PLG

Professional Logistics Group

Oil & Natural Gas: The Evolving Freight Transportation Impacts

Prepared for

Northwestern University Transportation Center

Northwestern University Transportation Center

Business Advisory Committee Meeting

October 31, 2012 Evanston, IL

About PLG Consulting

- Boutique consulting firm specializing in logistics, engineering, and supply chain
  - Established in 2001
  - Over 80 clients and 200 engagements
  - Significant shale development practice since 2010

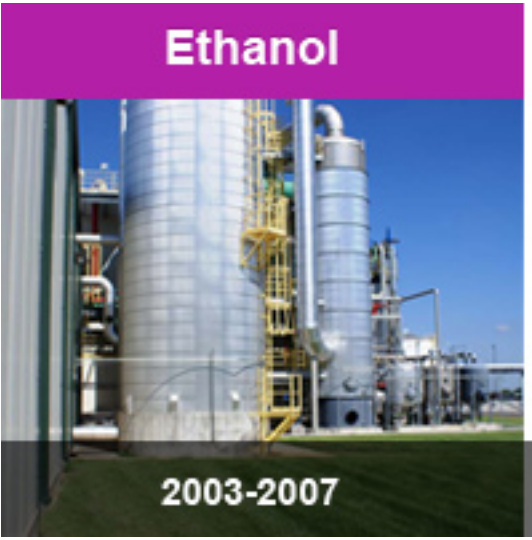
- Headquarters in Chicago USA, with team members throughout the US and with “on the ground” experience in:
  - North America / Europe / South America / Asia / Middle East

- Consulting services
  - Strategy & optimization
  - Assessments & benchmarking
  - Transportation assets & infrastructure
  - Logistics operations
  - M&A/investments/private equity

- Specializing in the logistics of
  - Oil & gas
  - Chemicals & plastics
  - Wind energy & project cargo
  - Bulk commodities (minerals, mining, agricultural)
  - Industrial & consumer goods

The Shale Development Gold Rush

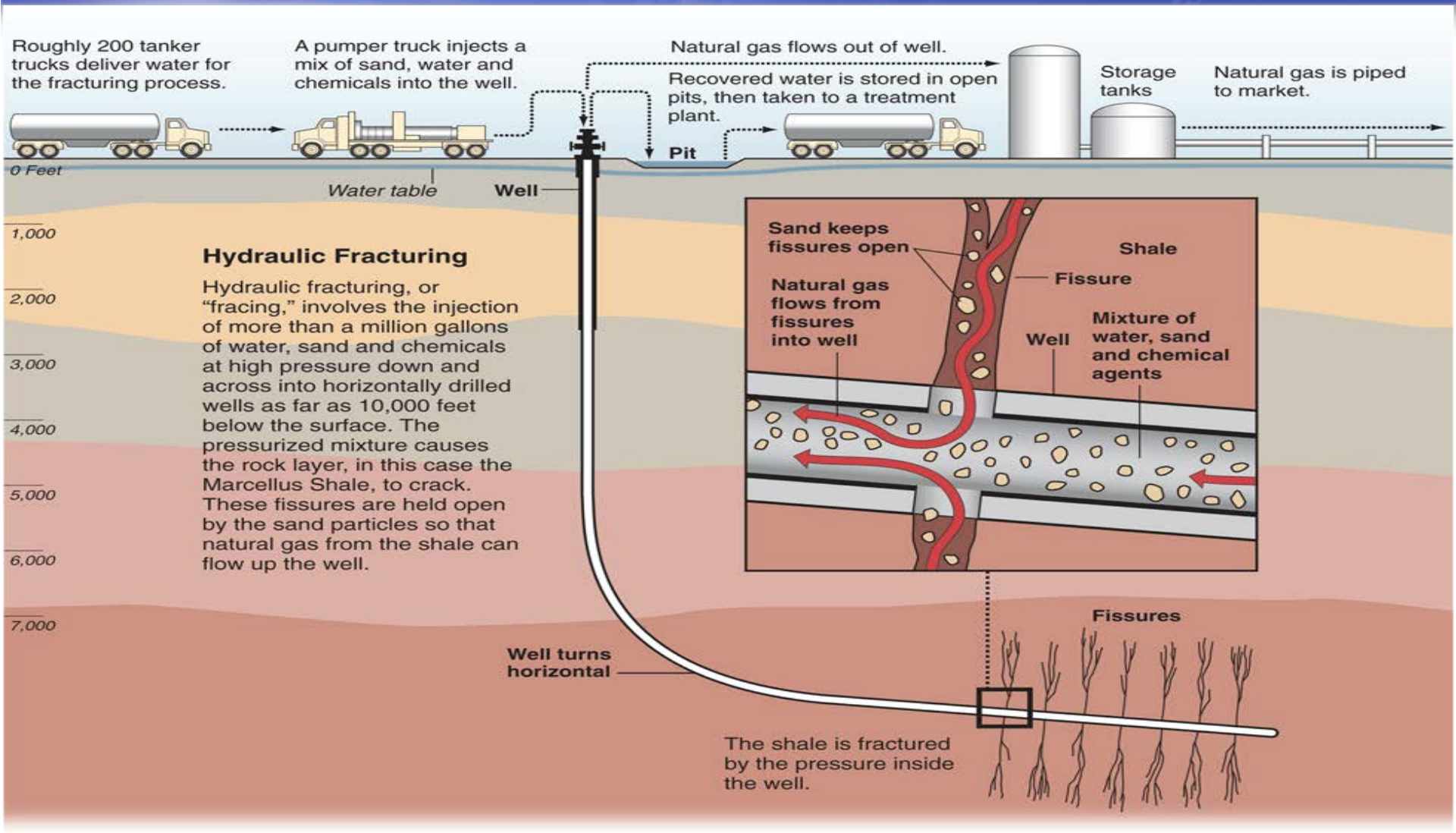
» Other recent energy “boom” events with major transportation impacts



» Common characteristics

- New technology breakthroughs and/or dramatic market shifts
- Speed to market is paramount
- Rush of capital and new players
- **Continuous change and evolution in both technology and markets**
- **Logistics and related infrastructure of greater importance in shale development, and therefore a major platform for competition and strategy**

Hydraulic Fracturing and Horizontal Drilling



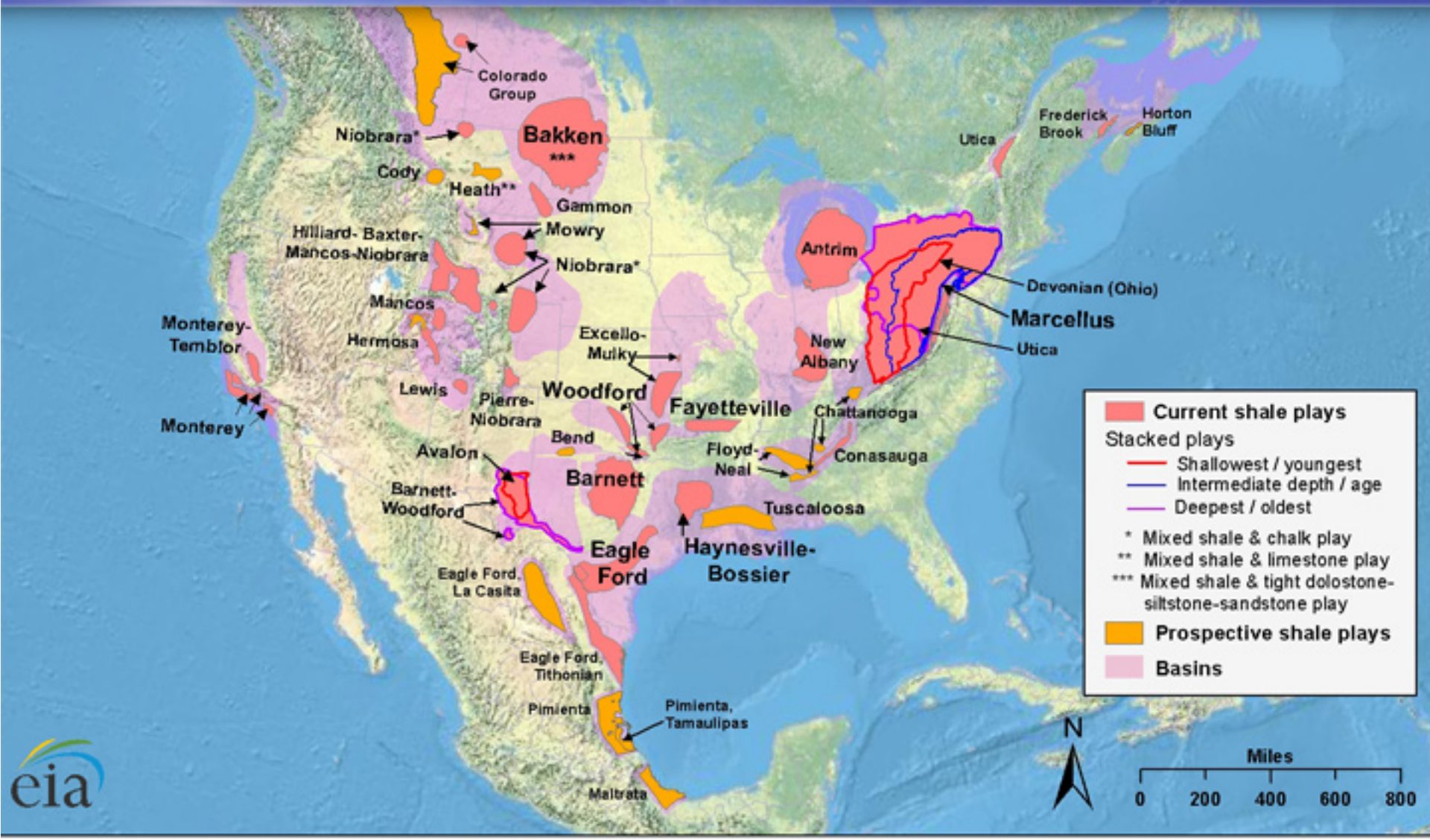
Source: NPR.org

Graphic by Al Granberg

Hydraulic Fracturing Equipment Staging Area

Source: JPTOnline.org

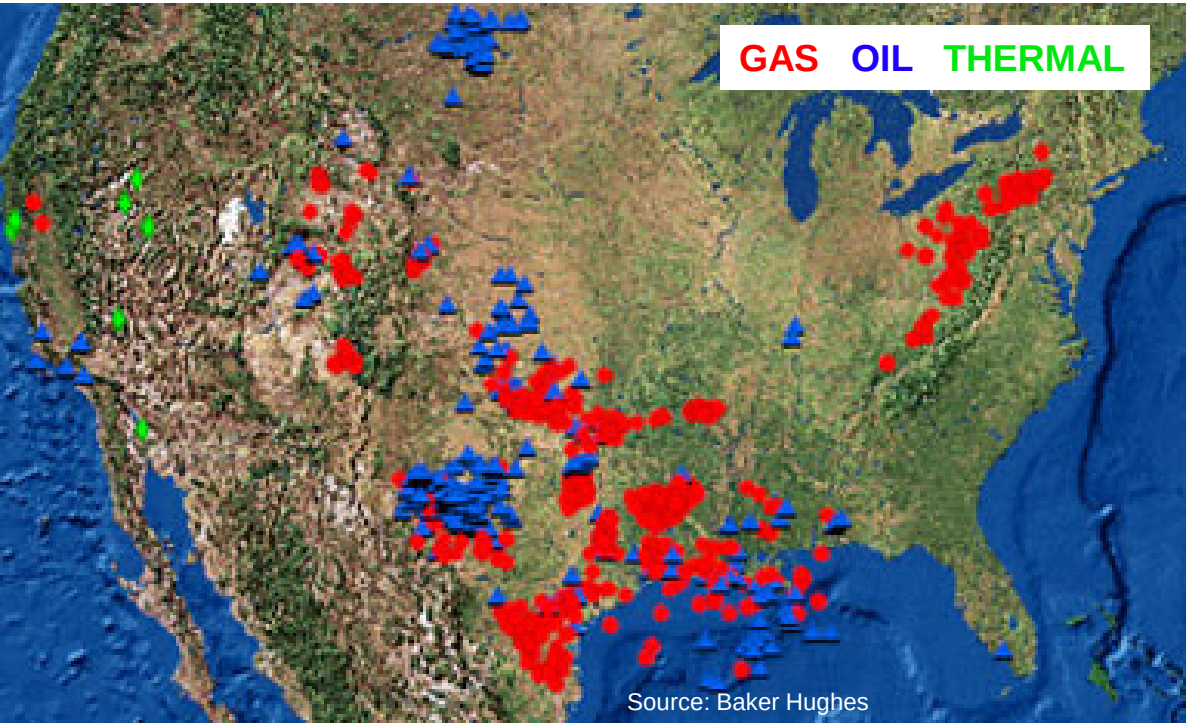
North American Shale Plays



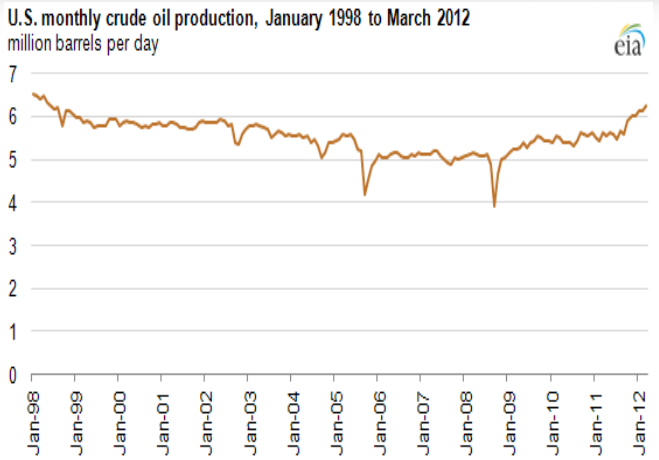
Source: U.S. Energy Information Administration based on data from various published studies. Canada and Mexico plays from ARI.
Updated: May 9, 2011

Shale Driving Growth in Natural Gas and Crude Oil Production

- 1,839 rigs in operation as of October 19, 2012
- Rush of capital into the industry
- 700% increase in shale gas production since 2007
- Domestic oil production at 14-year high (6MM bbl/d)
- "Unconventional" becomes "conventional" by 2015

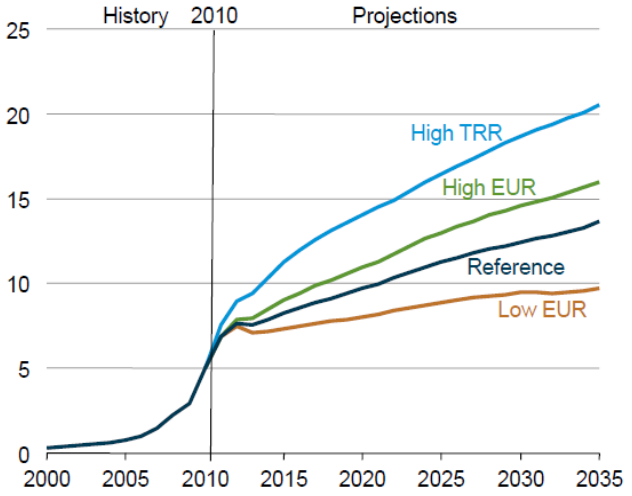


Source: Baker Hughes



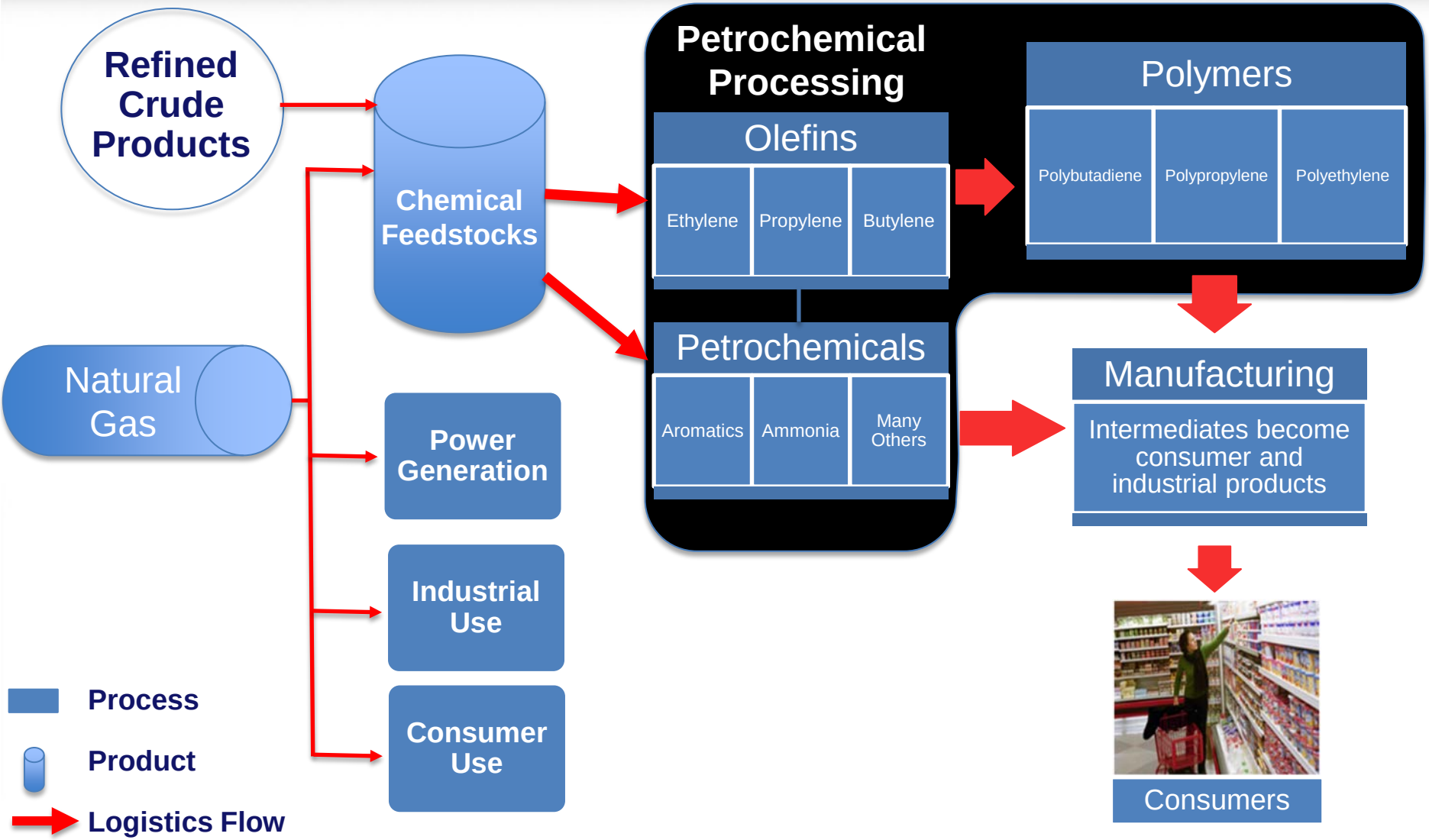
Source: EIA 2012

Figure 56. U.S. production of shale gas in four cases, 2000-2035 (trillion cubic feet)



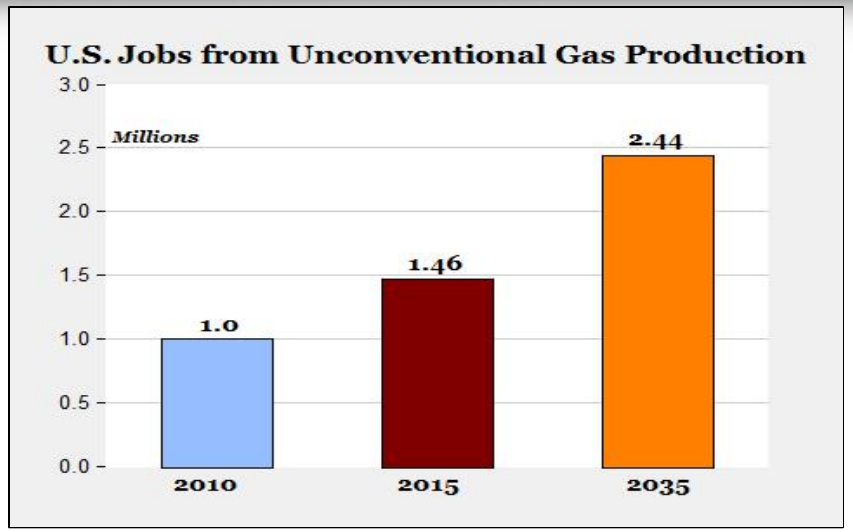
Source: EIA 2012

Natural Gas & Petrochemical Supply Chain

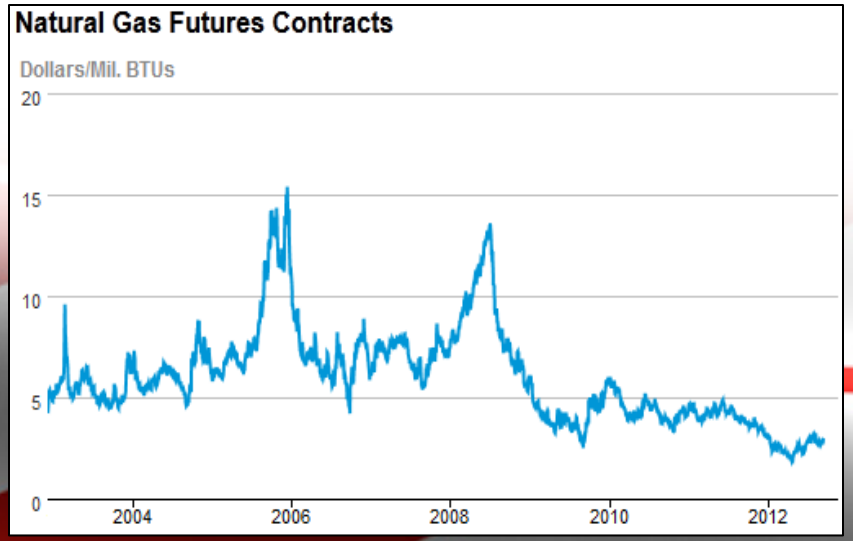


Benefits Go Beyond Energy

- Shale development a “net win” for United States
  - Highly advantaged NGL cost structure vs. rest of world (ethane vs. naphtha)
  - Creates strong, long-term export market for US polyethylene and other petrochemicals
  - Abundant natural gas benefits domestic manufacturing
    - Lower electricity prices
    - Lower feedstock costs
  - Jobs creation
  - Trade deficit reduction



Source: IHS



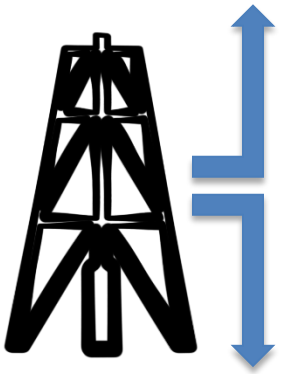
Source: American Chemistry Council, EIA

Hydraulic Fracturing Materials Inputs and Logistics – Per Well

Materials	Source to Transloading	Transloading to Wellhead Site
Proppants	40	160
OCTG (Pipe)	5	20
Chemicals	2	8
Clean Water/ Cement	Local source	~1,000
	47 Total Railcars	~1,200 Total Truckloads

Waste Water

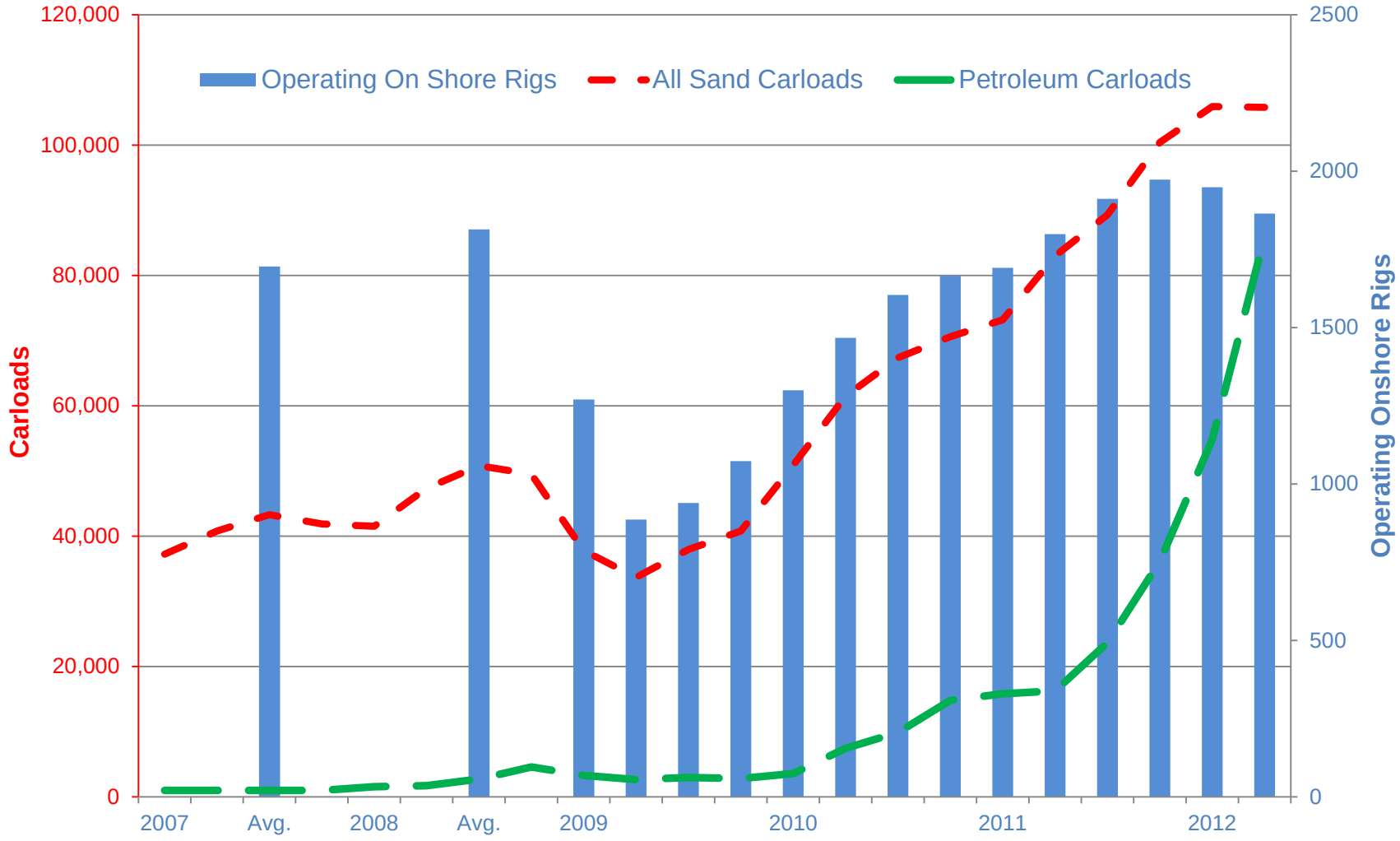
~500 Total Truckloads



Oil/Gas/NGLs

Truck, Rail, Pipeline

Correlation of Operating Rig Count with Sand and Crude Shipments

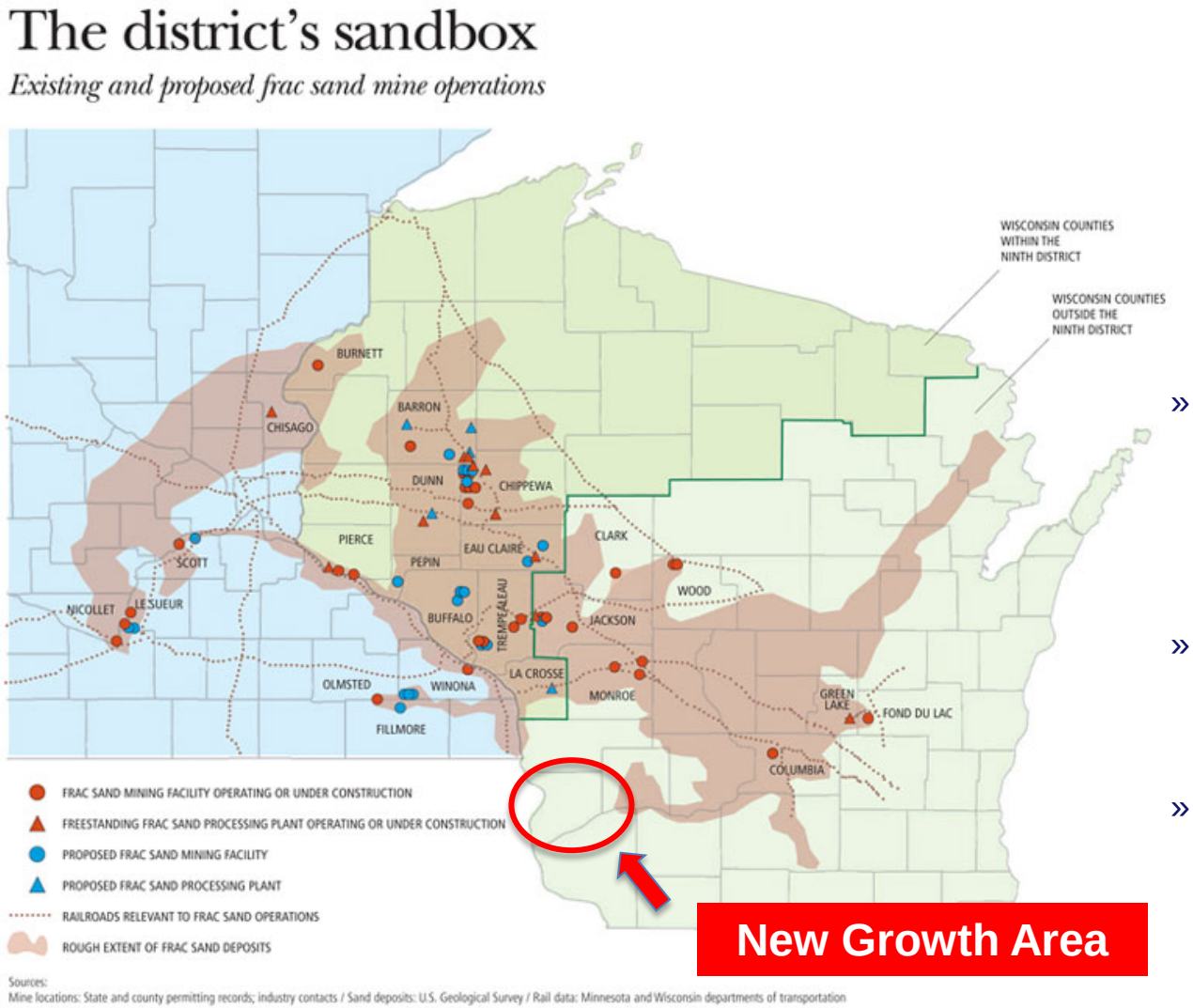


STCC 14413 (sand) and 13111 (petroleum) Data sources: US Rail Desktop, Baker Hughes

All Sand Handled by Railroad

STCC 14413 Source: US Rail Desktop

Sand Mining Continues to Expand



New Growth Area

- Proppant processing and shipping activity growing rapidly in Western and West Central Wisconsin counties
  - Chippewa
  - Barron
  - Trempealeau
  - Jackson
  - Monroe
  - Crawford
- New announced projects
  - Superior Silica Sand – Clinton, WI
    - $35MM main line rehabilitation by CN
  - U.S. Silica – Sparta, WI
  - Smart Sand – Oakdale, WI
  - Pattison – Prairie du Chien, WI
- Minnesota areas also active
  - Southeastern border along Mississippi River
  - Western Twin Cities
- Established Illinois companies seeing significant upturns in volumes and financial returns

Source: Federal Reserve Bank of Minneapolis, July 2012; PLG analysis

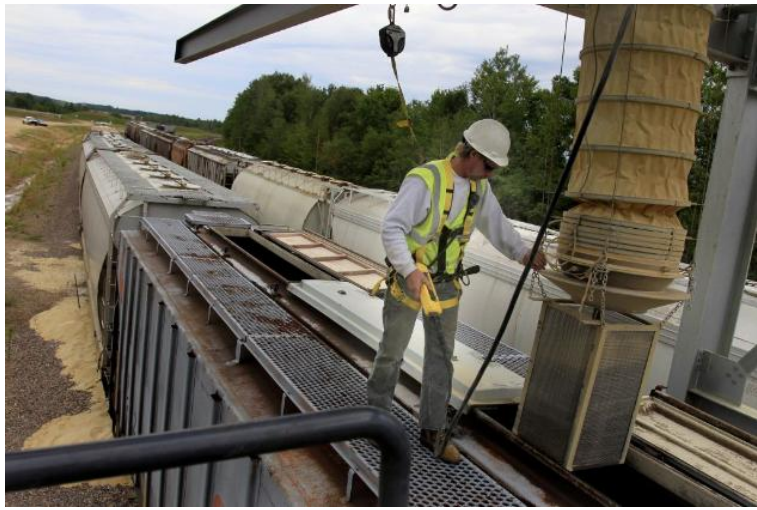
Changes in Rail Shipment Pricing Q3 2011 vs. Today - Sand

- Since Q3 2011, have seen an overall rail price increase of 10 - 14% in public pricing (varies by corridor)
- In the 600-1,300 mile range, rates vary from $0.045 - $0.074 per ton-mile for manifest shipments
- Shippers who are willing to ship unit trains and make volume commitments have realized significant savings with longevity over public pricing
- Western carriers are driving single line hauls to Eagle Ford via pricing differentials
- Canadian and Eastern carriers are aggressively working to grow their markets by providing very competitive pricing and securing sand originations
  - CN/Superior Silica Sands – Poskin, WI
- Major sand providers are establishing “in the play” transloading facilities to provide ready access to product
  - U.S. Silica - East Liverpool, OH

Source: PLG analysis

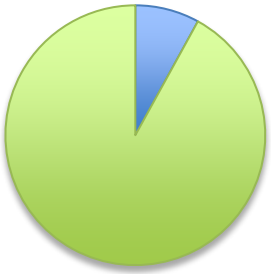
Sand Railcar Market Conditions

- **New-build market has run its course**
  - Much smaller backlog
    - 3Q 2011: 10,000 cars, ten month wait
    - Today: no significant wait
  - Significant drop off from ~15,000 new cars per year
  - No new spec building by lessors – all deal specific now
  - Lower pricing
  - Some new cars going into storage
- **Lease market also post-peak**
  - Existing 286K cars available now
  - Cars with sub-optimal specs (grain, <286K, cement) are being phased out of frac sand fleet
  - Creditworthiness an important criteria
- **Long-term horizon**
  - No sign of cement market return, easing pressure on small cube hopper cars
  - “Rational” vs. gold rush conditions

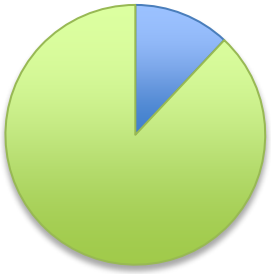


Logistics Cost as a Percentage of Product Value – Frac Sand

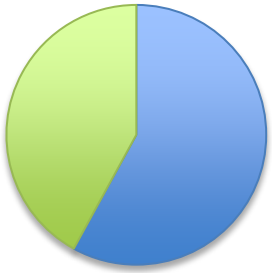
- Frac sand is highly sensitive to logistics costs relative to past energy "booms"
- As frac sand costs are decreasing, rail freight rates are increasing



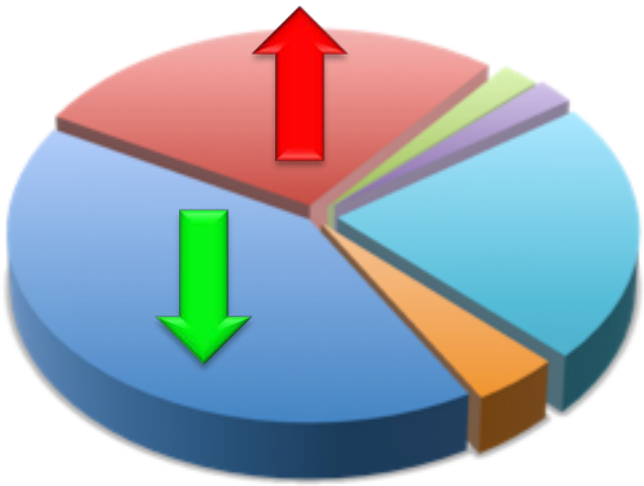
Ethanol 8%



Wind turbine 12%



Frac sand 58%



Representative logistics costs for example sand price of $180/ton

Source: PLG analysis

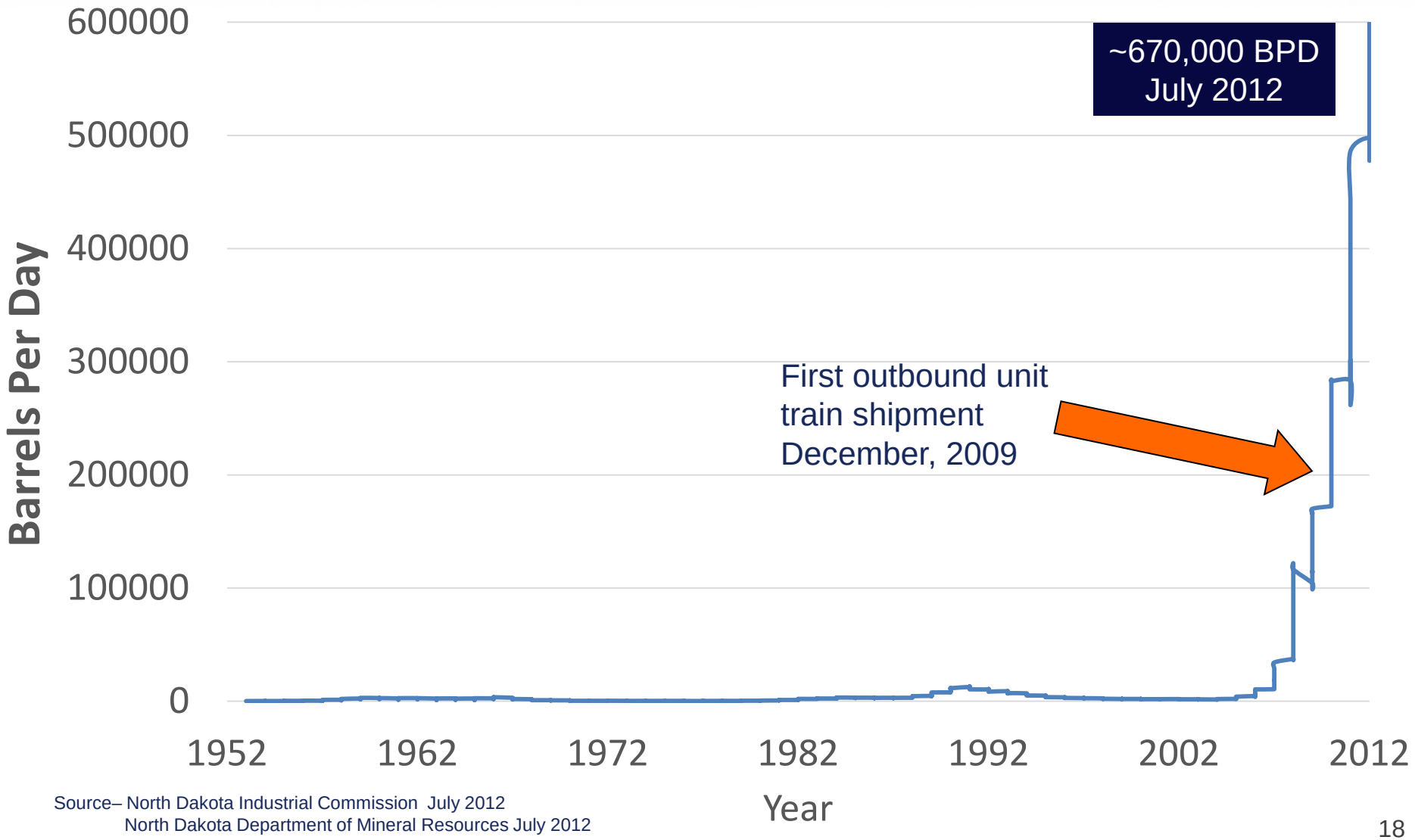
Shale Play Product Flows Outbound

» Natural Gas
- Majority via pipelines, some trucks

» Natural Gas Liquids (NGLs)
- Requires processing (fractionation)
- 3-9 gallons/MCF (thousand cubic feet)
  - **Ethane 63%**
  - Propane 22%
  - Butane 8%
  - Pentane 5%
  - Other 2%

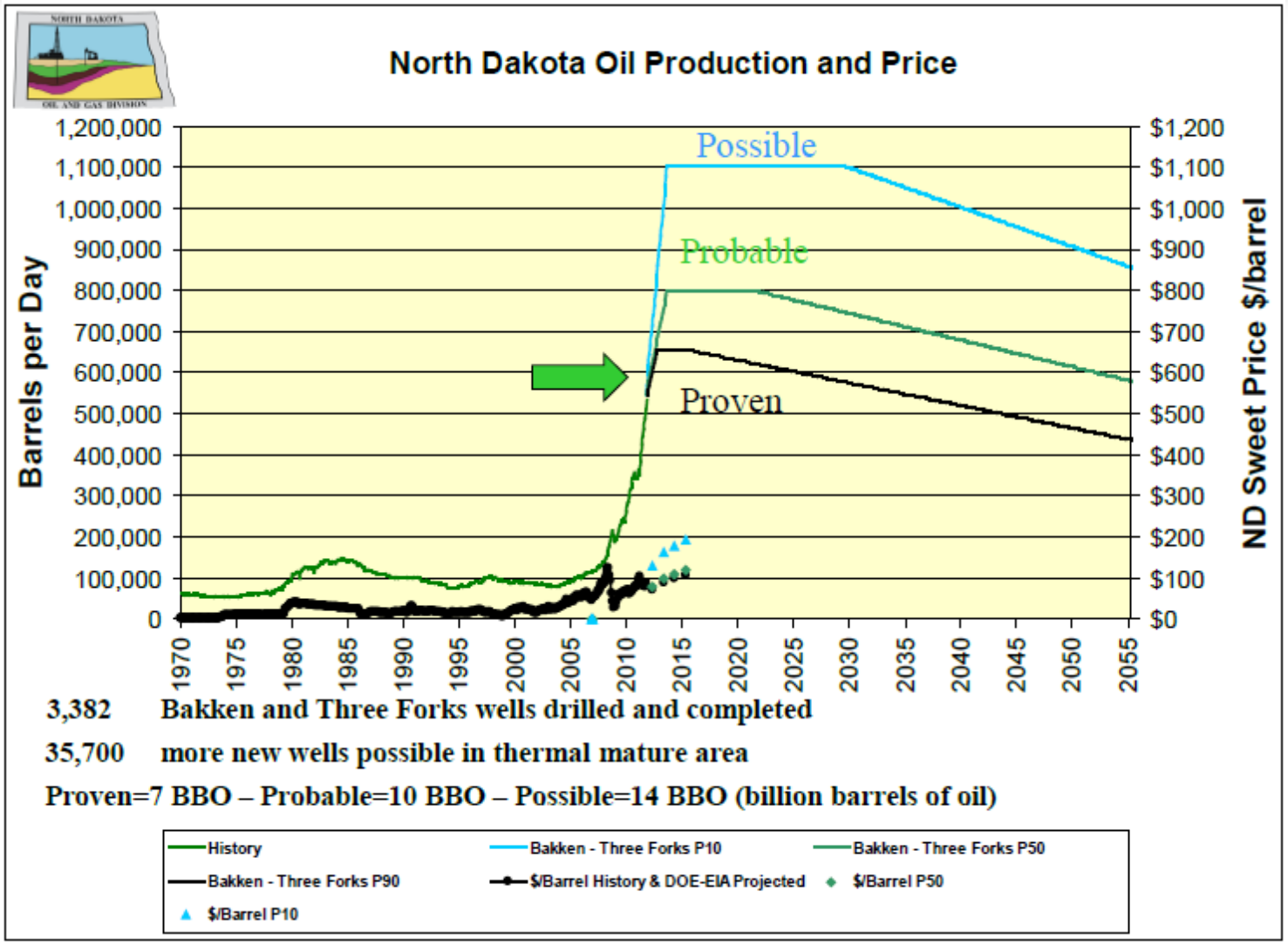
» Crude Oil
- Bakken play as a model
- Strong potential for Utica play (currently 2-3 years behind Bakken)

Bakken Oil Production - History



Source– North Dakota Industrial Commission July 2012
North Dakota Department of Mineral Resources July 2012

Bakken Oil Production - Forecast

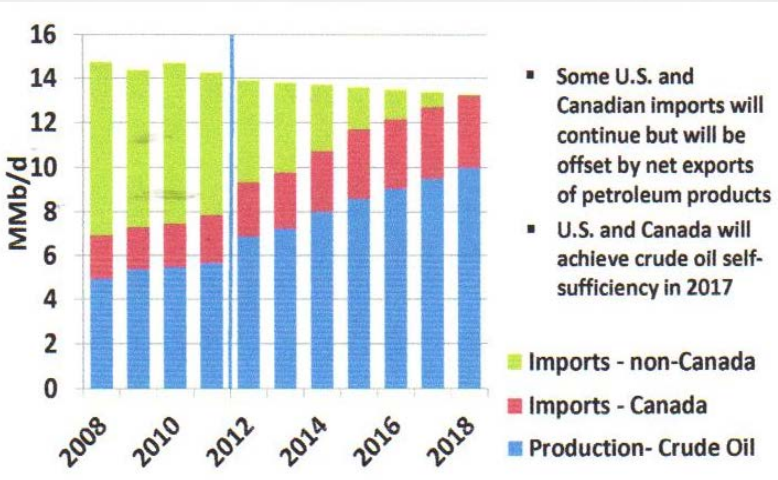


Source: North Dakota Oil and Gas Division May 2012

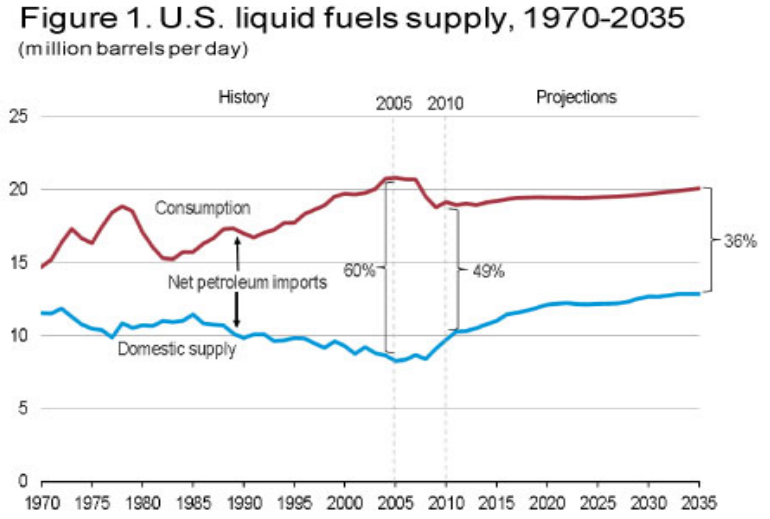
Bakken vs. Peer Crude Oils

- Bakken oil is a light, sweet crude with low sulfur content and low viscosity
  - Requires less downstream processing
  - Equal in quality to benchmark WTI
  - Higher gas, jet, and distillate yield than peer crudes

- Already a "game changer" in global oil market
  - Bakken and WTI trading at ~$20/bbl less than Brent
  - Increased unit train receiving capacity (St. James, Pt. Arthur, Cushing, Albany, Philadelphia, California, St. John, NB, Anacortes, WA) coming on line to displace waterborne crudes
  - Some analysts forecasting Canada and US crude oil self-sufficiency and prices well below global levels by 2017



Source: RBN Energy 2012



Source: EIA 2012

Bakken Crude No Longer "Stranded" Due to Logistics

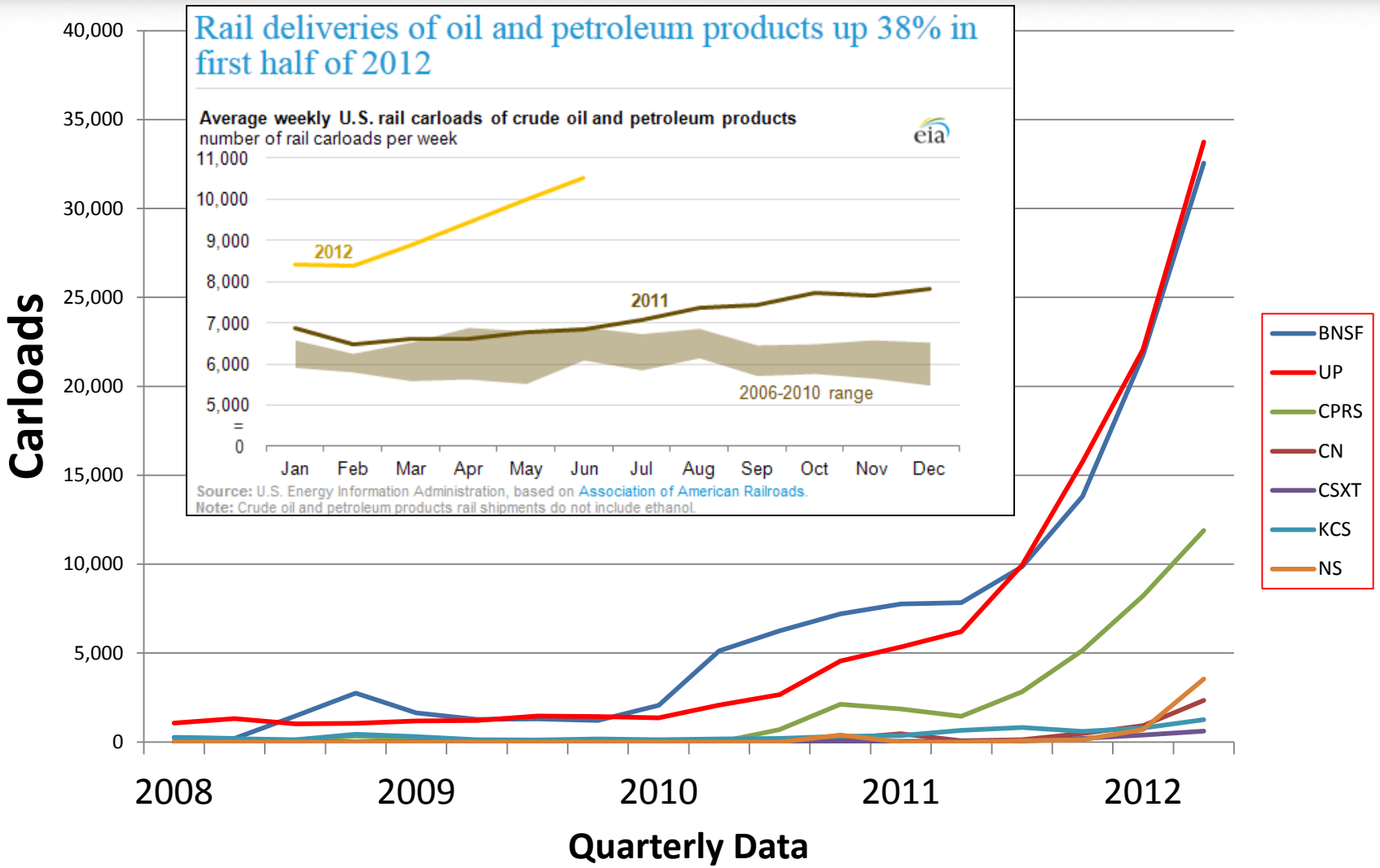
- Change in past 12 months
  - November 2011:
    - 2012 Bakken discount vs. WTI have ranged from $8-12 bbl
    - Undervalued due to logistics constraints "stranding" the oil
  - October 2012:
    - Bakken now priced evenly with WTI due to improved logistics
- Significant expansion of crude by rail terminal capacities in 2011- 2012
- Crude by rail now a major market factor
- Tank car availability/lead time - major short term entry barrier
  - Current order backlog runs to 2Q 2014
  - Major purchases by oil majors and midstream companies
  - Extremely tight market with very high lease rates

	Crude by Rail Share	ND Production (bpd)	Crude by Rail (bpd)
Dec. 2010	**15%**	273,800	41,070
Dec. 2011	**23%**	470,290	108,167
June 2012	**40%**	610,000	244,000
August 2012	**48%**	635,127	317,564

Source: North Dakota Industrial Commission, PLG analysis

Bpd = Barrels per Day

Crude Oil by Rail Volume Growth



Source - US Rail Desktop

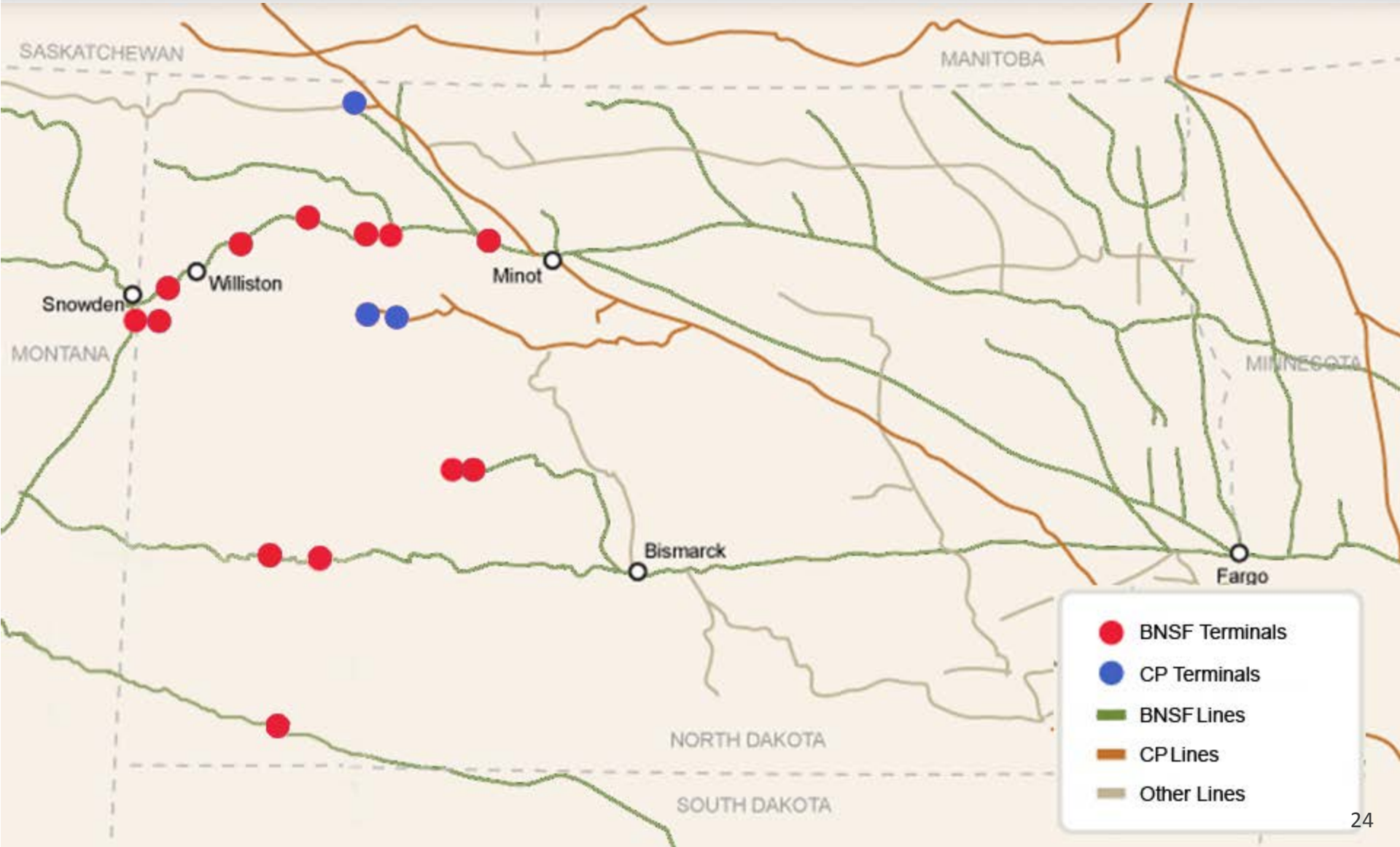
Crude Oil by Rail – North Dakota Terminals

(Existing and planned by December 2012)

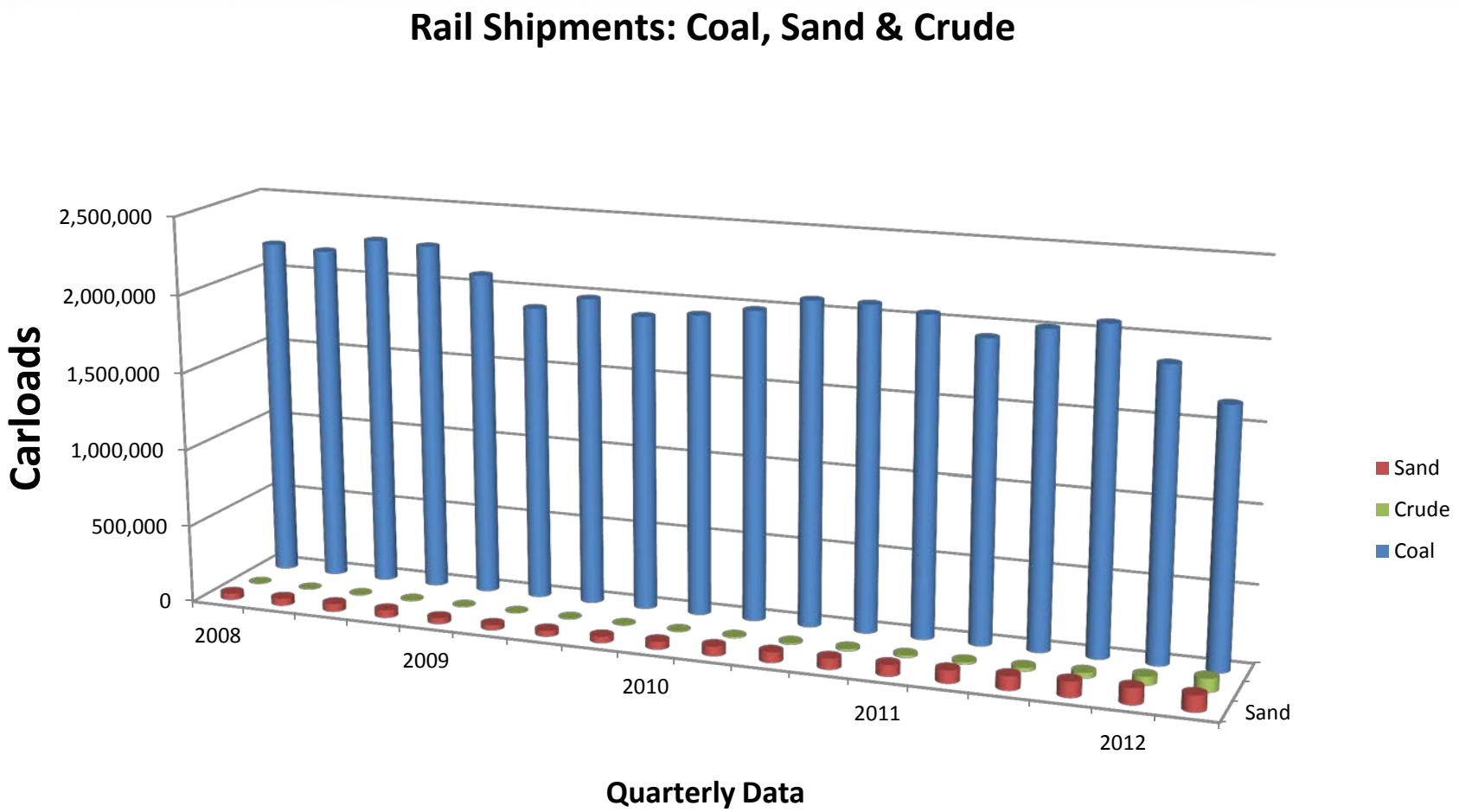
Facility	Location	Loading Capacity (Barrels per Day)	Rail Carrier
Musket Corp	Dore	60,000	BNSF
Savage Services	Trenton	60,000	BNSF
Red River Supply	Williston	10,000	BNSF
Hess Oil	Tioga	60,000	BNSF
Plains All American	Manitou	65,000	BNSF
Bakken Transload	Ross	10,000	BNSF
EOG	Stanley	65,000	BNSF
Basin Transload	Zap	20,000	BNSF
Bakken Oil Express	Dickinson	100,000	BNSF
Enserco	Gascoyne	10,000	BNSF
Rangeland	Epping	65,000	BNSF
Enbridge	Berthold	10,000	BNSF
Great Northern	Fryburg	60,000	BNSF
	BNSF Total Capacity	595,000	
Global	Stampede	60,000	CP
Dakota Plains	New Town	40,000	CP
US Development	Van Hook	35,000	CP
	CP Rail Total Capacity	135,000	
	Total Crude by Rail Capacity	730,000	

Source: PLG analysis

North Dakota Class I Railroads and Crude Oil Terminals



Shale Related Rail Traffic Still Small Relative to Coal Volumes



Source: US Rail Desktop

Crude Oil Pipelines – Existing and Future

Source – CAPP Report 2011

Bakken Area Outbound Pipelines

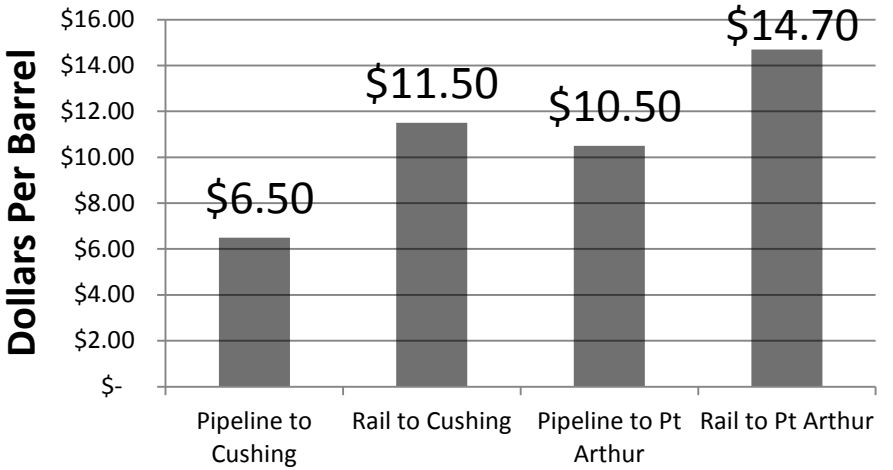
Current Capacity (Q2 2012) - 440,000 bpd			
Announced pipeline capacity expansions			
Company	**Project Name**	**BBL's/day Capacity**	**Expected in service date**
Enbridge	Berthold Expansion	145,000	1Q 2013
	Sandpiper	225,000	2015
Plains All American	Bakken North	50,000	1Q 2013
Saddle Butte	High Prairie	150,000	1Q 2014
Oneok Partners	Bakken Express	200,000	2015
Trans Canada	Bakken Marketlink	100,000	2015
	Keystone XL	830,000	2015?
	Total New Pipelines:	**1,700,000**	
NEW pipeline capacity expected operational:			
	2013	195,000	
	2014	150,000	
	2015	525,000	
	TBD (K XL)	830,000	

Bpd = Barrels per Day

Source: PLG analysis, North Dakota Governors Pipeline Summit June 14 2012 – presentation materials

Crude Oil by Rail vs. Pipeline

- Current pipeline options ~ 30-45% lower cost vs. rail
- Near-term offsetting rail advantages:
  - Site permitting, construction is much quicker and easier
  - Much lower capital cost and scalable
  - Shorter contracts
  - Transit to destination - 5-7 days via unit train vs. 30+ days via pipeline (between Bakken and US Gulf Coast)
  - Origin and destination flexibility/opportunistic to new market niches
- Long-term challenges that will affect rail volumes and margins:
  - Pipeline expansions
  - Bakken-WTI price equilibrium
  - Any significant narrowing of price differential between Brent and WTI



Source: PLG analysis

Bakken Production vs. Outbound Logistics: 2012–2014 Projection

Year	ND Production Forecast (Bpd)	Pipeline Capacity*	Rail Terminal Capacity	Rail Carrier Capacity	ND Refinery Consumption	Total Outbound & Refinery Capacity	Excess Logistics Capacity
2012	700,000	440,000	730,000	1,200,000	60,000	1,230,000	530,000
2013	790,000	635,000	800,000	1,300,000	60,000	1,495,000	705,000
2014	860,000	785,000	850,000	1,350,000	60,000	1,695,000	835,000

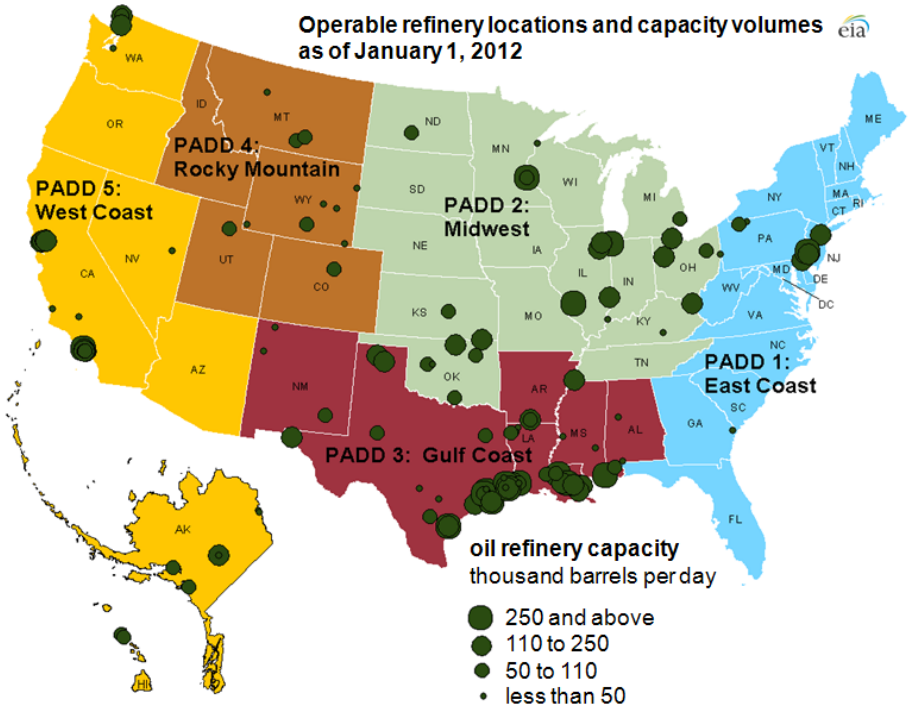
* Excludes Keystone XL

Bpd = Barrels per Day

Source: PLG Analysis

Crude Oil Logistics – Near Term Outlook

- Logistics capacity exceeds production and will continue to keep pace in future
- Crude by rail cost premium of .5x – 2.0x is not currently deterring volume moves
- Crude by rail is a key outbound logistics mode near-term; pipeline share of outbound Bakken production will grow annually and impact rail longer term (volumes and margin)
- Expected Seaway pipeline 250,000 bpd expansion in 1st quarter 2013 will relieve much Cushing congestion and likely will put additional pressure on railroad pricing to compete with expanded pipeline economics and availability
- Long term, the rail transportation cost premium will likely impact rail volumes as pipe vs. rail differential increases



Looking Ahead: Key Questions for Oil & Gas Supply Chain

» Shale play dynamics
- Influenced by supply/demand market fluctuations
- Crude vs. dry gas vs. NGL
- Potential environmental concerns

» Where are the destinations for further processing?
- Crude oil refineries – sweet vs. sour processing
- NGL fractionation
- Petrochemical manufacturing investments
- Increased CNG demand
- Crude, NGL, and LNG exports

» Will transportation services, assets, and infrastructure continue to meet demand?
- Pipeline locations and capacity
- Road and rail infrastructure
- Waterway availability
- Fleet assets
- Terminals and storage

Source: RBN Energy, LLC

Source: Waterborn Energy Inc. Data in $US/MMBtu

Thank You!

For follow up questions and information, please contact:

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