



The North American Oil Revolution: How Far Can We Take This Thing

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Our Key Takeaways

- Current crude oil prices are likely good enough to drive production to surplus given resource availability and estimated economics
- But future growth will be harder than in the past and linear extrapolations are perilous
- The extent of demand-side incremental absorption is nearing its ceiling, with a capacity of 1.0 - 2.0 mmb/d of light crude by 2017. The search for additional export outlets is inevitable
- If supply does lead to price pressure, it is likely uglier than you think: supply has structural characteristics that mean we will likely overshoot
- Exports are the only long-term answer, and this is pure politics



Do Current Crude Oil Prices Justify the Boom?

Question 1: How Economic is the Bakken

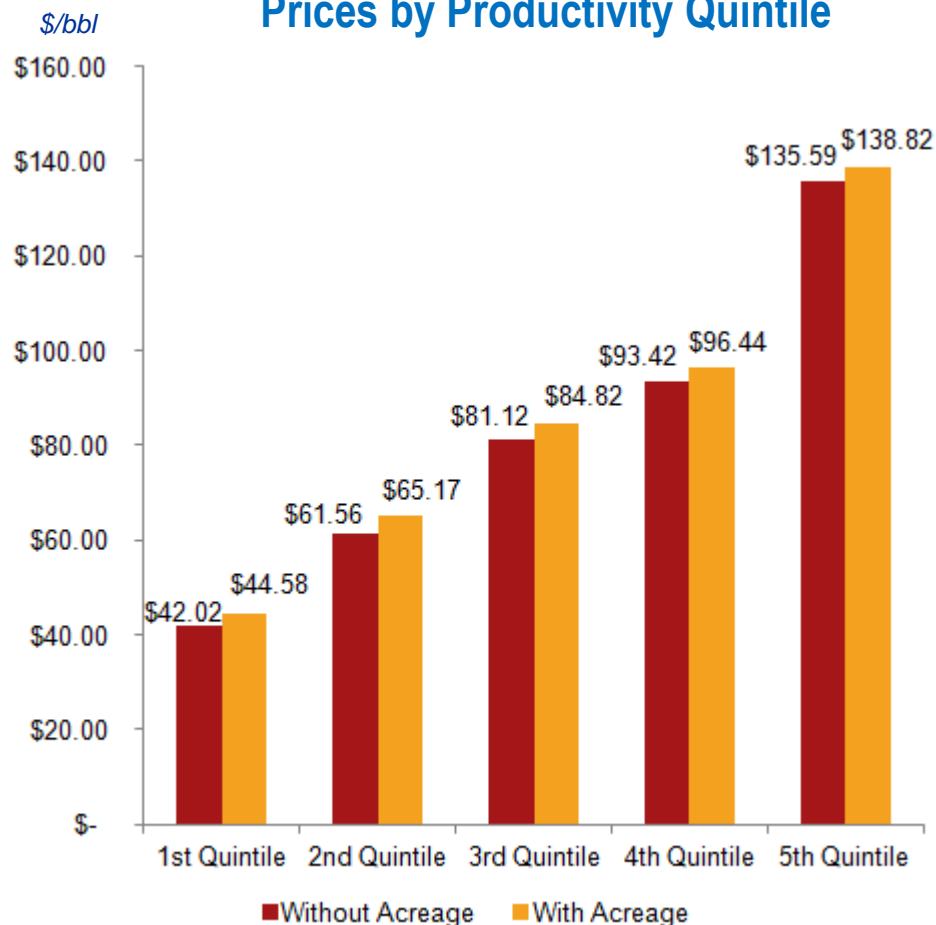
At \$90 WTI, what % of Bakken wells are profitable (i.e., achieve more than a 10% rate of return)?

- A) 20%
- B) 40%
- C) 60%
- D) 80%
- E) 100%

Breakeven Prices in the Bakken

- Well economics in unconventional plays offer a wide range of results
- Costs tend to be relatively similar and best practices and new technologies eventually converge on an optimum for a given play
- However, subsurface variability changes enormously both within and between plays

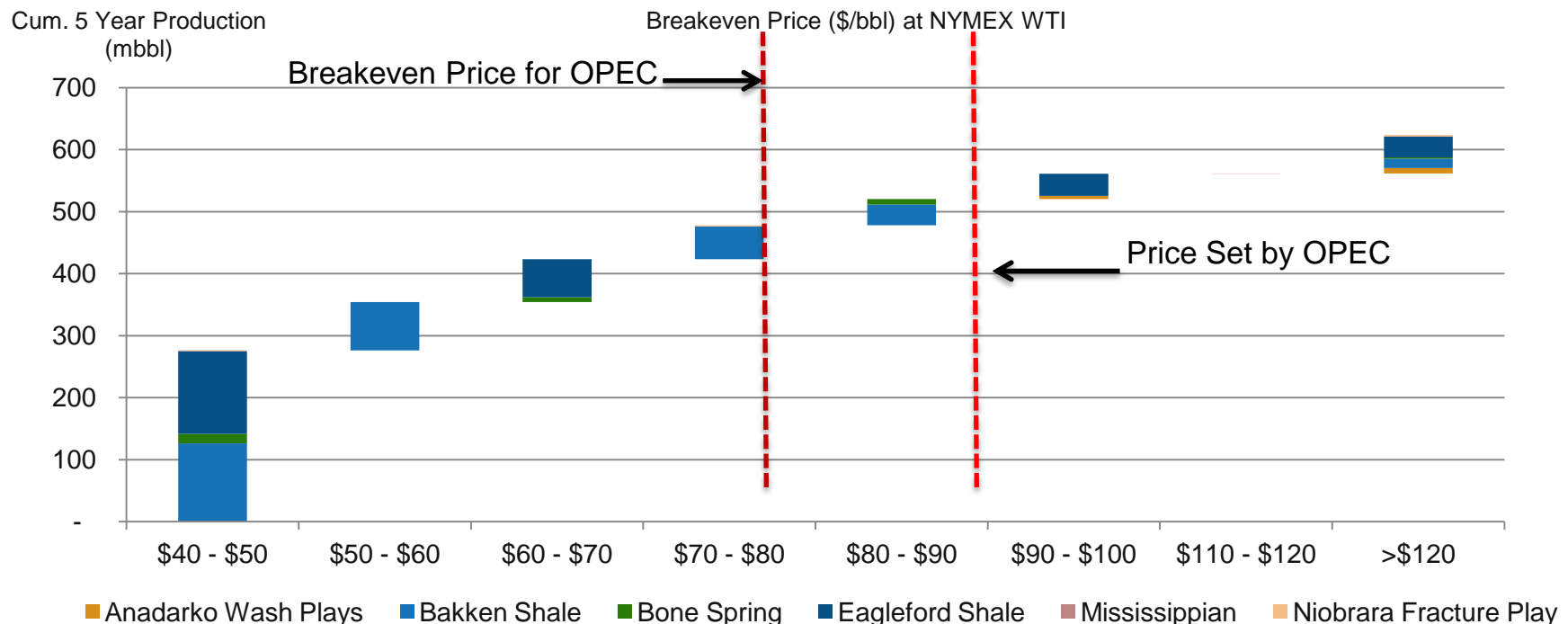
Estimated WTI PV10 Breakeven Prices by Productivity Quintile



Onshore Crude Production: Resilient to Changes in Price

- Majority of cumulative five-year production will reach market both at current OPEC set prices and even at OPEC breakeven prices
- Even riskier, lower probability plays farther on the production curve will likely be explored if prices are below breakeven rate

Estimate of Cumulative Five-Year Production Given Breakeven Prices



Risks Remain High, But Nothing We Are Not Used to

- Level of uneconomic drilling may seem highly irrational, but drilling of uneconomic wells is common in both the conventional and unconventional oil and gas business
- Five reasons companies drill uneconomic wells include:
 1. **This was supposed to be a great well**
 2. **Now we really know how it works**
 3. **We want to be ready for the price spike just around the corner**
 4. **We have to hold the acreage to create future option value**
 5. **We are rewarded for growing production and developing PUDs**
- Overall, the probabilities compare favorably, and will continue to drive strong activity

N. Amer Conventional	N. Amer Unconventional
Dry hole rate of about 50-70%	Dry hole rate of 5%
Zero revenue from dry holes	Even uneconomic wells produce revenue
Success is often very clear	Gray zone of semi-economic activity
Drilling and completion relatively simple	Drilling and completion more complex
Enormous amount of well control	Large, growing body of industry learnings



But Fastest Growth Likely Behind Us

Question 2: Emerging Oil Plays

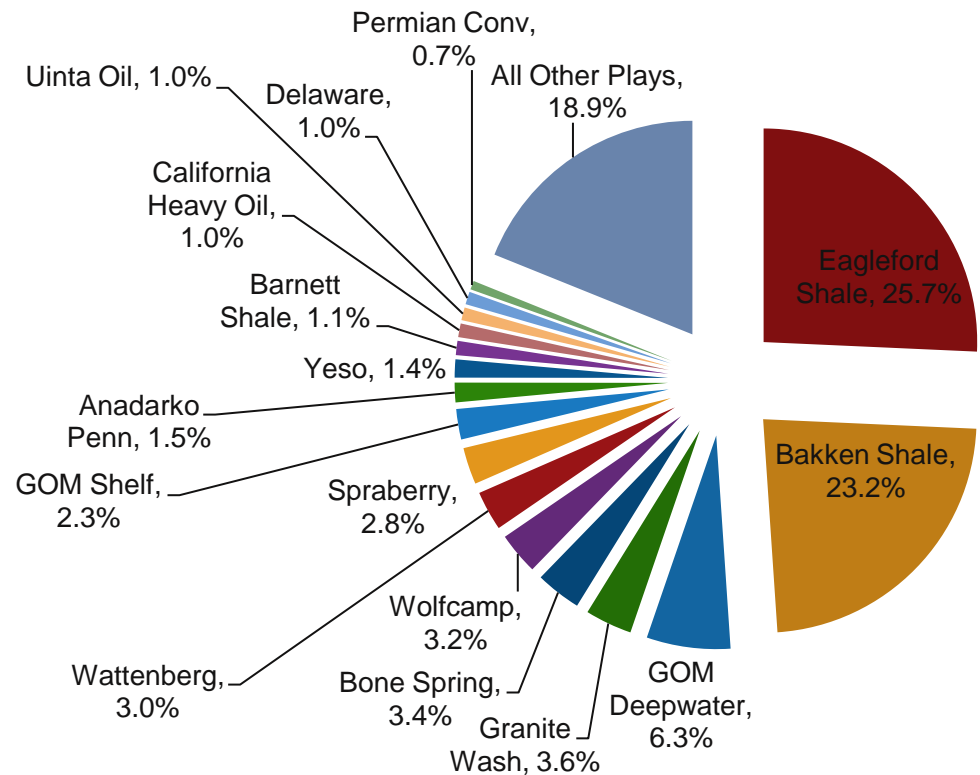
The Bakken and Eagleford represented 23% and 26%, respectively, of total US 2012 liquid wedge volumes. What was the next largest onshore play and its contribution?

- A) Granite Wash – 3.6%
- B) Marcellus liquids – 7.2%
- C) Bone Spring 3.4%
- D) Niobrara 5.0%
- E) Wolfcamp – 14.9%

How Many Pistons?

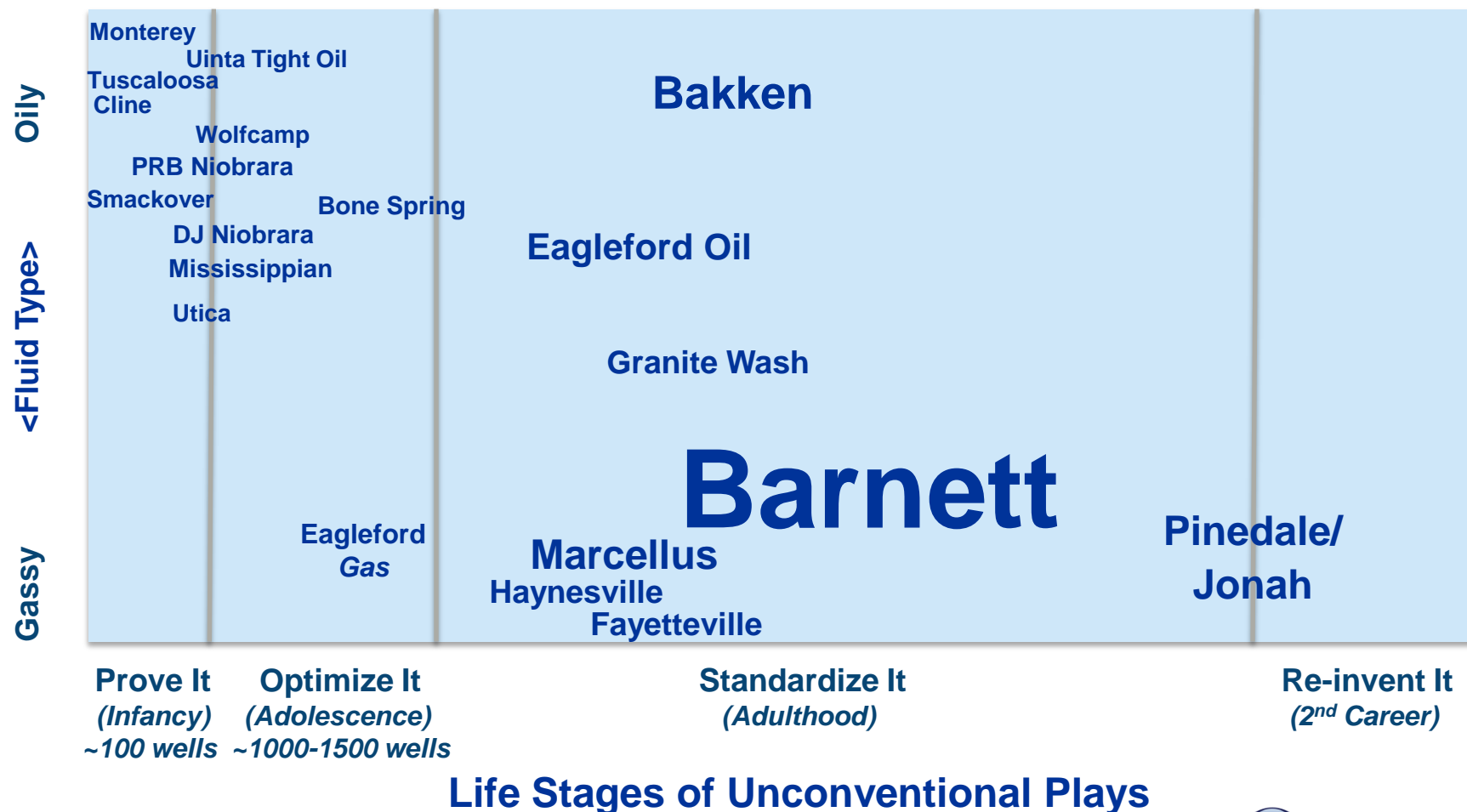
- The oil engine has only two pistons firing: The Bakken and Eagleford account for over 50% of wedge volumes. No other onshore plays contributes more than 4%
- We expect that growth will slow from the recent blistering pace as play maturation occurs
- The possible emergence of another 100+ rig play would provide meaningful upside for service sector and allow the national growth rate to continue

2012 Reported Oil Wedge – by Play



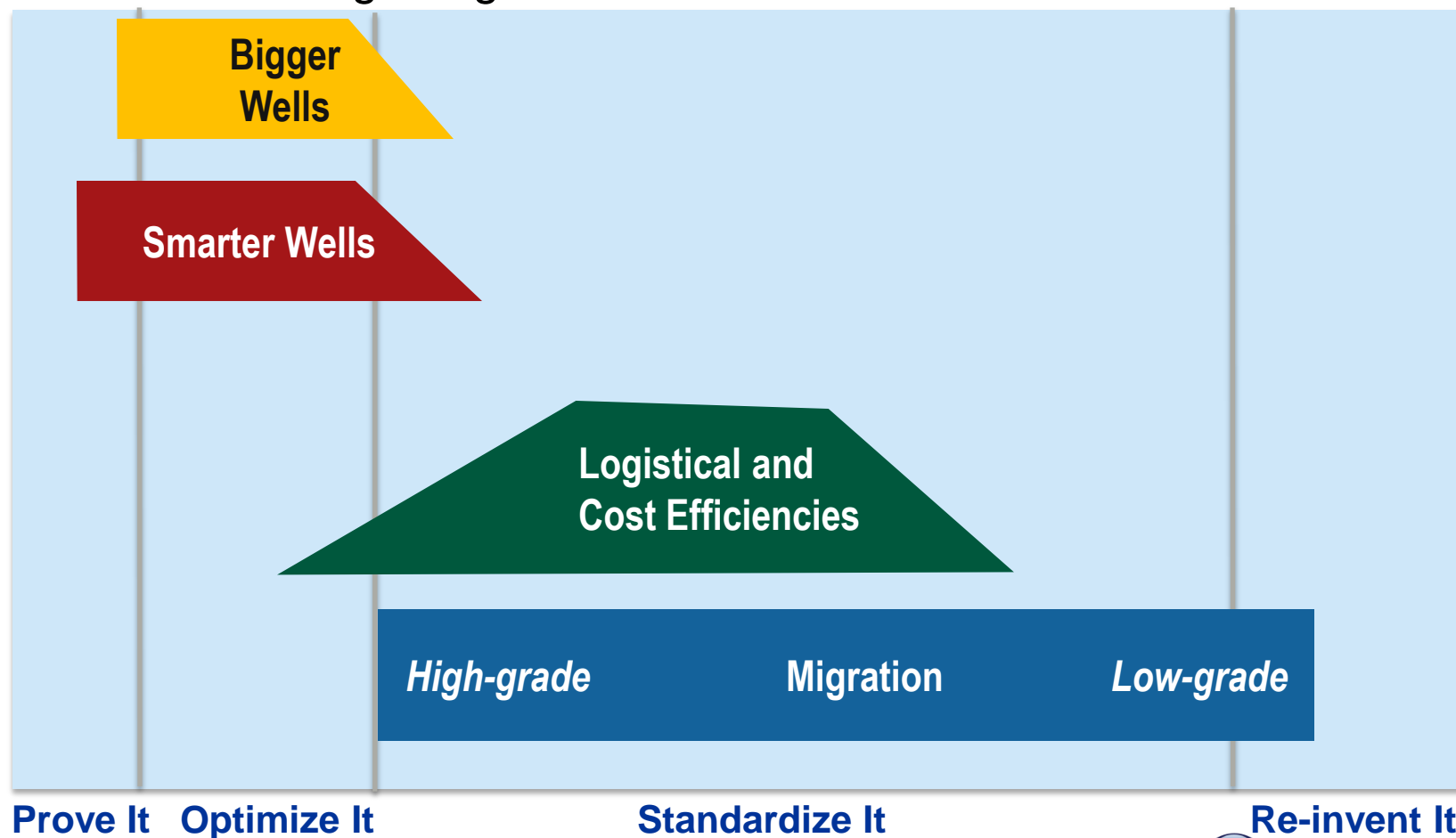
Unconventional Play Dynamics Evolve Over Time

- Plays pass through distinct life stages as they mature
- Pace of maturation varies tremendously



The Game and Its Players

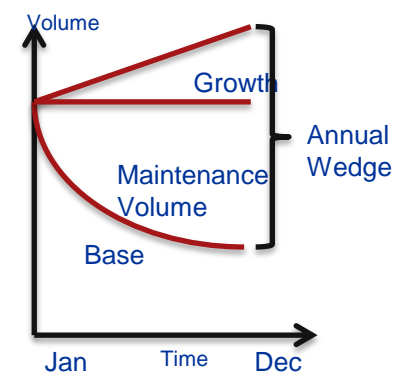
- Companies have 4 primary levers to pull to improve individual well results
- In early stages, these gains compound, but each tends to reach a plateau provide diminishing marginal returns



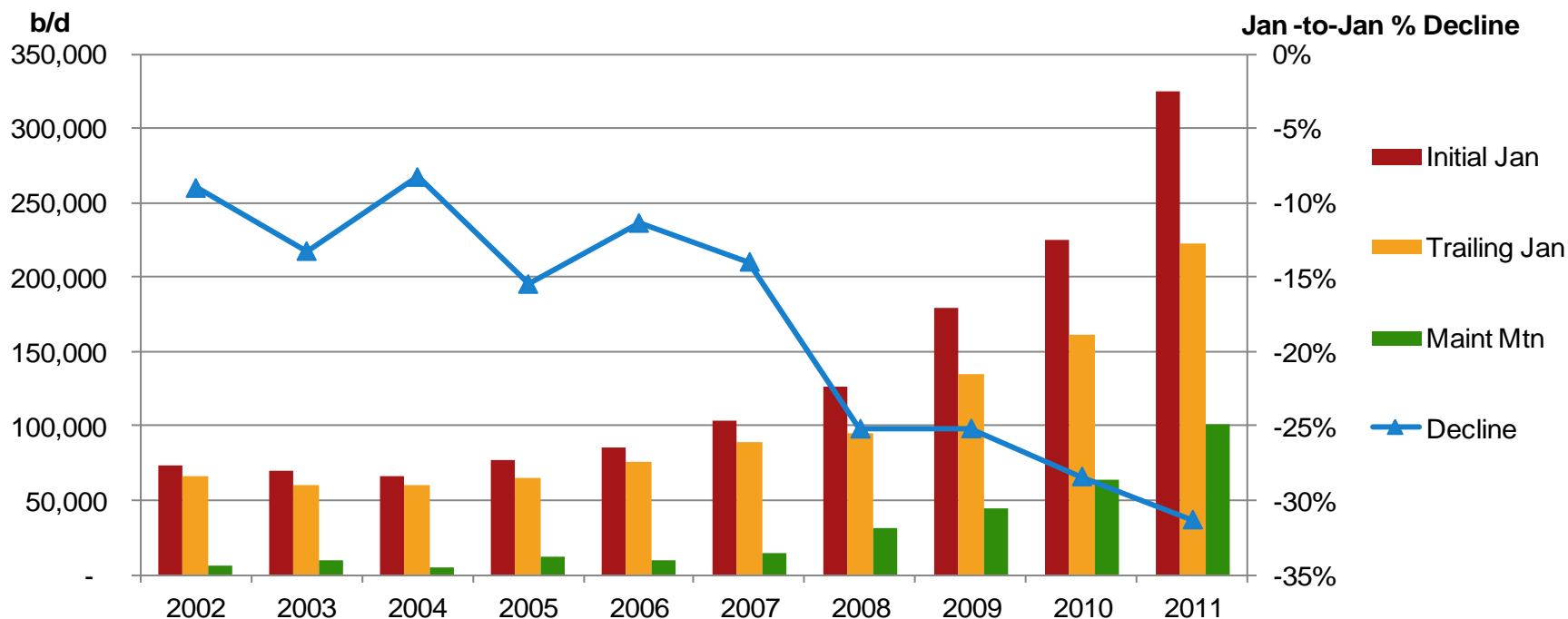
Treadmill Is Accelerating

- Inherent decline rate has dramatically steepened, offering drawback to explosive growth
- “Maintenance Mountain” has risen sharply, meaning more capital is devoted to simply standing still

Annual “Base” and “Wedge” Combine to Form Production



Initial and Trailing Base and Decline: N. Dakota





Will We Hit the Saturation Wall?

Question 3: Obviating Imports

As light, sweet crude volumes have grown, the US is importing less of this grade. If current trends continue, in which year will this process likely be complete (i.e., no material imports of light, sweet crude)?

- A) 2014
- B) 2016
- C) 2025
- D) 2020
- E) We will never get there

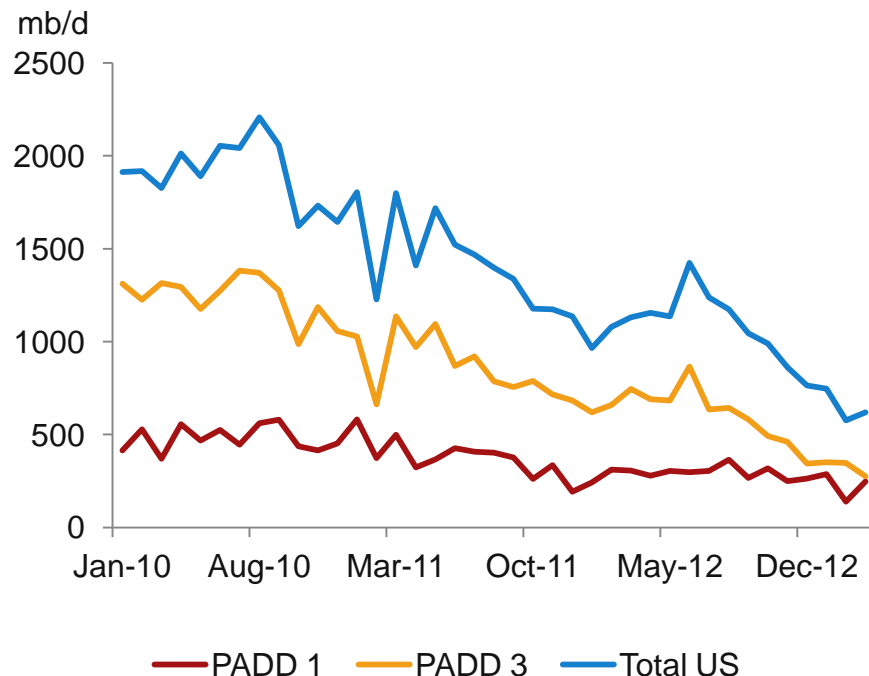
Outlets for U.S. Light Crude

Potential Outlet	Use to Date	Future Expectations
Stage 1: Import Substitution	Dropping dramatically	Done by 2014
Stage 2: Lightening crude slate or blending	Blending ongoing	Additional blending will occur, but major increases unlikely due to dearth of heavies
Stage 3: Exports to Canada	Current exports at 14 mb/d	Will ramp up once light sweet imports in GC displaced. Potentially up to ~700 mb/d
Stage 4: Increase refinery capacity to run lighter barrels	Some, but companies have been resistant to expensive capital programs	Incremental investment, but rational limit growth: Atlantic basin over-capacity and potential change in crude export policy
Stage 5: Change in export policy	Most discussions focused so far on LNG: crude debate is emerging	Industry and trade partner will strongly challenge policy: studies to start, and potential scope and timing of changes unpredictable

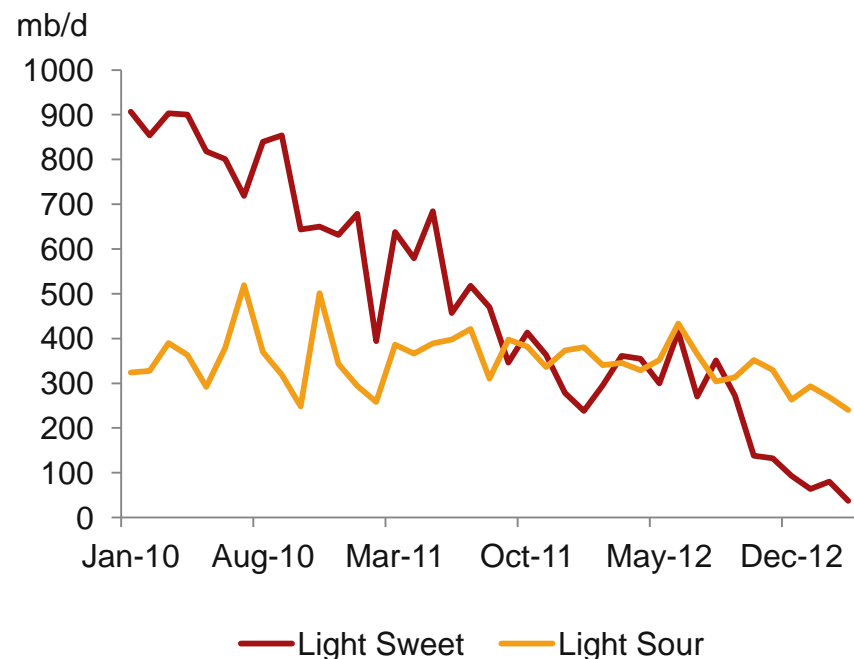
Import Substitution Largely Done!

- Plummeting light imports offer slimming substitution potential: done by summer 2013 in PADD 3
- East Coast provides limited scope due to its size
- Bakken crude reaching far and wide by rail, negating need to repeal Jones Act

U.S. Non-Canadian Light Imports (Jan. 2010 –Mar. 2013)

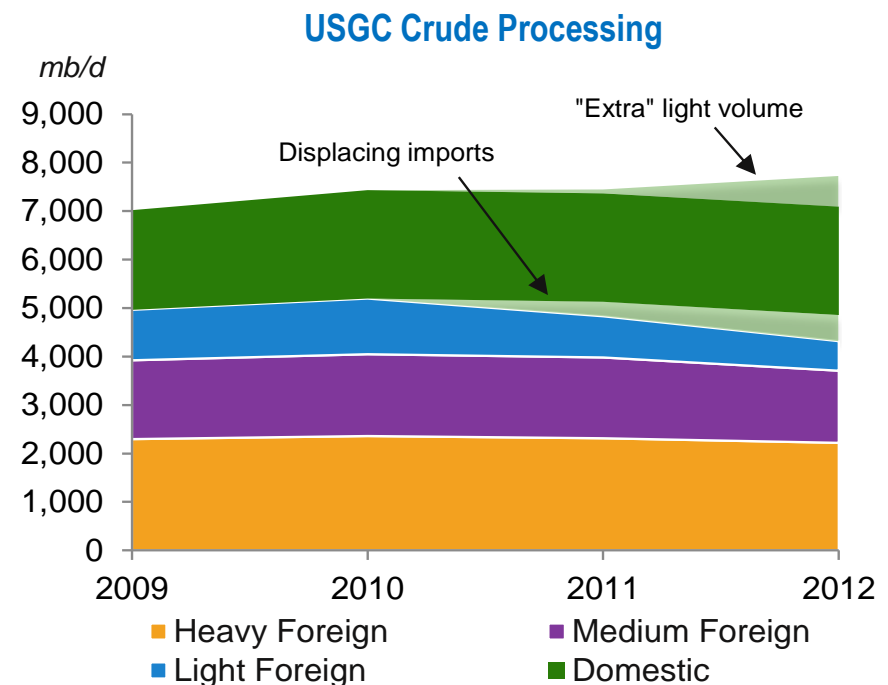
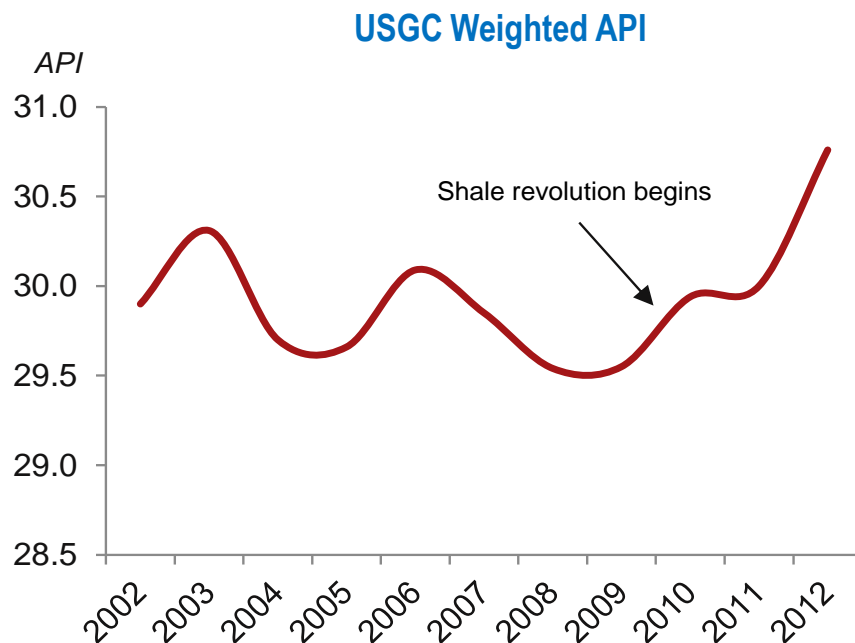


USGC Light Sweet vs. Light Sour Imports (Jan. 2010 –Mar. 2013)



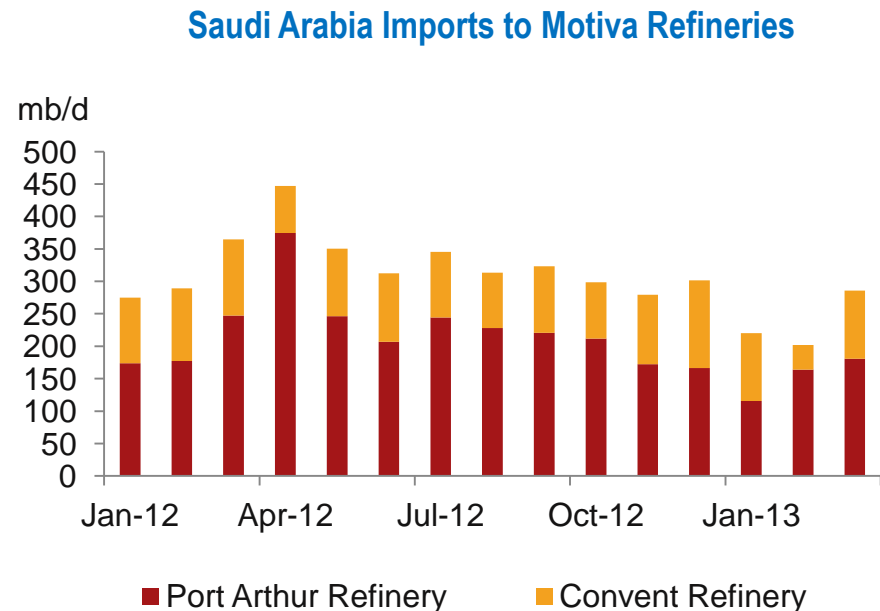
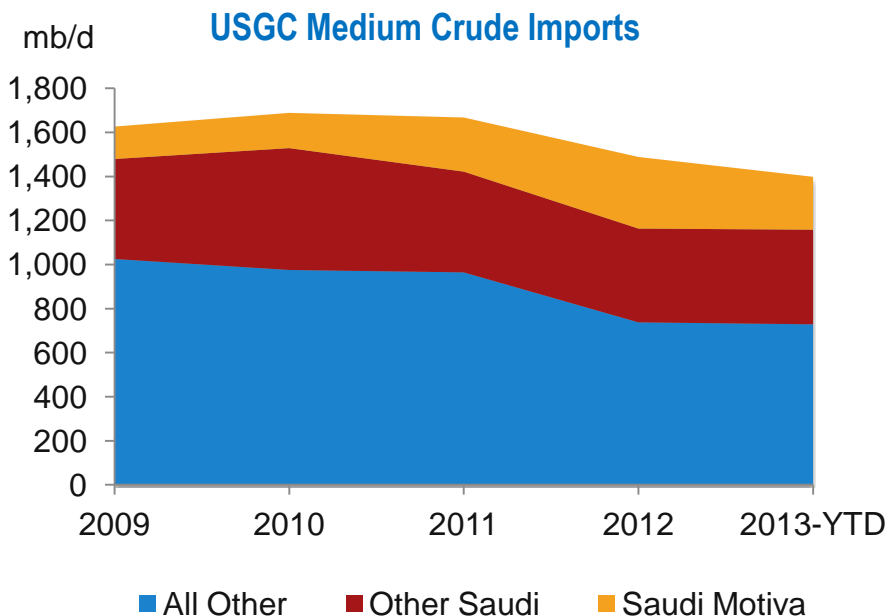
Lightening Slates: A Noticeable Shift

- The weighted API of the Gulf Coast crude slate has risen to nearly 30.8 last year from 29.5 in 2009
- Technical and commercial limits to lightening slate without modification to existing refineries or construction of new processing facilities
- How much more easy lightening?



Limits to Medium Import Substitution Aplenty

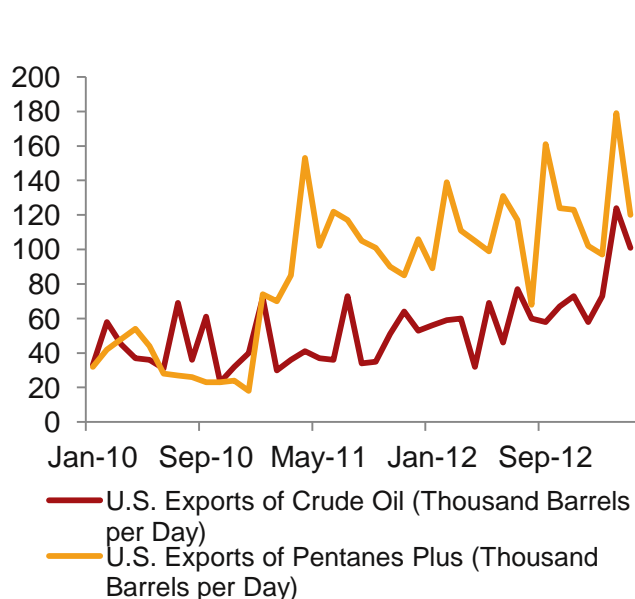
- Substitution of Medium imports (now ~1,500 mb/d) by blending is a fake solution
- Three factors that will keep blending low
 1. “Immovable” Saudi Imports to Motiva Refineries
 2. Insufficient Volumes of Heavy Crude in PADD 3 until 2017-2018, Light-Heavy Differentials
 3. Technical Challenges
- We expect the total medium imports that can plausibly be displaced through blending in the next two years to be 400-600 mb/d



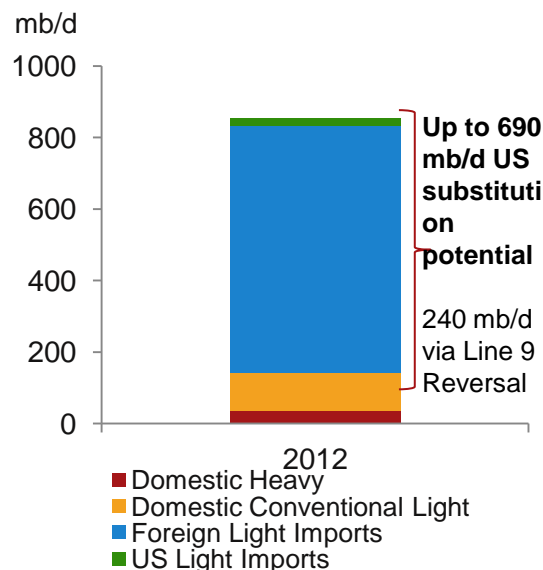
Exports to Canada: A Useful But Limited “Relief Valve”

- Exports to Atlantic Canada are an appealing “relief valve” for the pending light crude surplus in the Gulf Coast
- Over 80% of the crude processed by Atlantic Canada is imported light crude (~690 mb/d), with the remainder sourced from offshore fields
- This relief valve limits the price of Brent-like crudes in the GOM to no more than US\$ 2/b below Brent as long as available
- U.S. exports could displace all Atlantic Canada imports by 2016. Then what?

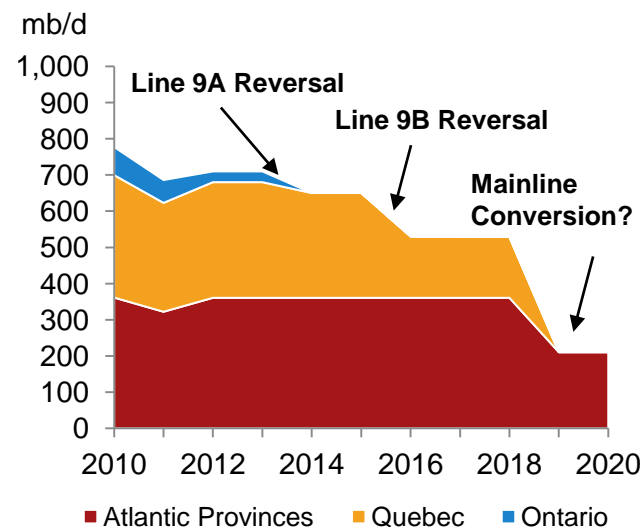
U.S. Crude and Pentanes Plus Exports



Atlantic Canada Crude Slate



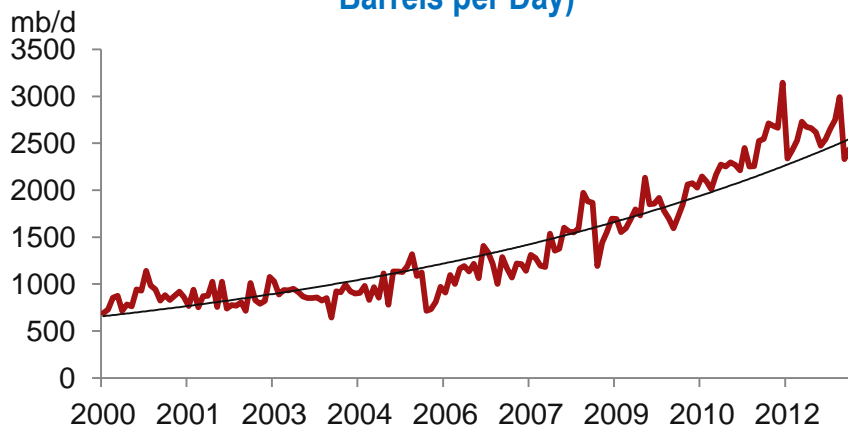
Non-U.S. Imports to Canada



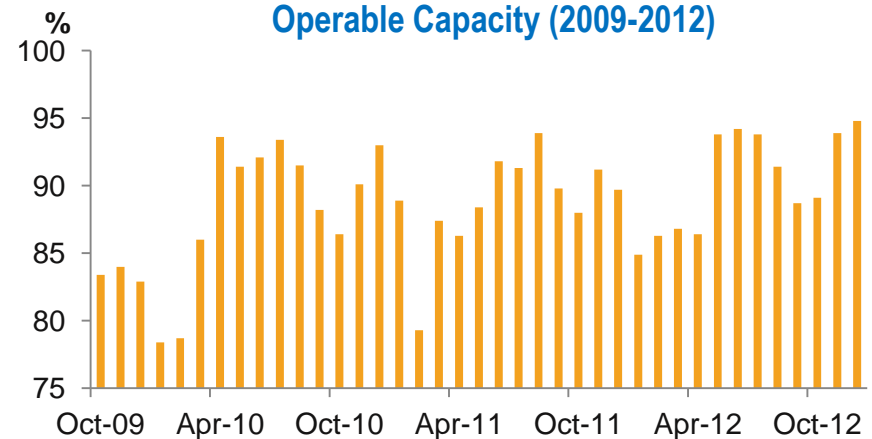
Product Exports Reaching Plateau as Utilization Rates Near Ceiling

- Products exports have grown exponentially since the early 2000s but growth prospects waning
- Much of the growth has been driven by increased utilization rates by U.S. refineries
- As utilization rates in PADD 2 and 3 near their ceilings, increased throughput purposed for product exports is likely to slow, limiting crude demand growth
- The question remains whether we will witness a revival of the refinery creeping years of the 1990s

U.S. Exports of Finished Petroleum Products (Thousand Barrels per Day)

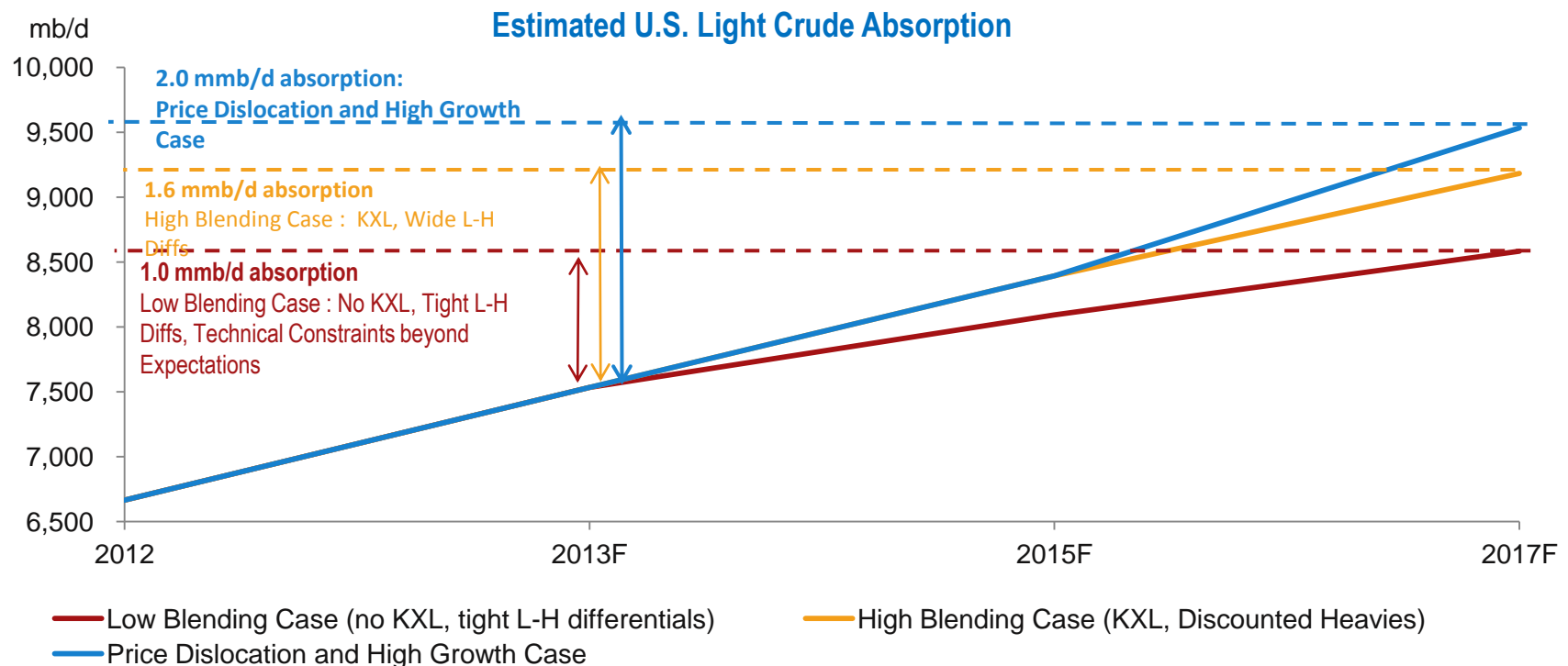


Gulf Coast (PADD 3) Percent Utilization of Refinery Operable Capacity (2009-2012)



Putting It All Together: How Much Can We Absorb Before Dislocation?

- Assuming all alternatives are exploited to utmost potential and provided production increases in line with our forecasts, the system can accommodate, at most 2.0 mmb/d of incremental light production by 2017
- The chart below presents the demand-side absorption capacity for light domestic production and does not account for incremental medium production from the GOM





Why Falling Prices May Not Prevent a Train Wreck

Question 4: The Distribution of Results

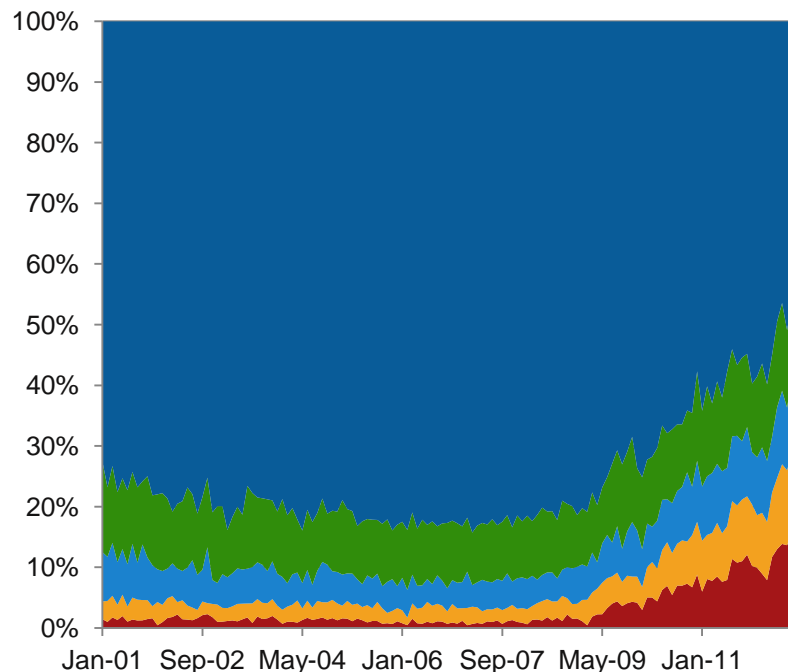
If we examine the new wells brought onstream in recent months, the most productive 20% of the wells are responsible for what % of the total output from those wells?

- A) 90%
- B) 70%
- C) 35%
- D) 20%
- E) 2,456% (Hint: this is not possible)

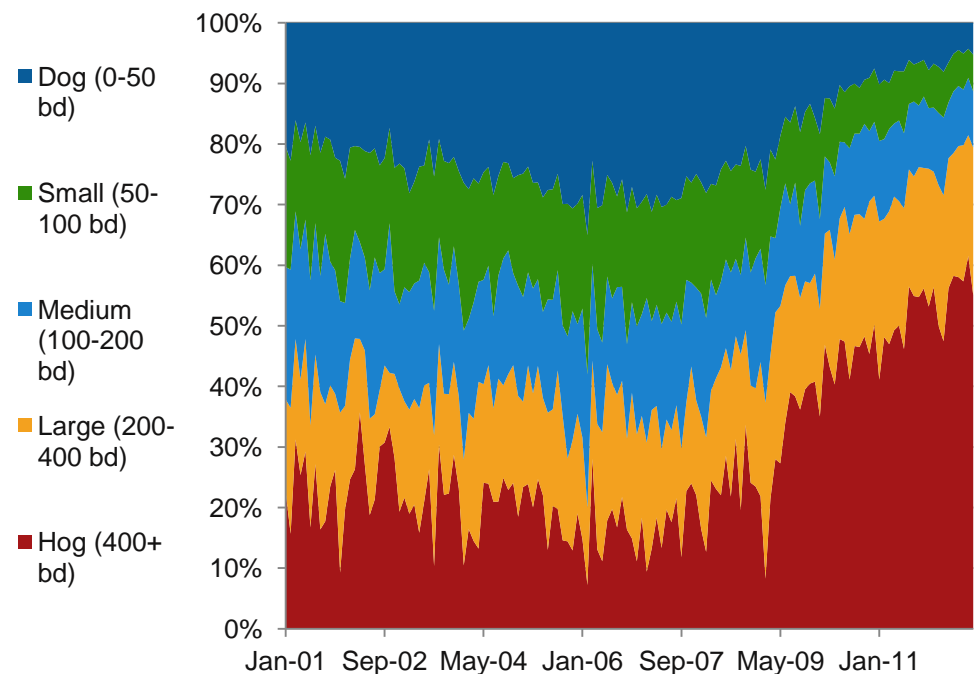
Why We Can Drop Oil Rigs and Still Grow

- Like the gas supply system, US oil demonstrates a very large skew, with small number of wells driving wedge volumes and a long tail of poor wells
- If producers are forced to cut activity, high-grading allows growth to continue with very little deceleration. In effect, this means any market glut may persist longer than expected, as producers continue to decrease activity until they “cut into the muscle”

New Wells Drilled by Category



Sum of Peak Well Oil Prod by Category





Exports: The Eventual, Inevitable Solution?

Question 5: Exports

Who has control over the ability to export crude oil from the Lower 48?

- A) Congress (because it's a law)
- B) Dept of Energy (because it's an energy regulation)
- C) Dept of Commerce (because it's a trade thing)
- D) The President (because its an administrative order)
- E) Raoul (because he's *The Man*)

The White House has the Authority to Control Energy Exports



Energy and Policy Conservation Act

- “The President may, by rule, under such terms and conditions as he determines to be appropriate and necessary to carry out the purposes of this chapter, restrict exports of –
 - (1) coal, petroleum products, natural gas, or petrochemical feedstocks, and
 - (2) supplies of materials or equipment which he determines to be necessary which he determines to be necessary (A) to maintain or further exploration, production, refining, or transportation of energy supplies, or (B) for the construction or maintenance of energy facilities within the United States.”
- All Crude Oil Exports Require a License from the Bureau of Industry & Security at the Commerce Department
- Natural Gas Exports Require a Permit from the Department of Energy

Natural Gas

- Regulated under the Natural Gas Act
- Exports to Free Trade Agreement Countries are Approved as a Matter of Course
- For Non-Free Trade Agreement Countries the DOE *shall* Approve Exports, *unless* the DOE finds it is NOT in the Public Interest
- Even so, it took two studies and two years between the Sabine Pass Approval and the Freeport LNG Expansion I Approval

VS

Crude Oil

- Crude Oil Exports Controlled by Several Statutes
- Certain Exports Are Prohibited, Unless the President Makes an Express Public Finding that They Are in the National Interest
 - Exports of most offshore-produced crude prohibited
 - Exports of most crude piped through pipelines that have federal rights-of-way prohibited
- The Commerce Department Regulates Crude Oil Exports under Short Supply Controls
- Some “Loopholes”
 - Lightly Refined Crude
 - Exports to Adjacent Countries (Canada)
 - Very Limited “Swaps” – limits based on volumes and quality
 - Questions about railed crude or crude shipments to free trade agreement countries

The 1st Path of Least Resistance: Light Refining



Lightly Refined Product

- No Export License Needed for Refined Products
- Product = Processed Through a Distillation Tower
- Topped Crude O.K. for Export
- Condensate Splitters & Crude Toppers
 - Proposed (100,000 b/d): **Kinder Morgan** – Galveston, TX

February 15, 2013 [OPIS] - The startup of Kinder Morgan's new condensates splitter plant at its Galena Park terminal in Galveston, Texas, has been **delayed** to April 2014 from its original startup timing of January 2014 **because of delays in obtaining federal and state permits for the project**, a company spokeswoman said.

Other Paths of Least Resistance – Potential Policy Changes for Crude



■ End of Term Presidential “Crude Pardon”

- **Piped Crude**...before any crude oil subject to this section may be exported ...the President must make and publish an express finding that such exports will not diminish the total quantity or quality of petroleum available to the United States, and are in the national interest and are in accord with the provisions of the Export Administration Act of 1979.
- **Offshore Crude**...before any oil or gas subject to this section may be exported ...the President shall make and publish an express finding that such exports will not increase reliance on imported oil or gas, are in the national interest, and are in accord with the provisions of the Export Administration Act of 1969.

■ Change in Regulation

- Definition of Crude Oil
- Preference for Quality
- Limited Waivers – free trade agreement countries? Railed crude?

■ Change in Law

- Mineral Leasing Act of 1920
- Outer Continental Shelf Lands Act (OCSLA)
- Jones Act

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