueling centers for heavy-duty road transport customers.

Sites will be developed in a phased approach, based on customer demand and are subject to change.
Other Factors in Play

• **Distance to market:** NGL users are predominantly in Gulf Coast. Marcellus (biggest field) on East Coast, new finds in California, Baaken in Midwest

• **High quality:** light, sweet Bakken; “Rich, wet” Marcellus & Utica gas - high BTU & natural gas liquids – chemical feedstocks (isobutane, ethylene)

• **Environmental benefit:** ½ of coal carbon emissions, slow greenhouse gases in short term

• **Lower cost for US industry:** fuel & chemicals

• **Extensive reserves:** “energy independence by 2017”; major improvement in trade balances
Significant Changes in Logistics

- Reduced Coal moves thru state (-4 trains/day in MN) as gas replaces coal in power plants
- Similar offsets in barge, Laker traffic
- Similar traffic changes in Texas, Oklahoma, Kansas, Pennsylvania, Ohio, Wisconsin
- Nationwide the drop in coal trains exceeds the gains in sand and oil transport by rail.
Gas-Driven Technology Changes

- “Gas-to-Liquid” (GTL) plants to convert natural gas to liquid fuels – diesel and jet fuel
- New interest in rail electrification
- High-speed ships & ferries – gas turbine power
- Decline in thermal coal production & end of “clean” coal power generation new-builds
Thank You.

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