PLG Consulting

Logistics Engineering Supply Chain

North American Unconventional Energy Impact to Rail – "Game On"

Prepared for:

RAILTRENDS®

New York, NY

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About PLG Consulting

Boutique consulting firm with team members throughout North America

- Established in 2001
- Over 100 clients and 250 engagements
- Significant shale development practice since 2010

Practice Areas

- Logistics
- Engineering
- Supply Chain

Consulting services

- Strategy & optimization
- Assessments & best practice benchmarking
- Logistics assets & infrastructure development
- Supply Chain design & operations
- Hazmat training, auditing & risk assessment
- M&A/investments/private equity

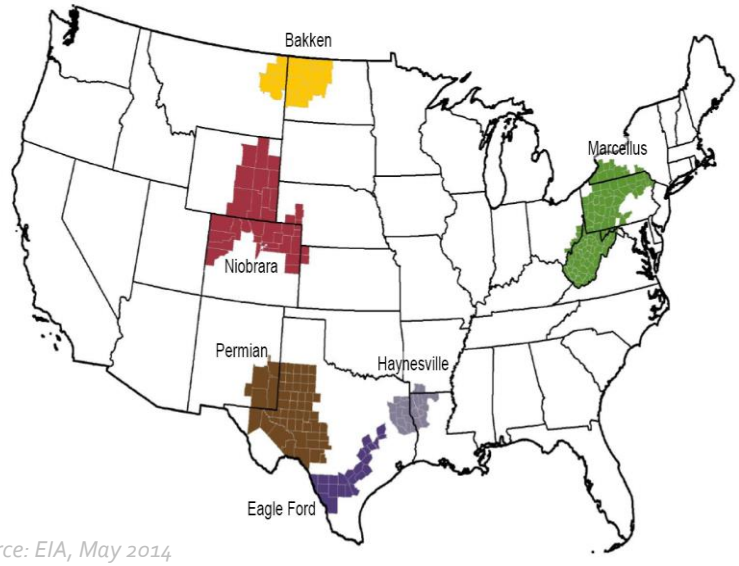
Industry verticals

- Energy
- Bulk commodities
- Manufactured goods
- Financial services

Partial Client List

Unconventional Energy Resources

US Major Shale Plays



Source: EIA, May 2014

- Innovative, new E&P technologies developed by smaller entities has allowed additional hydrocarbon production in new locations; each well <$10MM
- "Mass production" methodologies developed to lower costs
- **Challenges -> product variability and volatility**

Western Canadian (WC) Oil Sands

Source: CAPP, About Oil Sands, June 2013

- Multi-billion dollar capital investments required by a limited number of players to set up production infrastructure
- Open surface mining shifting to SAGD process will harvest more bitumen over long term
- **Challenges -> distance to markets and diluent**

What is Behind the North American Energy Revolution?

Recoverable Resources & Enabling Technologies

Resources
- N.A. shale plays
- Western Canadian oil sands

Technologies examples
- Hydraulic fracturing
- Horizontal drilling
- Steam Assisted Gravity Drainage (SAGD)

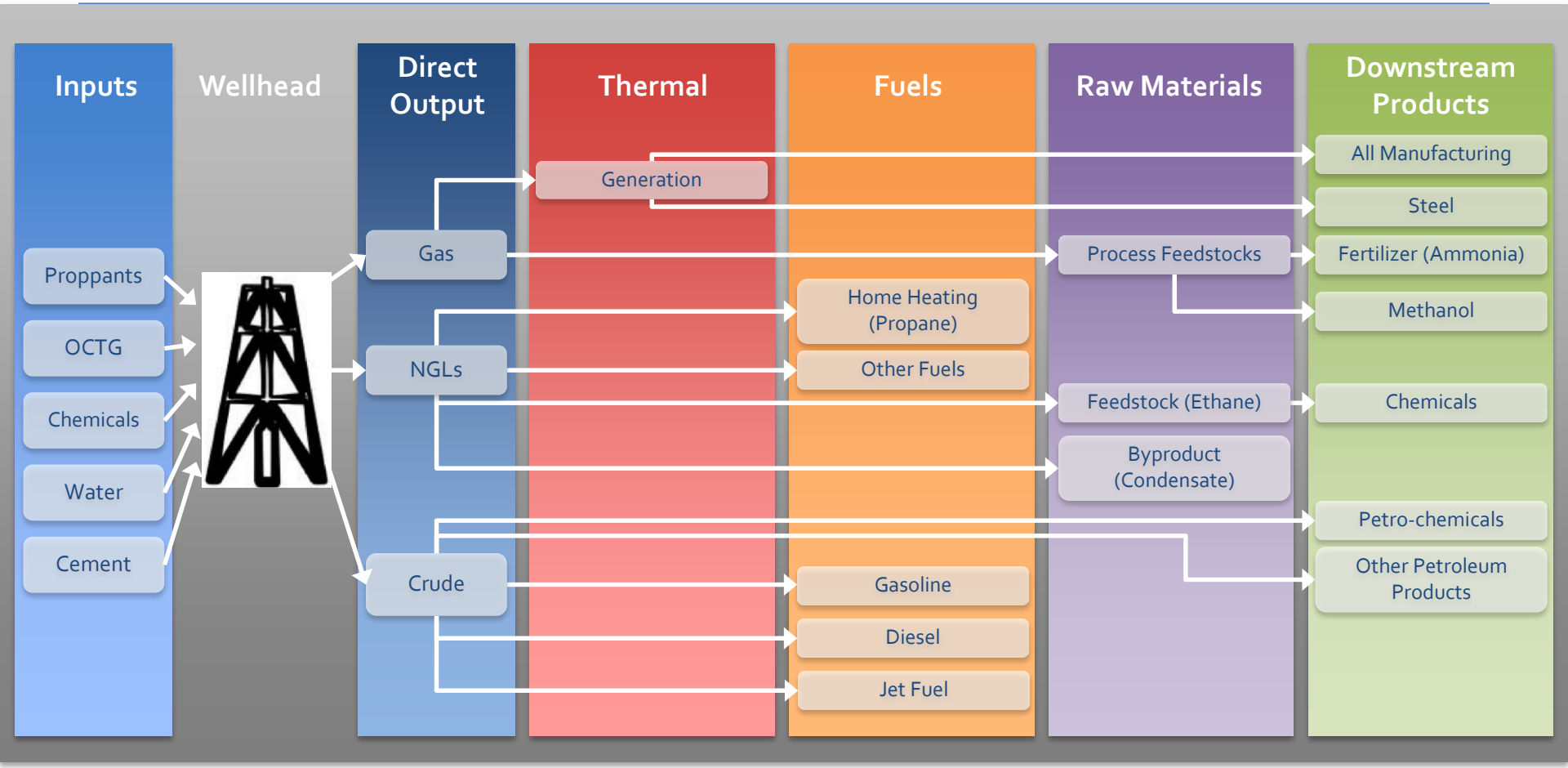
Continuous Improvement

- Evolving exploration and production technologies
- Tremendous productivity gains drives cost reductions and lowers breakeven levels
- Logistics infrastructure "re-plumbing" in progress

Energy Revolution

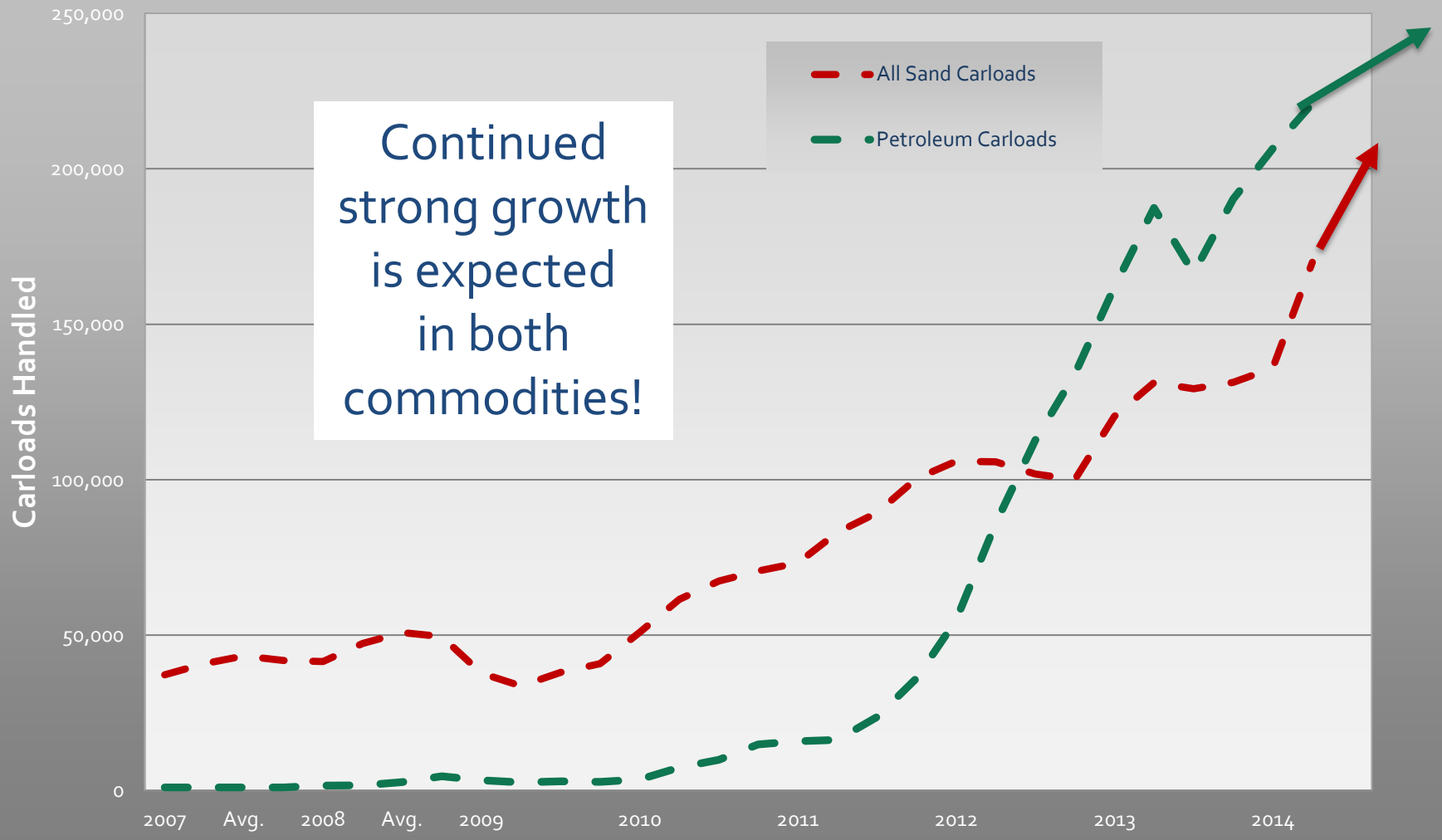
- Product abundance… overabundance
- Imports displaced… exports grow
- Recoverable resources grow…sustainability
- Globally competitive electricity and material cost structure
- Manufacturing industries grow/return to North America

Shale Supply Chain and Downstream Impacts



Availability of low cost hydrocarbons positively impacts all the North American industrial economy

U.S. Frac Sand and Crude Carloads Growth– The Race Has Just Begun!



STCC 14413 (sand) and 13111 (petroleum) Source: US Rail Desktop, Surface Transportation Board, PLG Analysis, October 2014

Awaiting U.S. DOT PHMSA Decision – Jan 2015?

Classification & characterization of mined gases and liquids (minimal)

- Was expected; most parties have already taken steps to tighten process

Rail routing risk assessment (minimal)

- Class 1's had already agreed to do this voluntarily
- Given limited options in some cases will not have significant impact to actual routings

Reduced operating speeds (minimal ~ large negative)

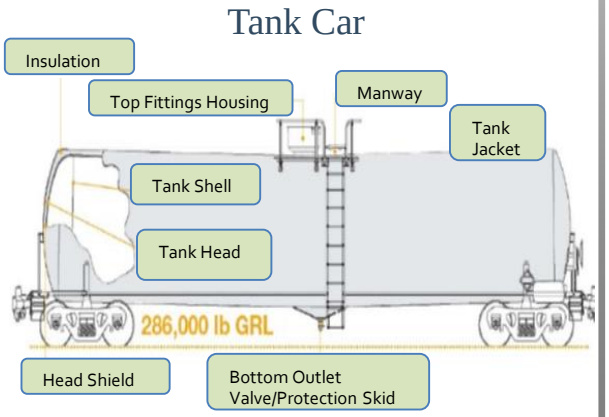
- 40 mph speed restriction for HHFT trains with any cars not meeting enhanced standard in:
  - High threat urban areas OR Areas of > 100k population OR all areas
- If "areas of >100k population" or "all areas" is selected this could have ***negative impact***

Enhanced braking (minimal ~ large negative)

- If ECP braking system is required it would require large investments and modifications

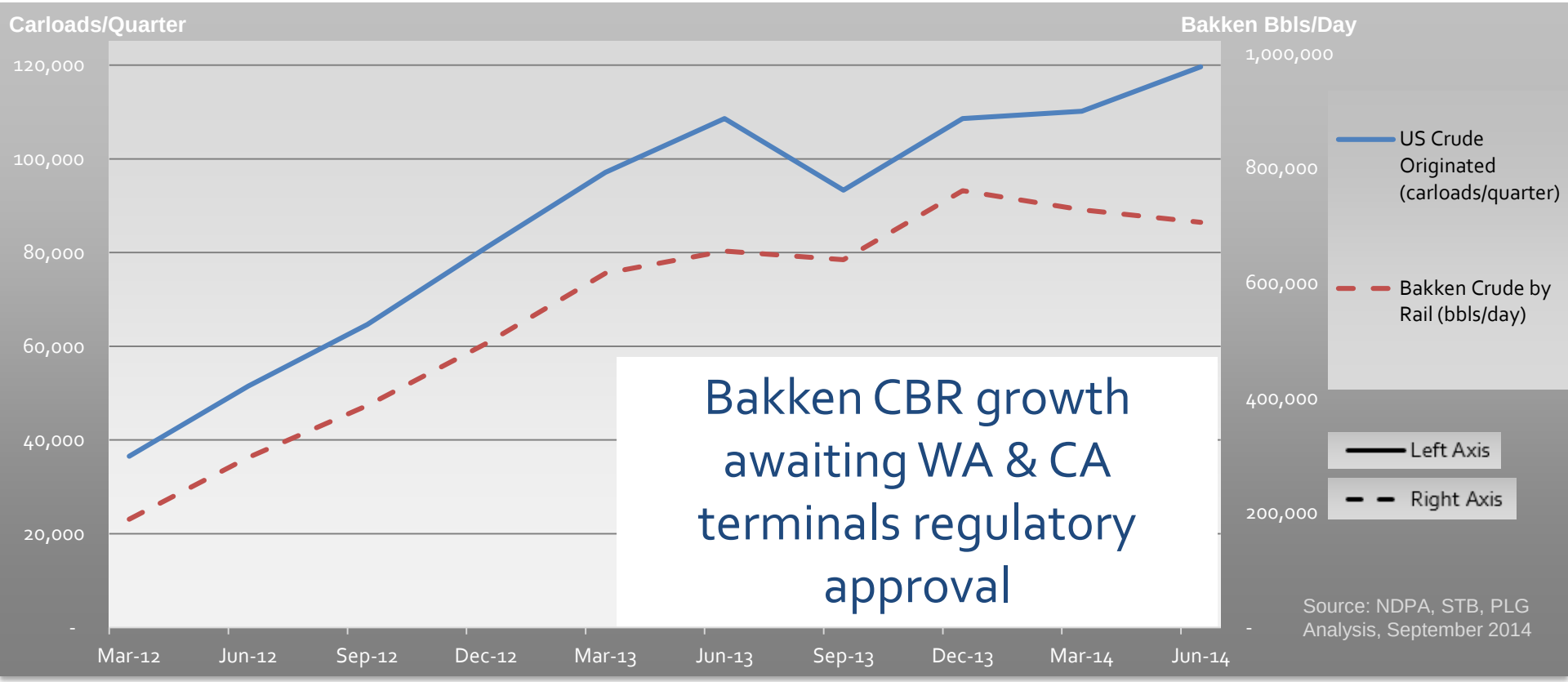
Three tank car options announced for HHFT trains (minimal ~ large negative)

- PHMSA and FRA Designed Tank Car, AAR 2014 Tank Car, Enhanced CPC 1232 Tank Car
- 2 with shell thicknesses of 9/16"
- NPRM expects existing 7/16" shells will meet new standard (9/16") by adding an additional 1/8" thickness to the retrofitted jacket (no grandfathering in mentioned in NPRM)
- Uncertainty on how many cars can actually have this performed and to what extent tank car owners will want to retrofit



Source: API with PLG simplification

US Crude By Rail 2014 Growth Analysis



Bakken CBR lower in 2014 than predicted due to:

- Railroad performance related to severe winter and large grain harvest
- Slowing of crude production during severe winter
- Decrease in CBR shipments to USGC due to pipeline expansion
- Delays in offloading terminals in PNW and CA caused by environmental and permit issues

Western Canada Oil Sands Production – Not The Bakken!

Oil (bitumen) recovery uses two main methods - mining and drilling (in situ)

- 20% of the Oil Sands reserves are close enough to the surface to be mined using shovels and trucks (3% of oil sands land area)
- 80% of the Oil Sands reserves will be recovered in situ by drilling wells (97% of oil sands land area)

Steam Assisted Gravity Drainage (SAGD) is most popular method

- Two parallel wells are drilled
- Upper well has high pressure steam continuously injected
- Lower well recovers softened bitumen

Diluent is added to the bitumen (15~30%)

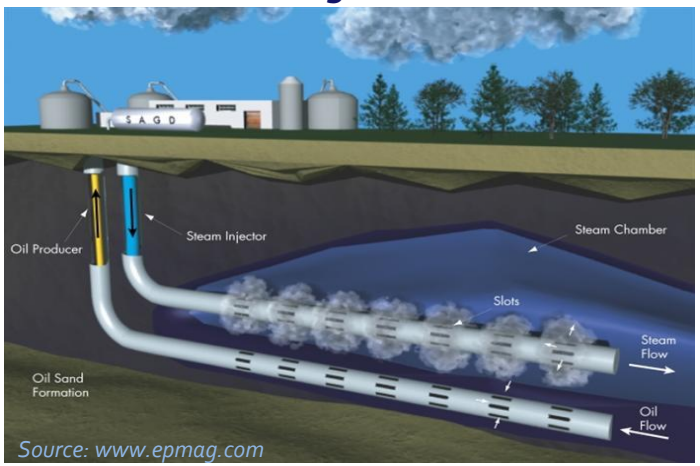
- Diluent is very light oil or "condensate"
- Enables the product to flow through pipelines and be loaded into rail cars

Bitumen extraction has become profitable as extraction technologies improved

- Economical at ~ $ 45 - $ 65/bbl

Mining

Drilling - SAGD



Source: www.epmag.com

Western Canada Crude Oil Pipelines – Kryptonite To W.C. CBR

Current pipelines are at capacity with higher apportionment due to maintenance and expansion

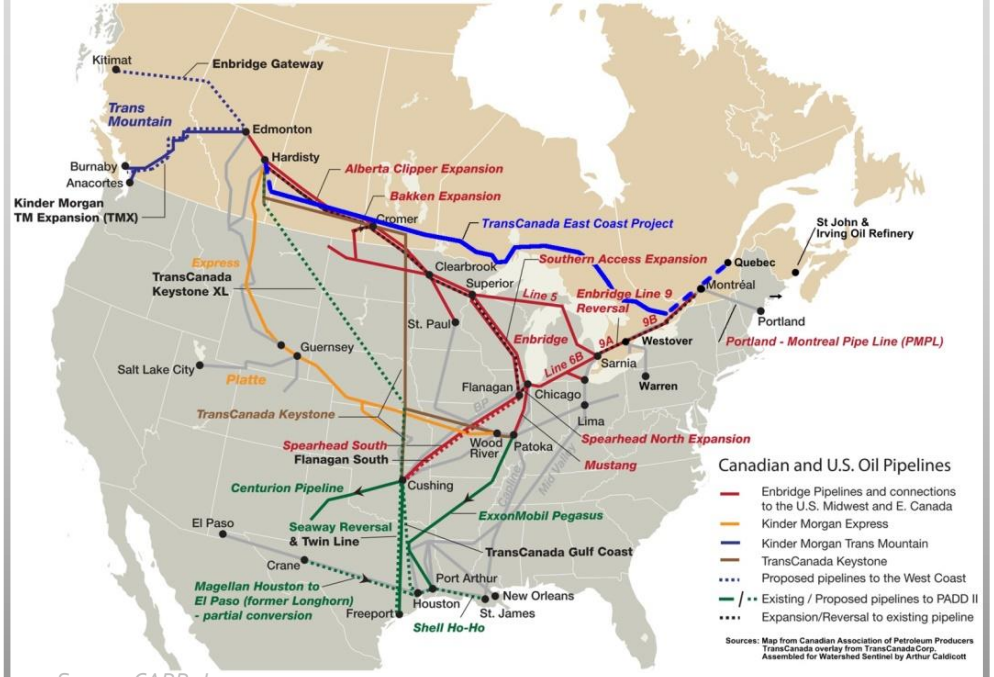
Oil Sands pipelines are under intense scrutiny and subject to court challenges and protests in US and Canada

- NEB is extending its review of Trans Mountain expansion by 7 months
- Recent Canadian Supreme Court ruling gives more power to First Nations in land claims

Innovation with existing pipelines increasing capacity

- Enbridge will temporarily switch the flows of Alberta Clipper and Line 3 on 17.5-mile segment across the US-Canadian border
- Will maximize the flows under existing permits until the Department of State review is completed on expansion
- Increases Alberta Clipper flows by 27% to 570 kbpd by end of September and potentially up to 800 kbpd in 2015

Large Canadian oil producers and pipeline companies are strategically investing in CBR as a flexible option to pipelines for the short and long term



Source: CAPP, June 2013

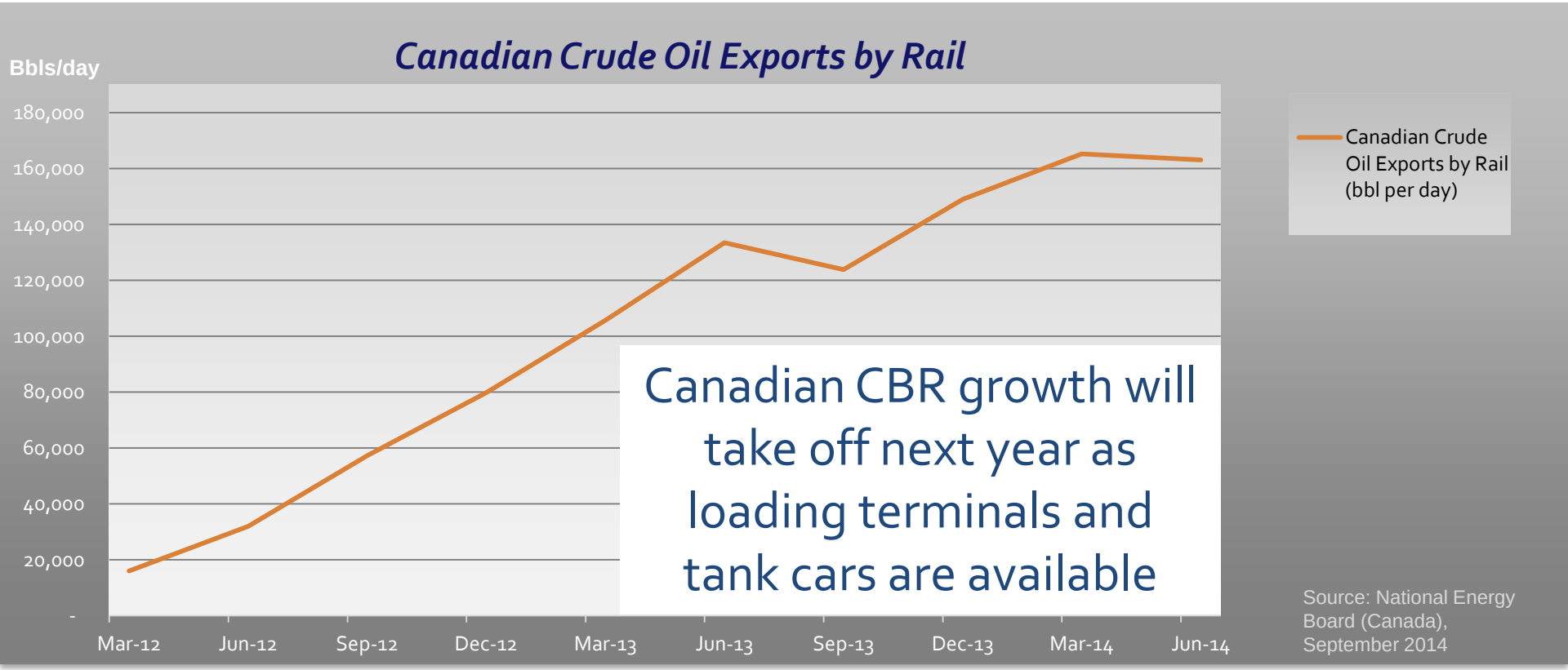
Likely Built Within Medium Term (~2019)

- Trans Mountain Express (Kinder Morgan)
- Alberta Clipper (Enbridge)
- Keystone XL (TransCanada)

Likely Delayed Until 2020 or Later

- Northern Gateway (Enbridge)
- Energy East (TransCanada)

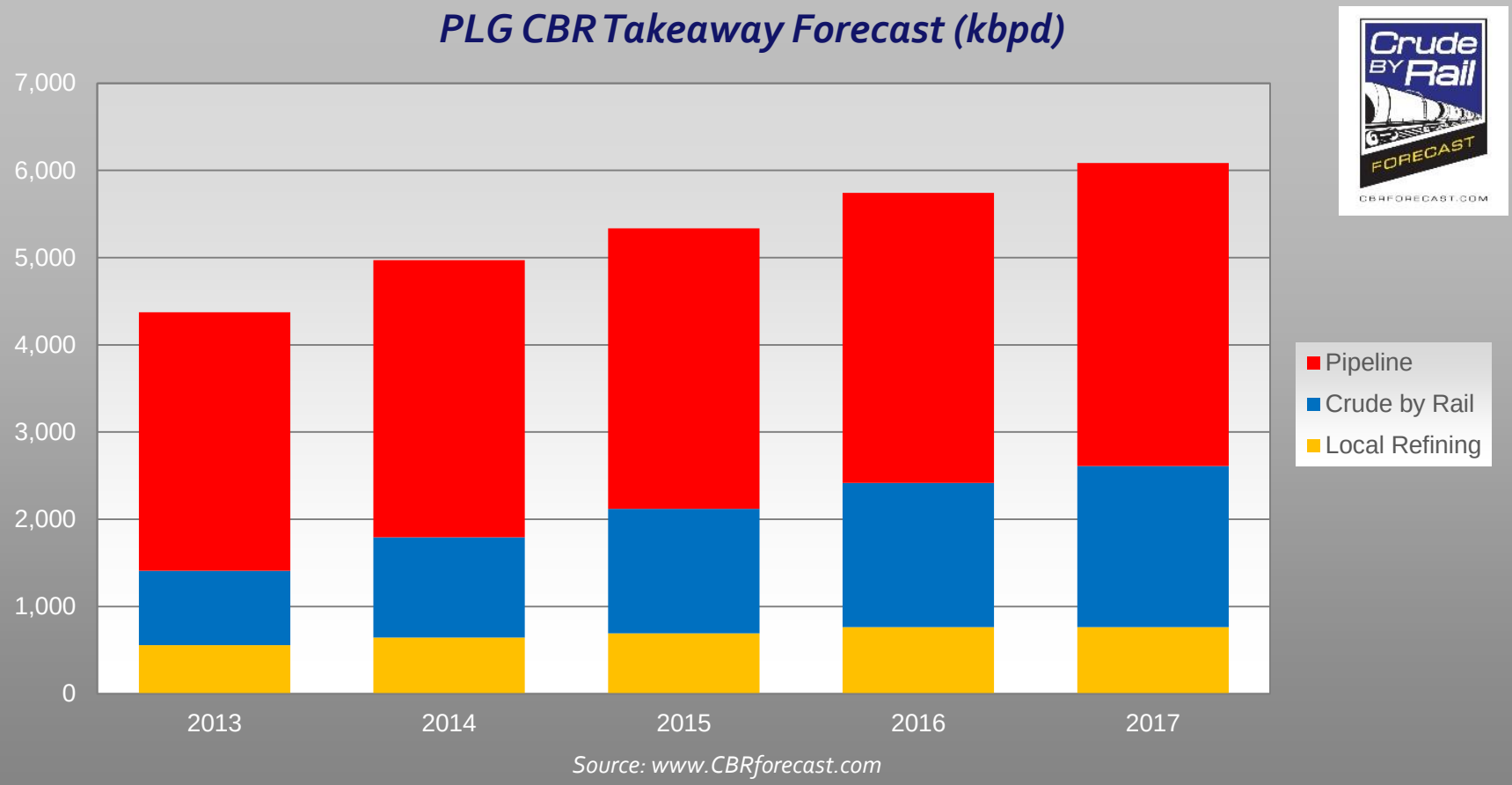
Canadian Crude By Rail 2014 Growth Analysis



Canadian CBR lower in Q2 2014 than predicted

- Shutdown of Canexus Bruderhiem loading terminal due to pipeline issues – was largest loading terminal in WC
- Delays in opening of other unit train loading terminals in western Canada
- Tighter differentials between Canadian and US landed import heavy crude prices
- Over 100k b/d of crude is also moved within Canada

Bakken and WC Crude Oil Takeaway Forecast



Continued N.A. CBR growth through 2017

Latest Fracking Techniques Require Significantly More Sand - Driving Step Function Productivity Increases and Lowers Well Breakeven Costs

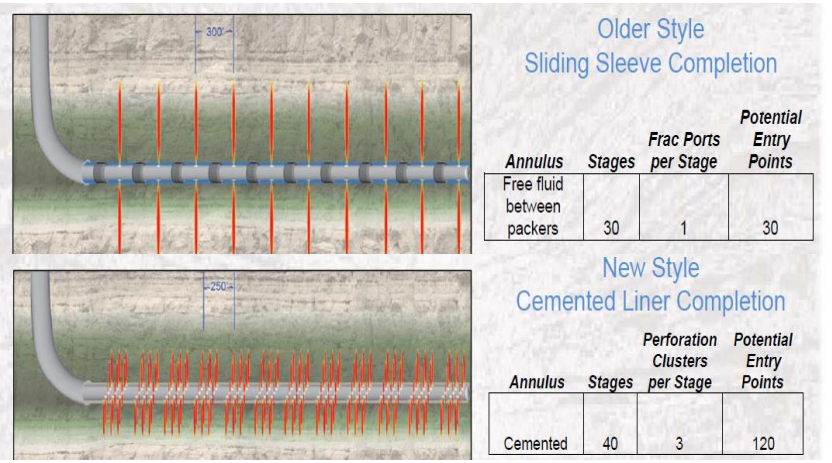
"Old" techniques increased productivity by 10-20% increments (2011~2013)

- More well bores per well pad
- Zipper wells
- Longer lateral lengths
- Zone fracturing

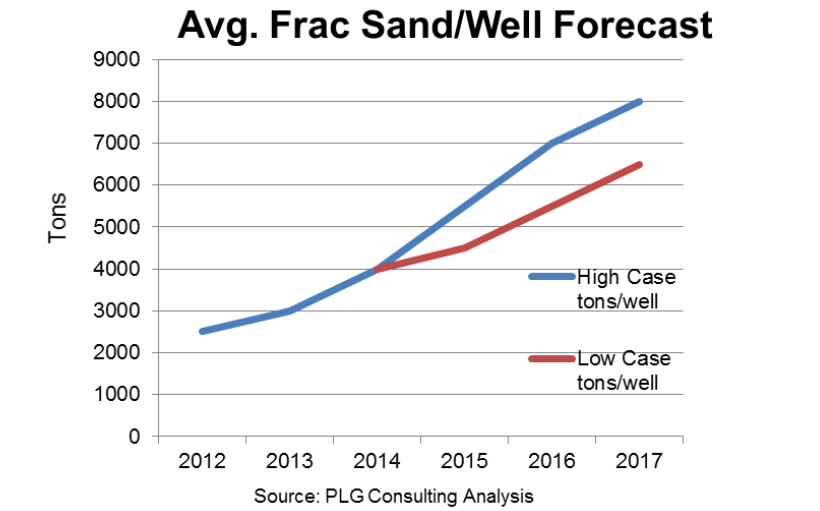
"New" high intensity techniques producing 25-100% productivity increases (2014~)

- Inner "perf" distances reduced by half
- Large increases in stages per well – up to 80!
- Sand per lateral foot – 2X to 5X previous methods
- **Some companies are exceeding 100 rail cars of sand per well!**

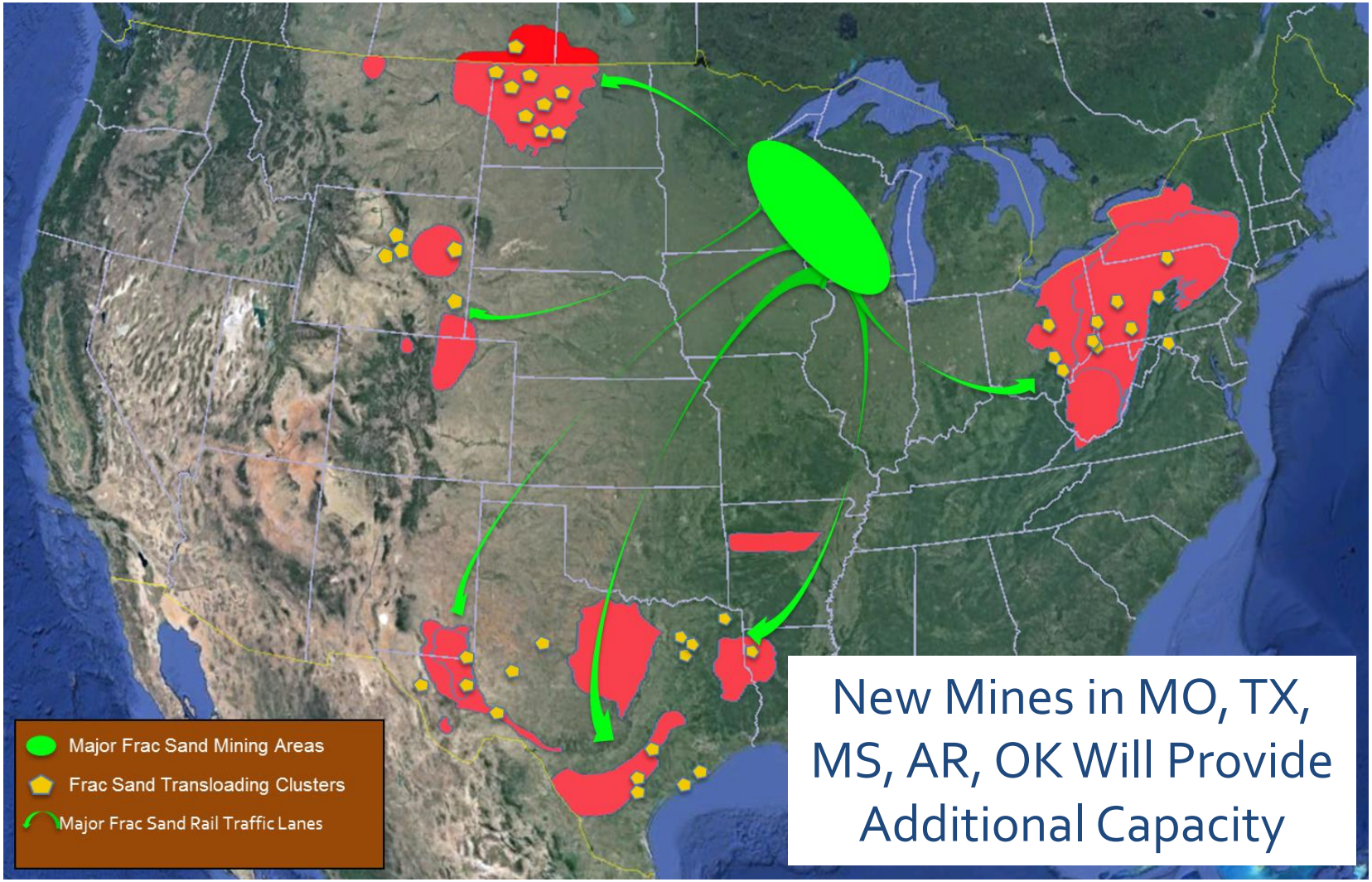
Despite additional cost for sand per well, NPVs are increasing by up to $2MM per well; ROR up 40%



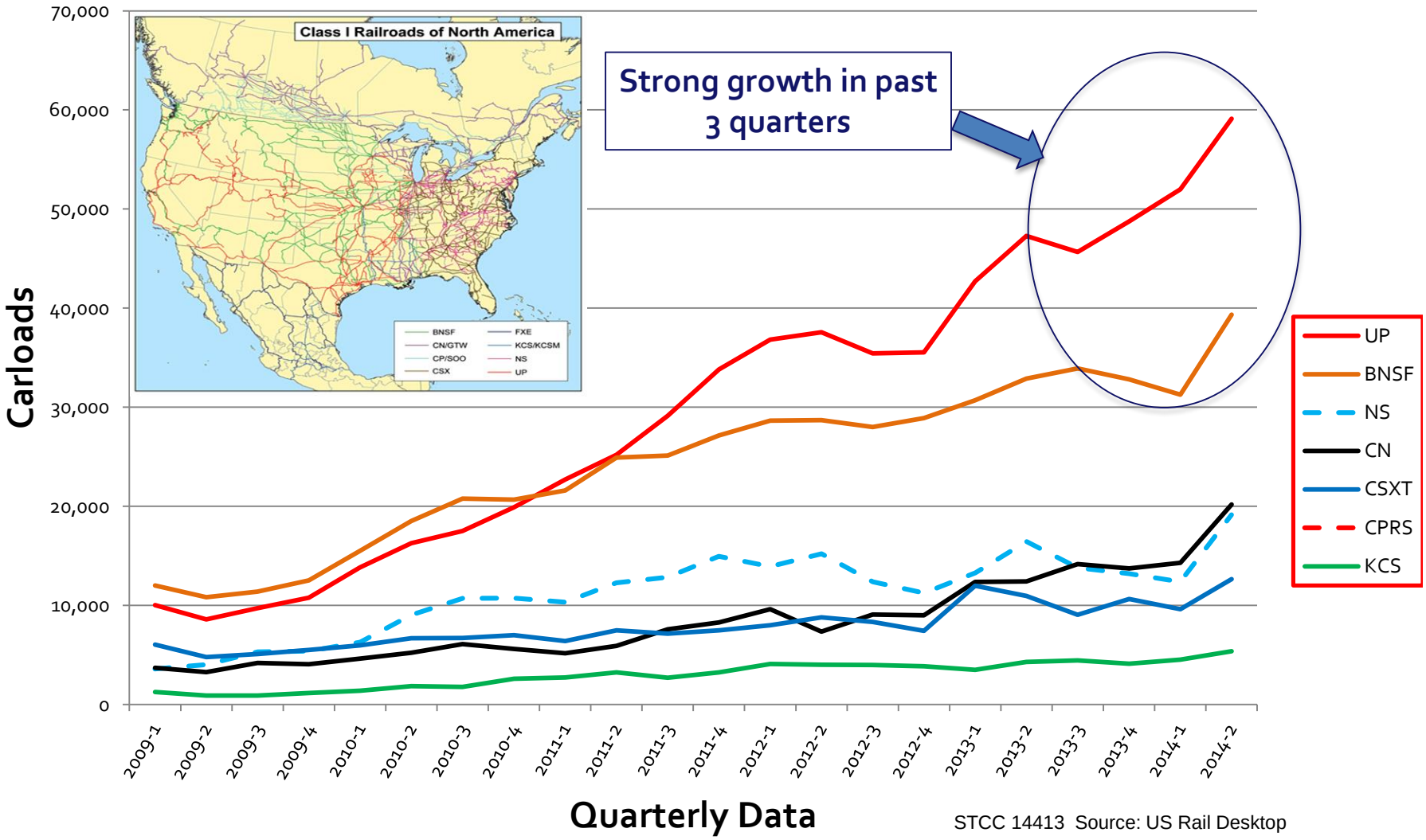
Source: Whiting Petroleum, December Investor presentation



Major Sand Shipping Flows



Frac Sand Handled by Railroads



STCC 14413 Source: US Rail Desktop

Total Delivered Cost of Sand Dominated by Logistics

"Benchmark" unit train example – Illinois to South Texas

- Single-line haul (one rail carrier)
- Private railcars
- Railcar fleet achieving two round trips per month
- Origin sand facility has direct rail load-out
- Destination trucking is less than 100 miles

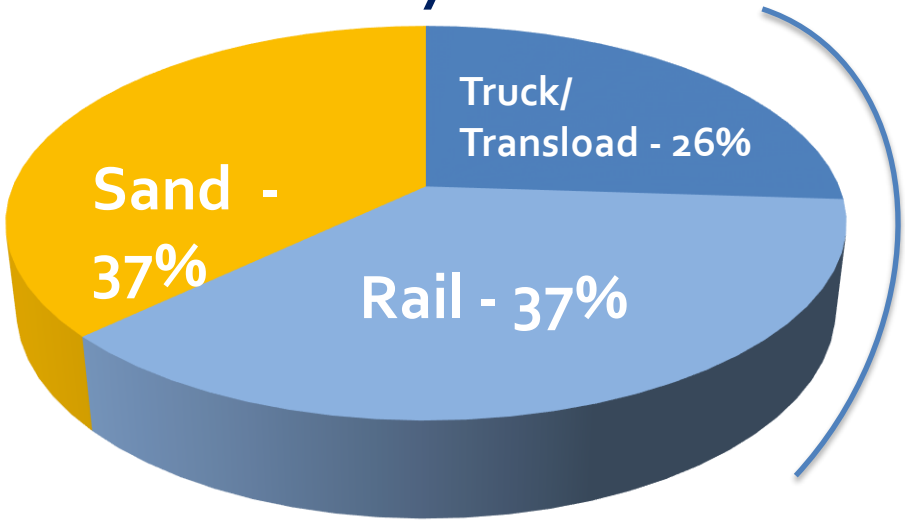
Unit train operations include efficient origin/destination handling

- 24 – 36 hours per train

Manifest service would increase rail-related costs by 17%

- Increased freight rate (12% higher)
- Railcar fleet only achieves one turn per month, on average
- Additional trackage required to accommodate larger fleet
- Delivery patterns are more variable, requiring additional destination storage and inventory

Total Delivered Cost per Ton ~ **$127**



Logistics costs drive ~63% of total delivered sand cost

Source: PLG analysis using BNSF public pricing – does not include fixed assets at origin or destination
Current average sand price per ton = $47

Small Covered Hoppers – Availability Holding Back Frac Sand Growth

Current market is "red hot"

- Increased frac sand per well demand, liquid rig count up 10% YTD
- Additional sand sources opening in Wisconsin
- New orders from cement shippers and plastic pellet cars

Availability is well into 2016 (18-24 month lead time) – 24k unit backlog

Typical full service lease rates $600 - $650

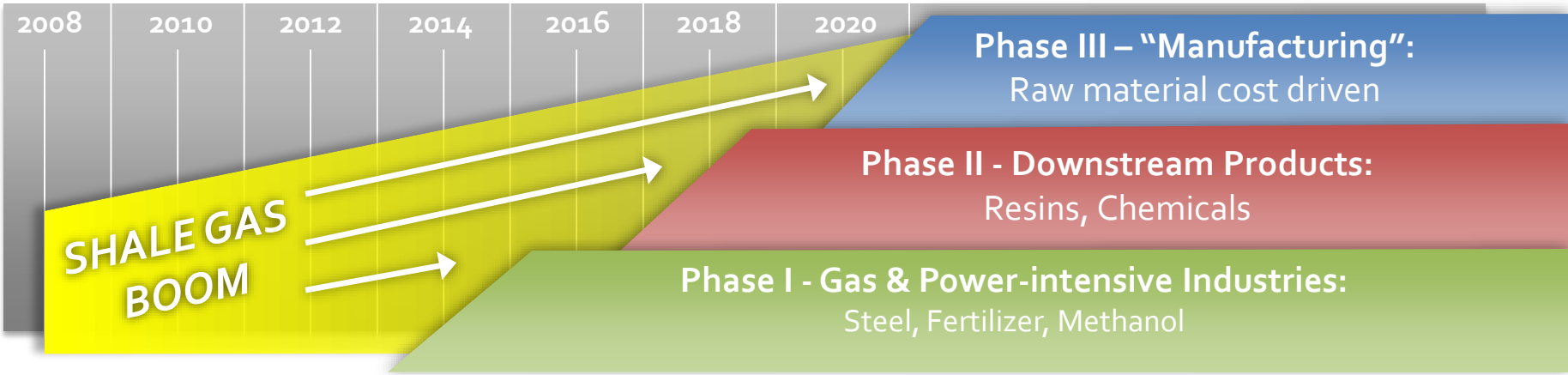
Frac sand shippers/receivers will continue to move towards more efficient methods of rail transportation

- Manifest shipments require 2X the number of railcars vs. unit trains due to increased cycle times
- Use of manifest service usually encourages use of railcar as storage at destination, further increasing fleet requirements

Cement consumption is expected to grow by 6%+ in 2014 and 2015, encouraging railcar orders

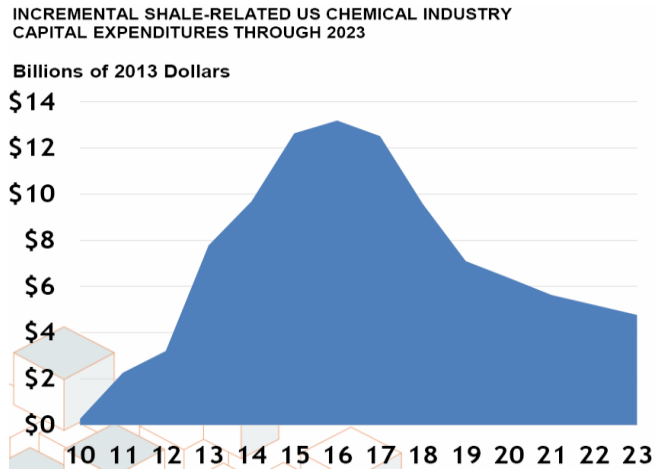
Small covered hoppers compete with large hoppers for capacity – 8k plastic pellet car backorder

Unconventional Energy Will Help Drive US Manufacturing Renaissance



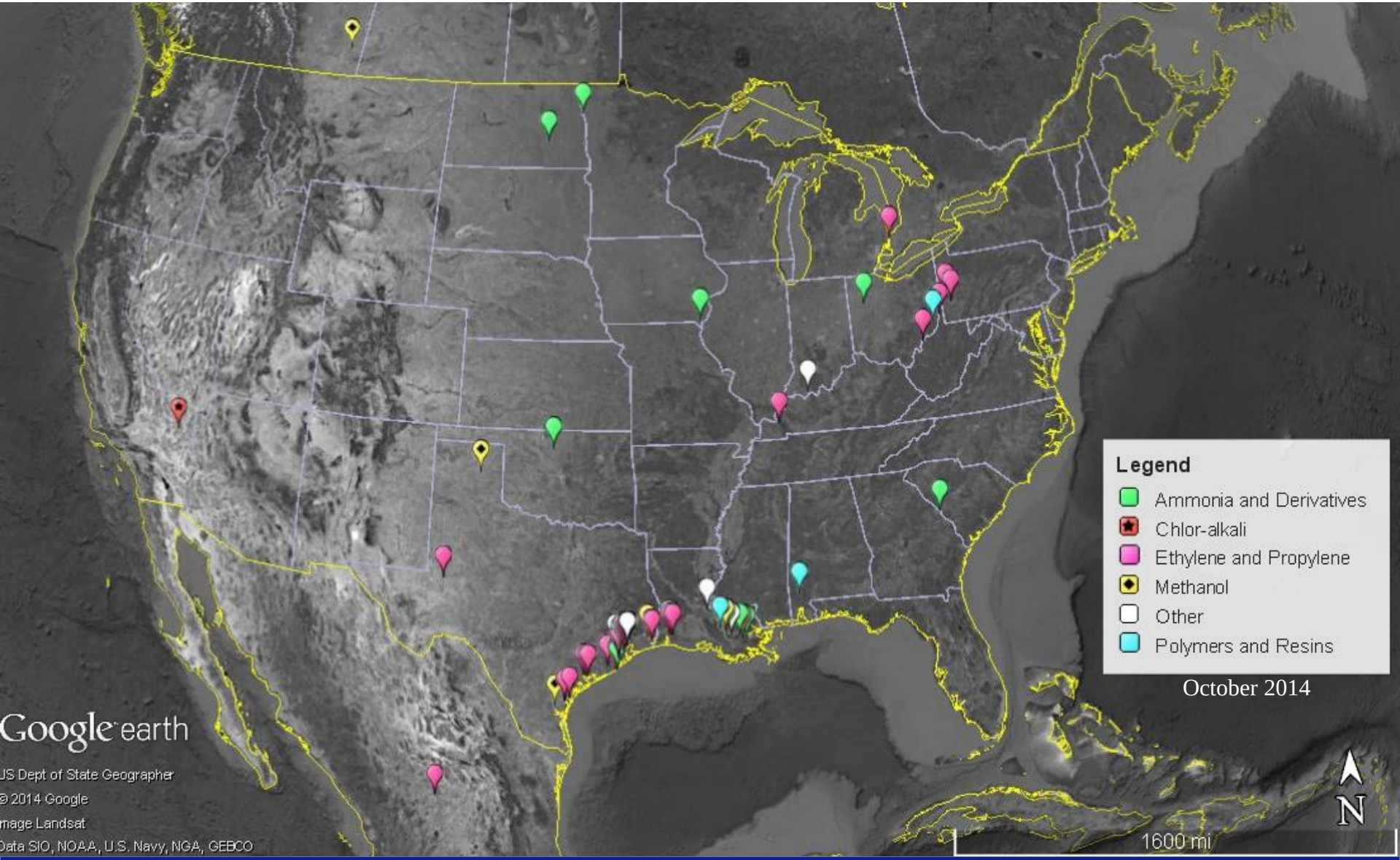
- Phase I – Industries using gas as primary feedstock have global cost competitiveness; new US factories being built
- Phase II – Downstream products require significant processing facilities investment and lead time
- Phase III – US material cost advantage will enable traditional manufacturing to return to North America as about 65% of the cost of manufactured product is material cost

>$120B of Chemical Expansion Announced

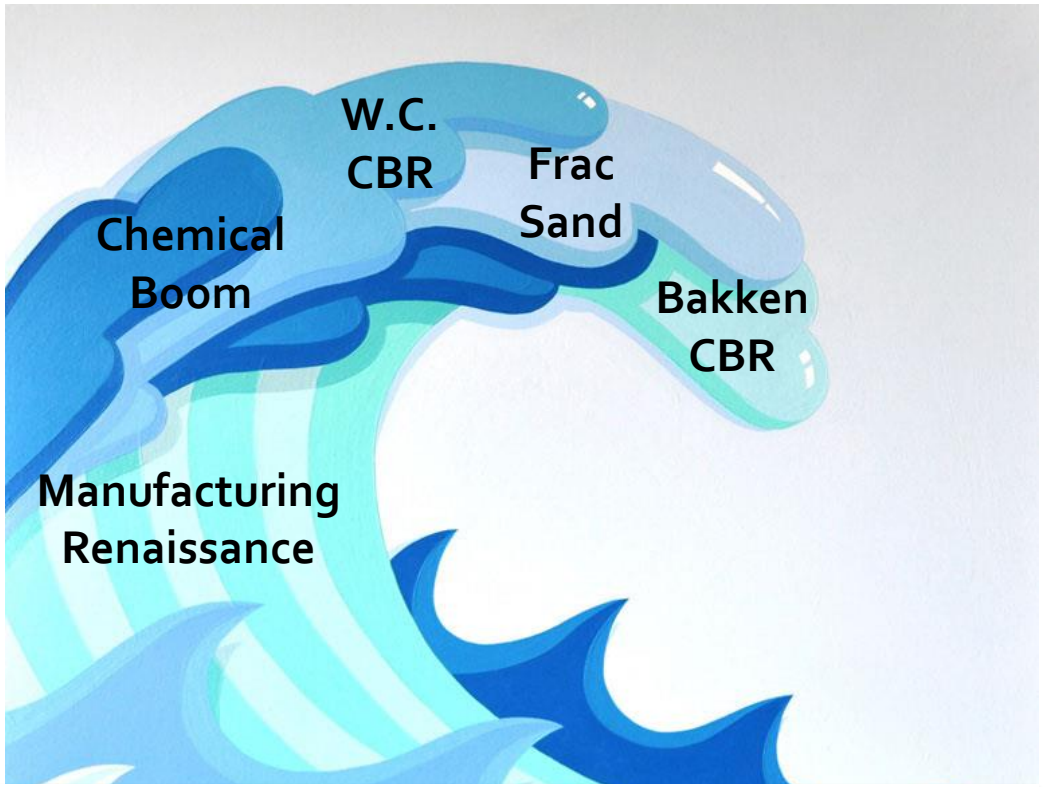


Source: American Chemistry Council, February 2014

Chemical Industry Growth -- Front End of the N.A. Industrial Renaissance



Unconventional Energy Impact to Rail Industry Continues to Build



- 7-10+ years of growth ahead
- Driving incremental growth on top of intermodal and other sector growth
- Lane growth will change over time challenging infrastructure, equipment and staffing
- Unconventional energy logistics intensity also stressing trucking and barge capacity
- Inflationary environment for shippers will be the norm
- Technology changes and continuous improvement will further evolve – don't bet against further improvements!

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www.plgconsulting.com/categories/presentations

Thank You !

For follow up questions and information, please contact:

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