U.S. Crude Exports One Year Later

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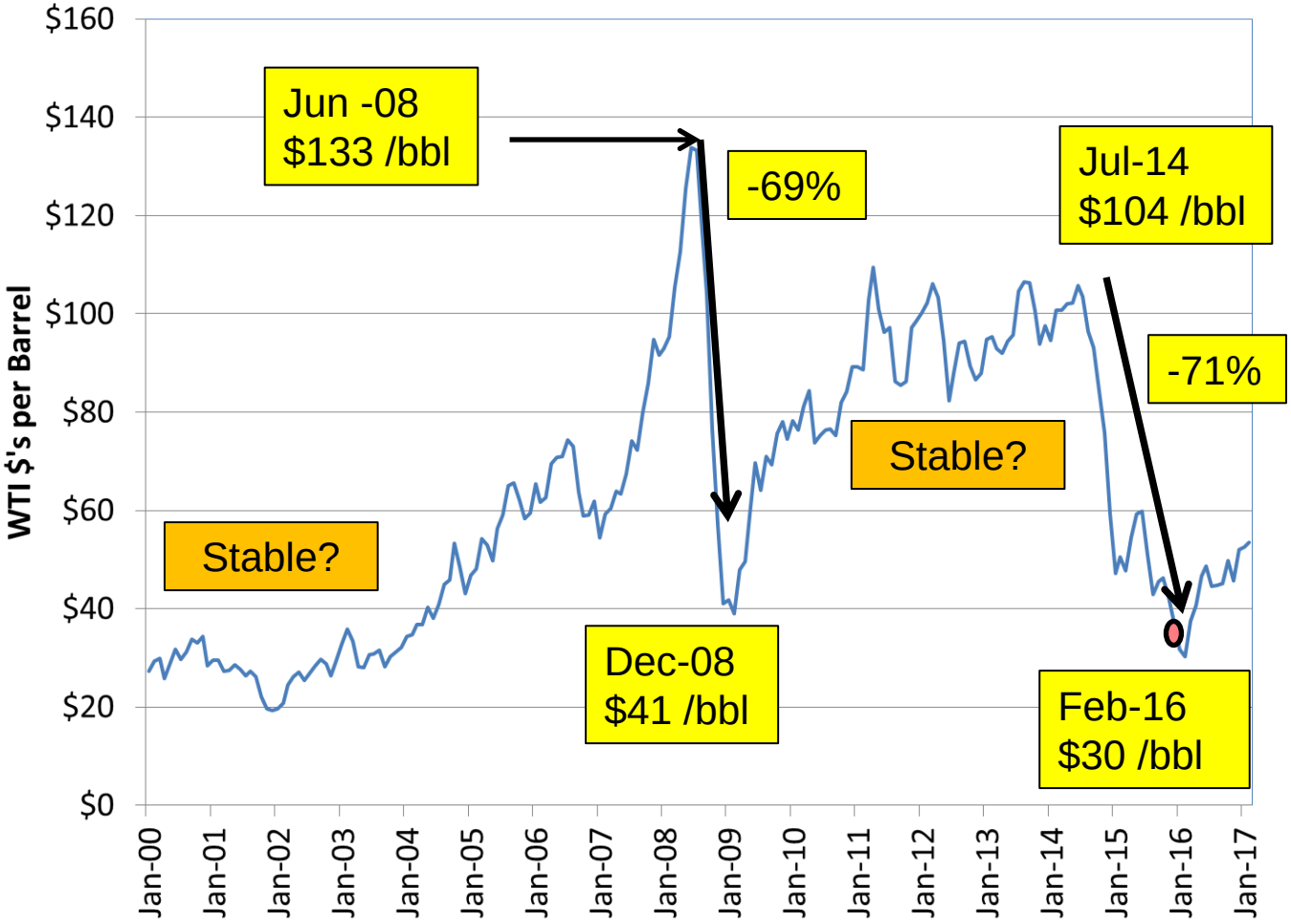
What's Happening Today?
US Crude Oil Markets?

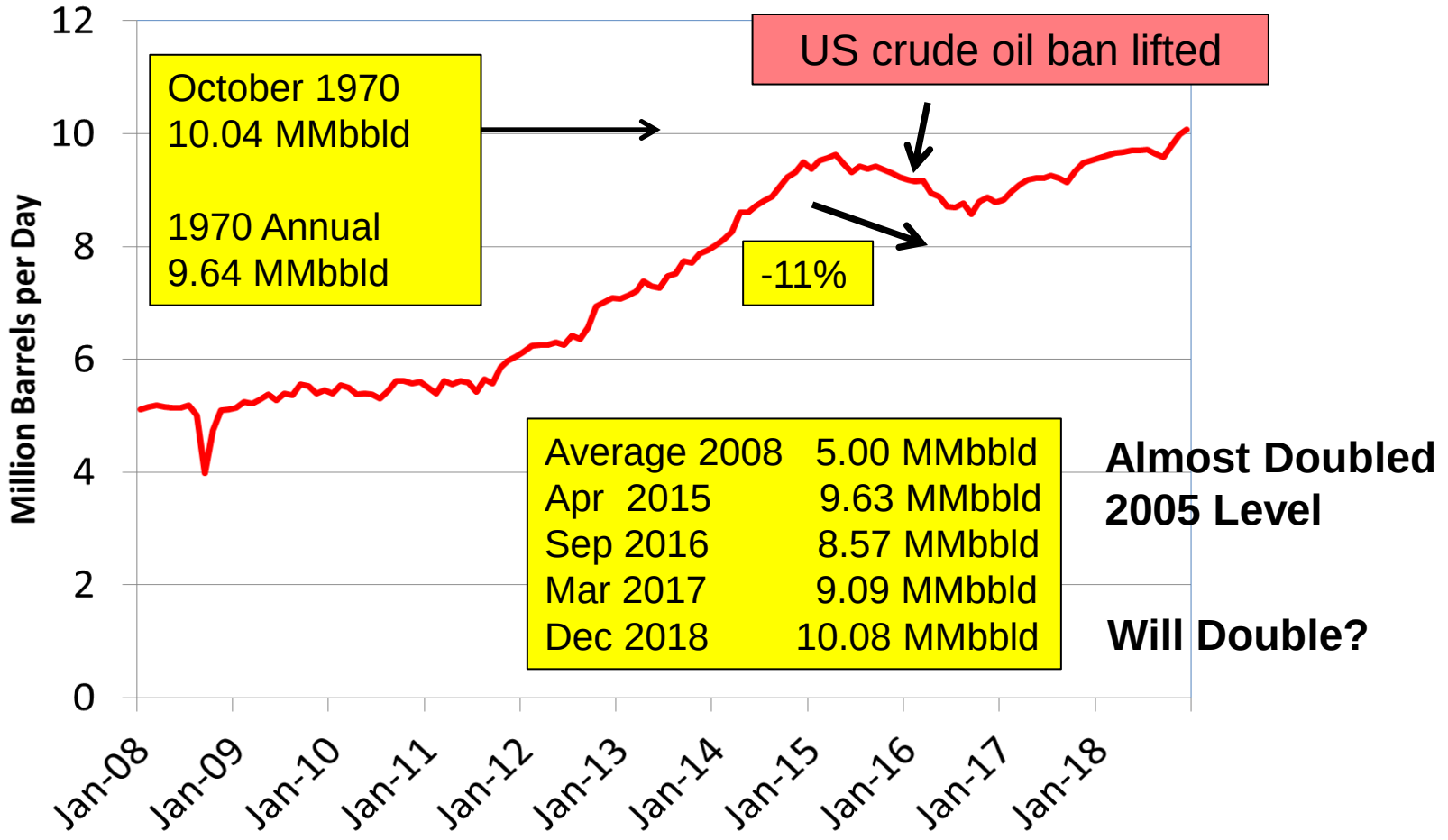
A Recovery in US Crude Oil Prices?



Source: EIA

US crude oil ban lifted – December 2015 – WTI $37 / bbl

US Crude Oil Production Turns Around



Source: EIA Short term Energy Outlook – March 7, 2017

Onshore Productivity on the Rise
Rig Counts Still Down

Bakken - ND	Jul-14	Apr-16	Feb-17
Basin Rig Count	180	30	40
New Well Oil (bbl/d) Production per Rig	480	700	1000
New Well Production (1000's bbld)	86	21	40

Production decline reduced

Eagleford - TX	Jul-14	Apr-16	Feb-17
Basin Rig Count	275	25	75
New Well Oil Production per Rig	600	1200	1350
New Well Production (1000's bbld)	165	30	101

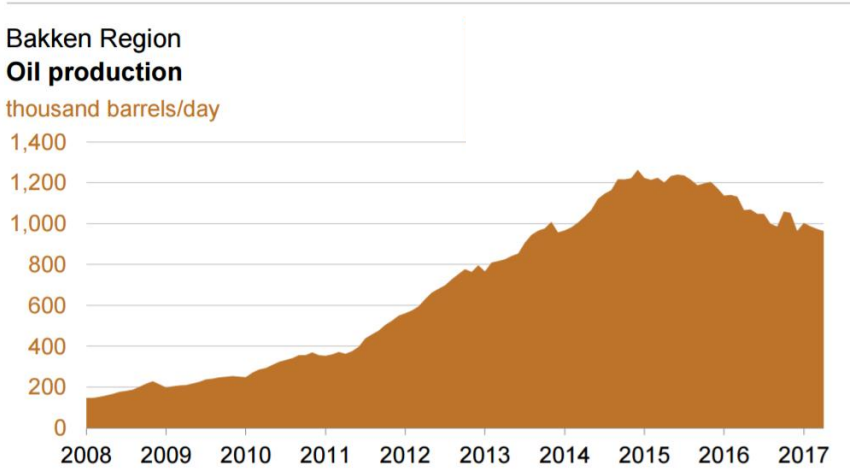
Turned the corner

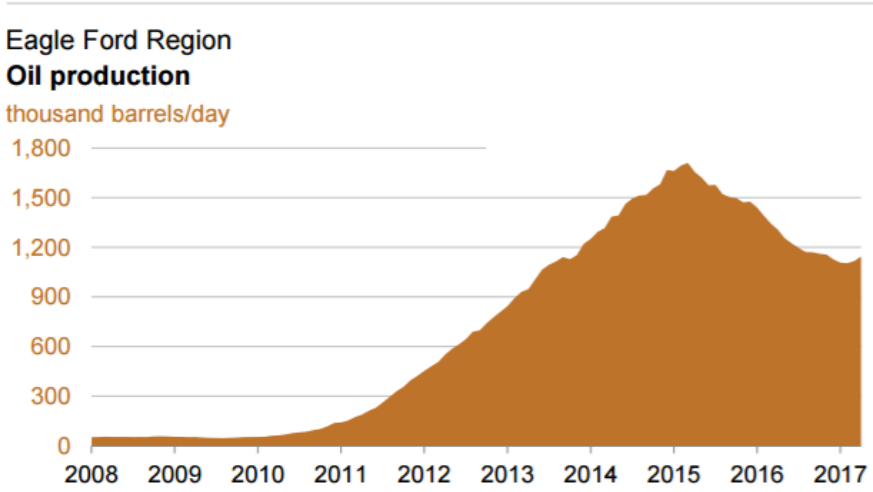
Permian - TX / NM	Jul-14	Apr-16	Feb-17
Basin Rig Count	550	140	300
New Well Oil Production per Rig	200	550	675
New Well Production (1000's bbld)	110	77	203

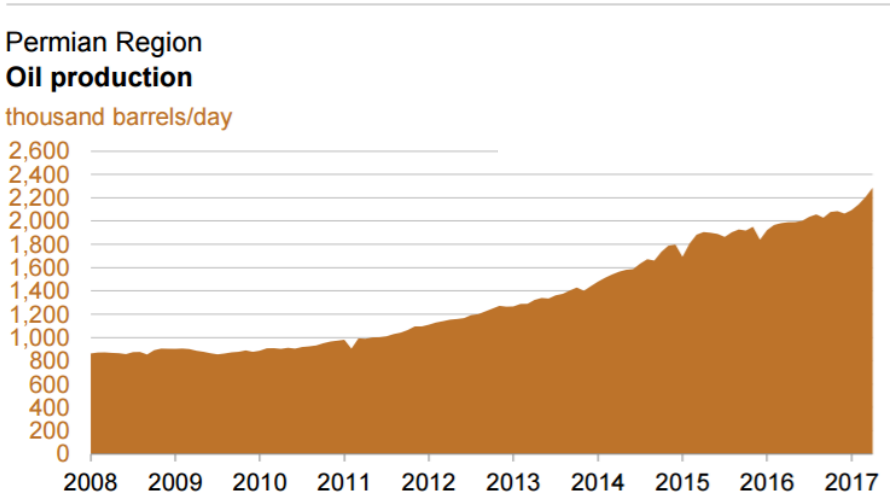
Where the action is

Source: EIA Drilling Productivity Report – March 13, 2017

Not all Basins the Same

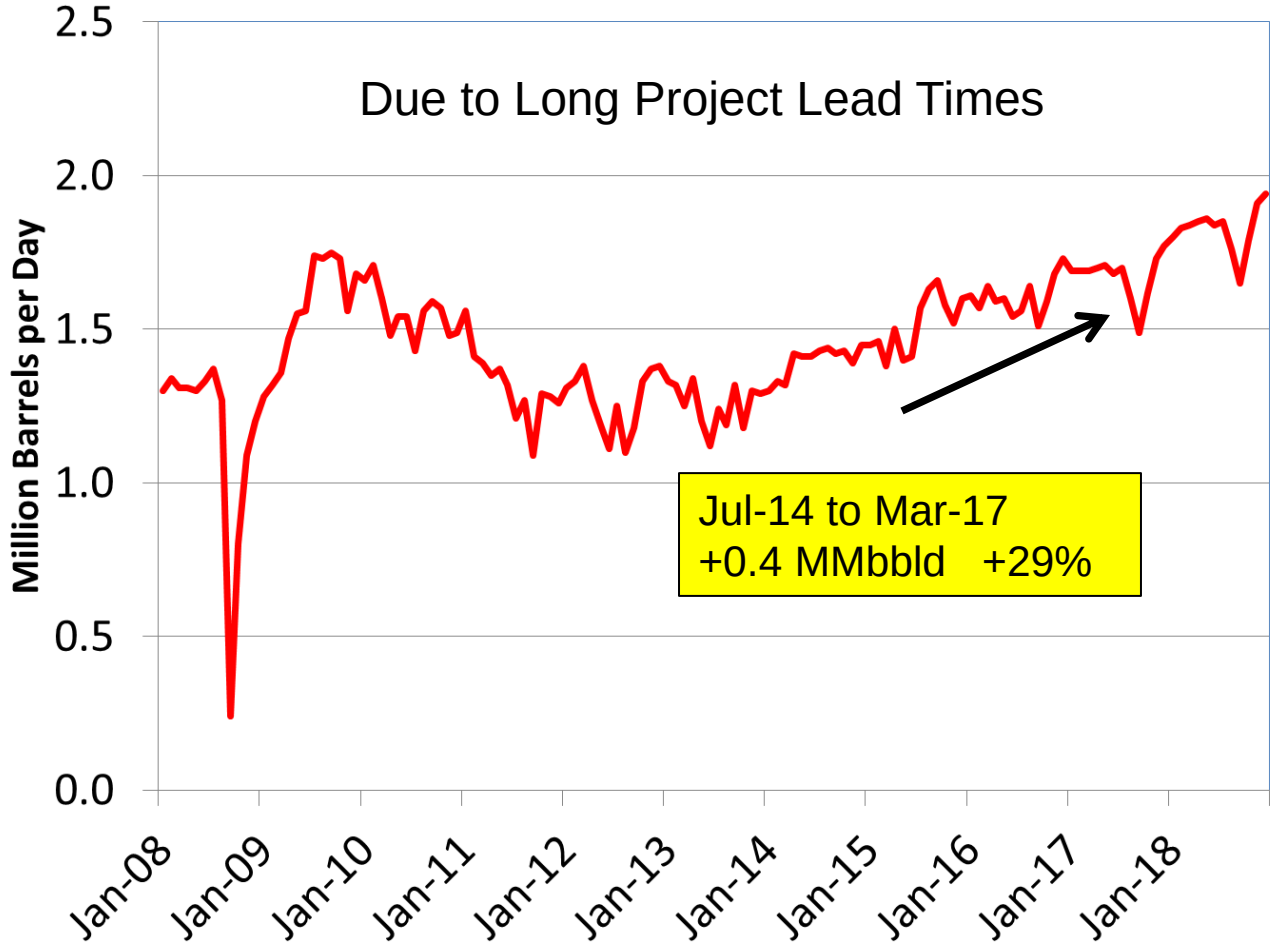




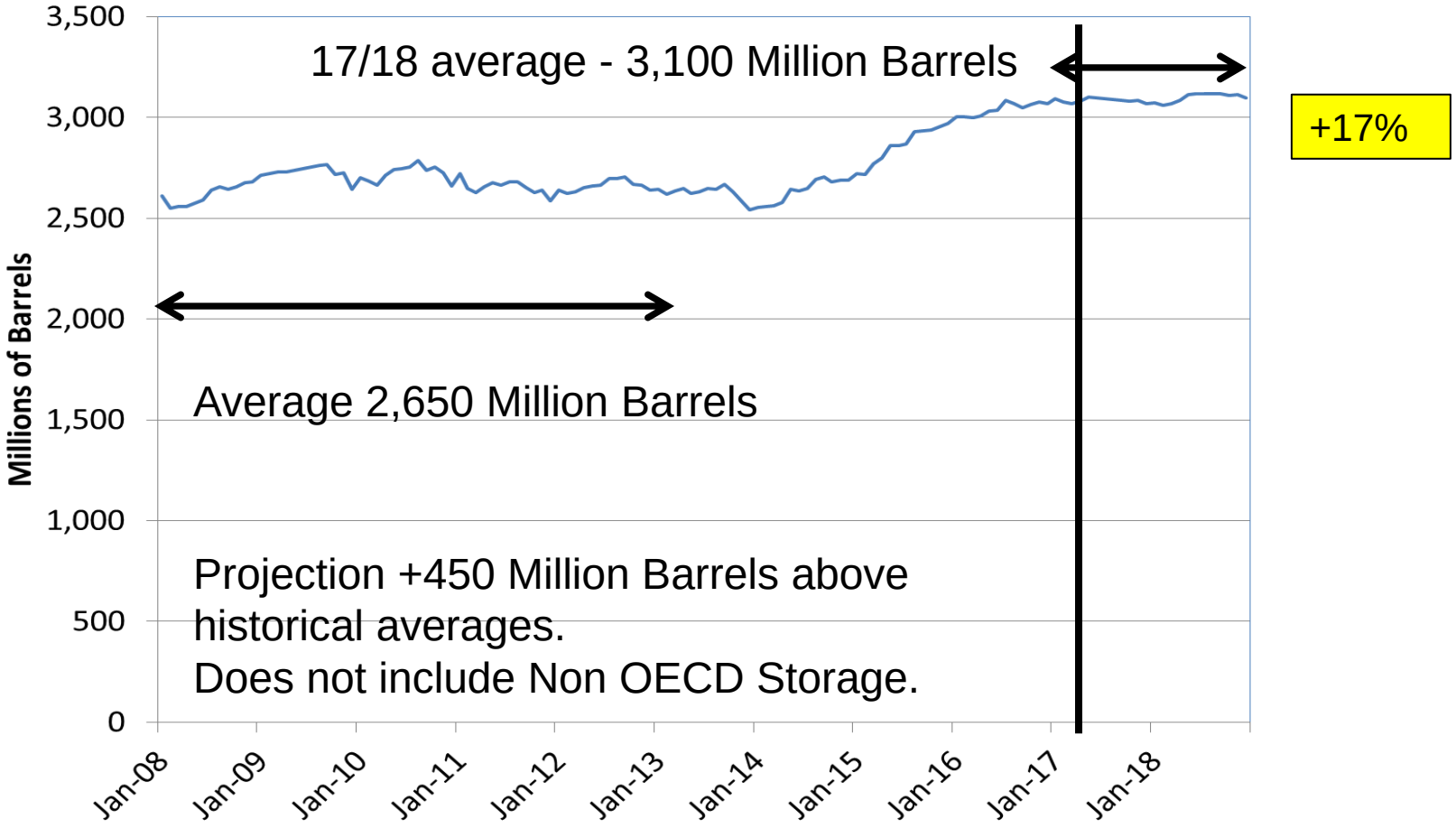


Source: EIA Drilling Productivity Report – March 13, 2017

Trends in Offshore Gulf of Mexico Production - Not Immediately Impacted by Prices

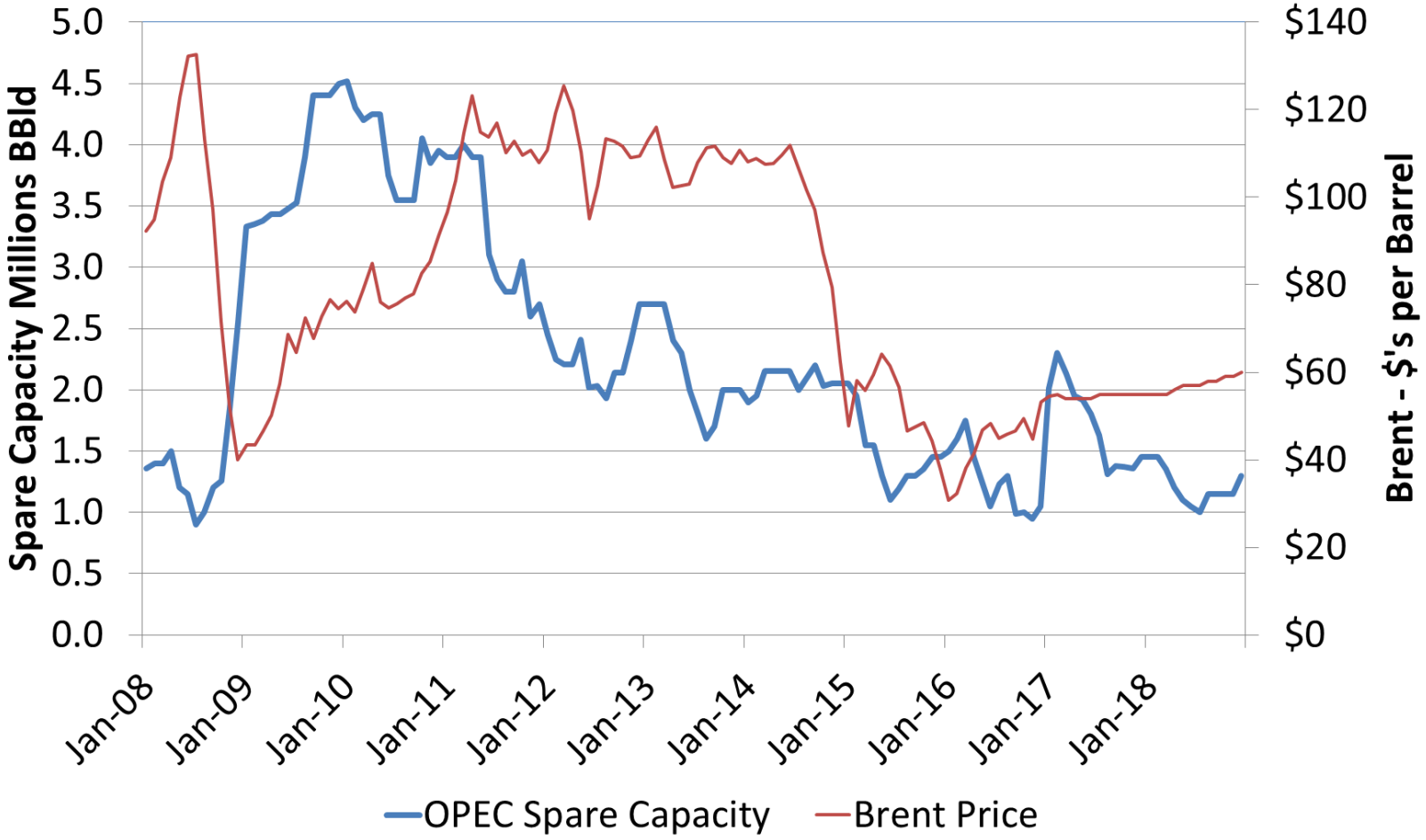


Global OECD Crude Oil Storage Inventories
A New Normal and/or Price Cushion



Source: EIA Short-term Energy Outlook

OPEC Spare Capacity Low – Ability to Raise Prices but not Lower Them



Projected Oil Prices – To Remain Moderate – Barring Major Supply Disruption

Year	WTI	Brent	Brent Premium	
2018	$56.18	$57.18	$1.00	**STEO $'s per Barrel**
2025	$80.08	$86.23	$6.15	**AEO 2017 2016$ / Barrel**
2030	$87.59	$94.52	$6.93	
2040	$102.86	$109.37	$6.51	
2050	$110.35	$116.80	$6.45	

Source:EIA Short-Term Energy Outlook March 7, 2017 and Annual Energy Outlook 2017

API does not forecast commodity prices.

The US Oil and Gas Industry has Weathered to Low Price Storm

Has Crude Oil Exports Helped?

Very Short History of Crude Oil export Ban

- President given power to limit in 1917 (WWI)
  - Various restrictions in War time than relaxed
- Peace time restrictions on crude exports started in OPEC Embargo 1973
  - The Energy Policy and Conservation Act of 1975
  - Gave the Commerce Department Power over Exports.
- Why the Ban?
  - US had crude oil price controls
  - Higher prices in the International Market

Without a crude export ban – nearly all US production would seek higher prices in the international market. Price controls were the reason for the ban

Very Short History of Crude Oil export Ban (cont)

- Last US oil price controls were abolished by President Reagan in 1981.
- Why wasn't the Crude Export Ban repealed
  - Nobody really cared for the next 30 years

- Examples – No mention of Crude Exports
- Jan 1981 – Export controls on refined products eliminated via Executive order
- Energy Policy Act of 2005
- Energy Independence and Security Act of 2007

Very Short History of Crude Oil export Ban (cont)

- Kick it down the road government actions
  - June 2014 – Commerce Department issued export licenses of lease condensate processed through a stabilization unit
  - October 2015 – Commerce Department issues a swap export license for a US / Mexican swap
- Full repeal – December 18, 2015
- First December 31, 2015 – Eagle Ford crude to Italy for Vitol Group (Swiss trading firm)

U.S. Crude Options before the lifting of the ban

- Send it to a US refinery
- Get an export license from the Commerce Department (Don't hold your breath – unless you are going to Canada)*
- Natural gas Plant Liquids – legally exportable. Lease and Field Condensates – not legally exportable. (where is more important than what)

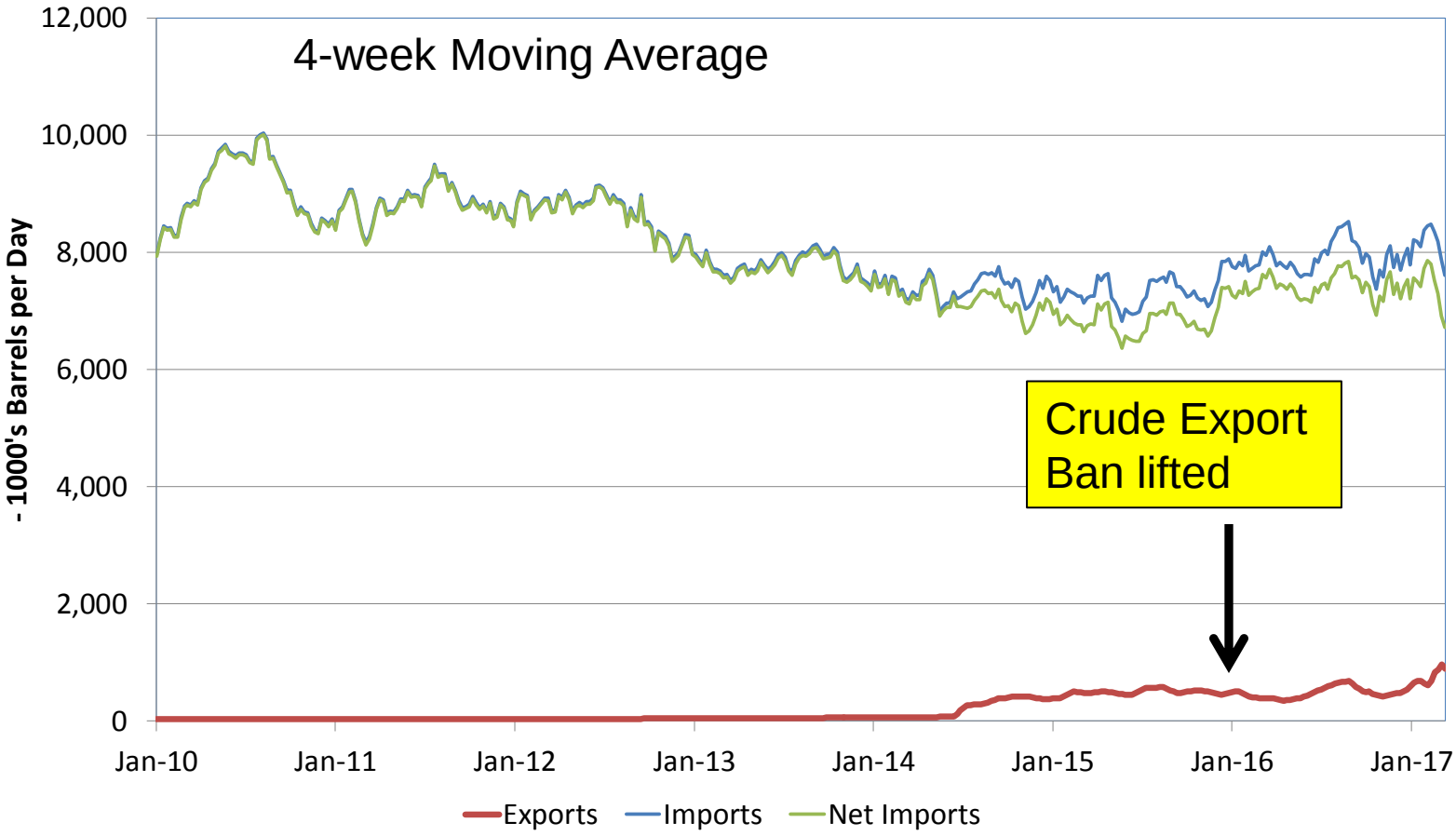
* Minor exceptions for Heavy California crude, certain swaps, Alaska Cook inlet, Non co-mingled Canadian Oil.

U.S. Crude Options After December 2015

- Send it to a US refinery
- Send it to a port for export
  (Or to Canada or Mexico)

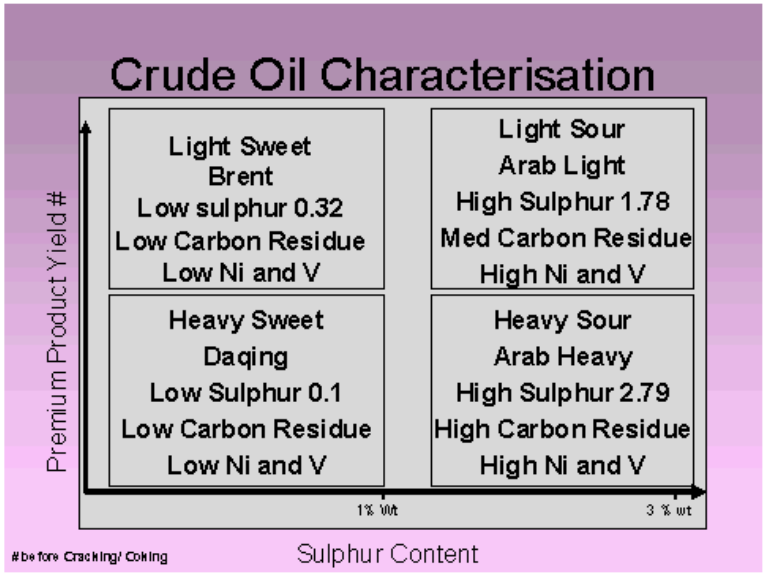
- No exceptions or export permits needed

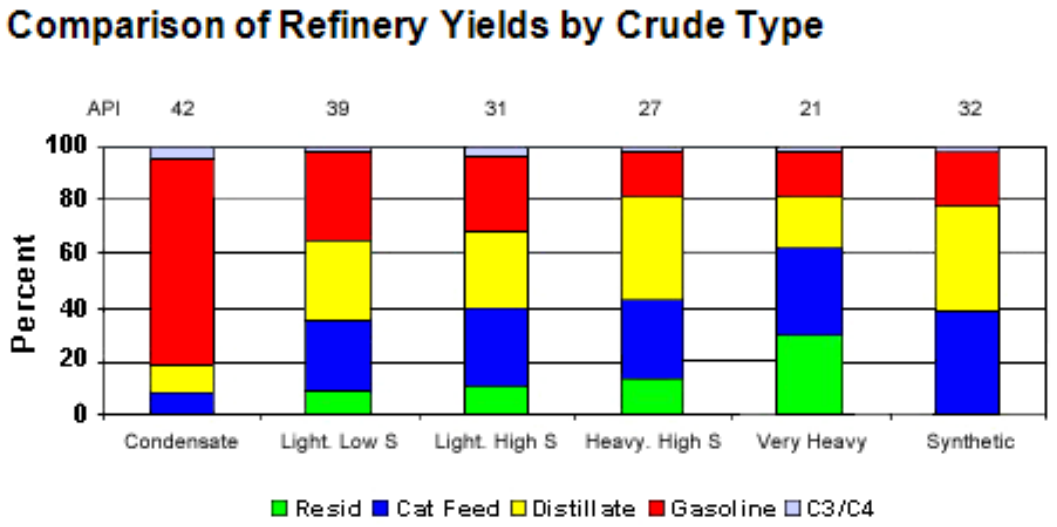
Why do we need to Export Crude? We still import a lot



Because
Crude oils are ***NOT*** the same.

Crude varies in weight and sulfur content.
Each refinery is optimized for a particular type.





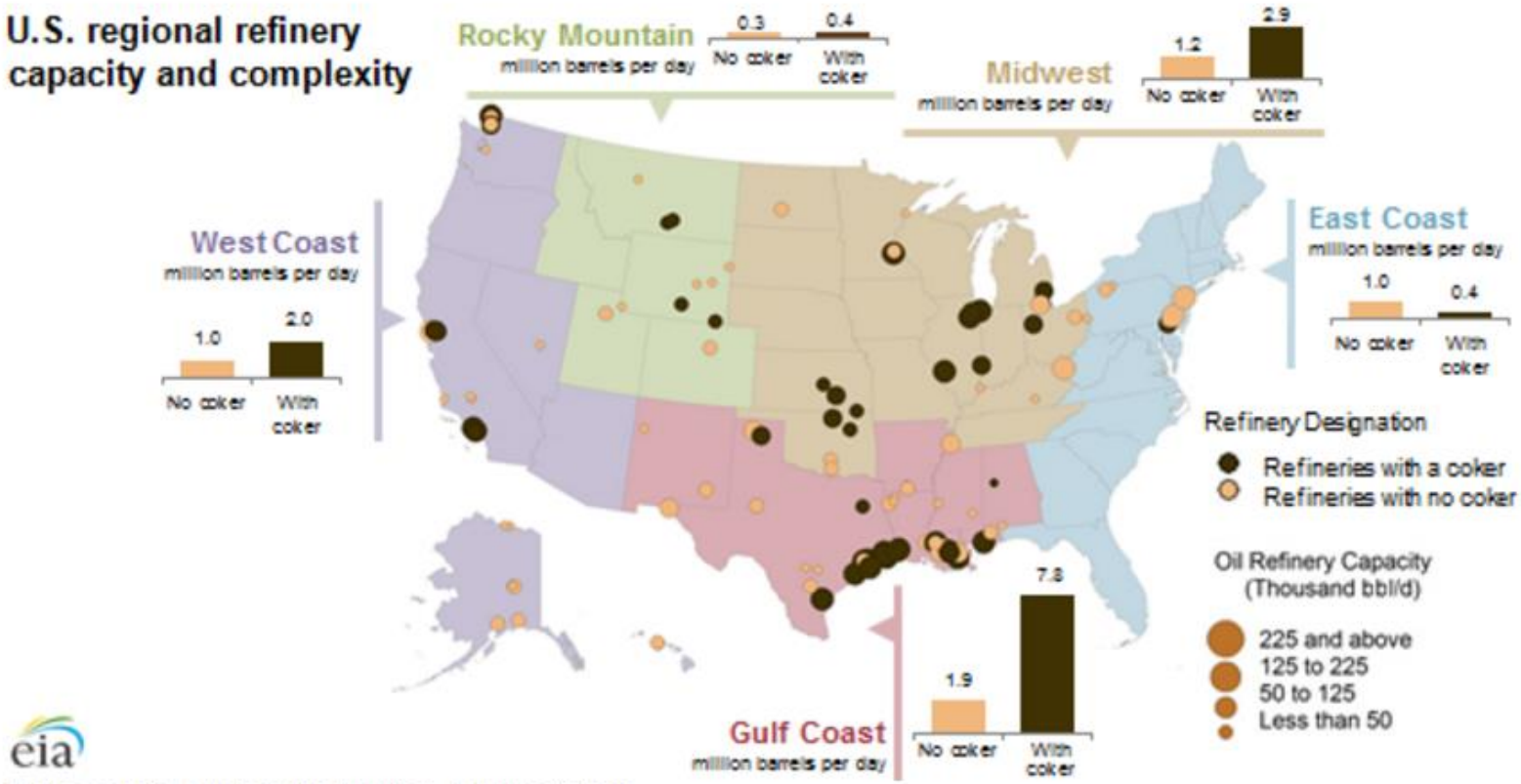
To Process Heavy Oil – You Need One of These

86,000 b/d unit being built in Mexico for $1.3 billion

It breaks larger carbon molecules into good stuff and leaves Coke behind

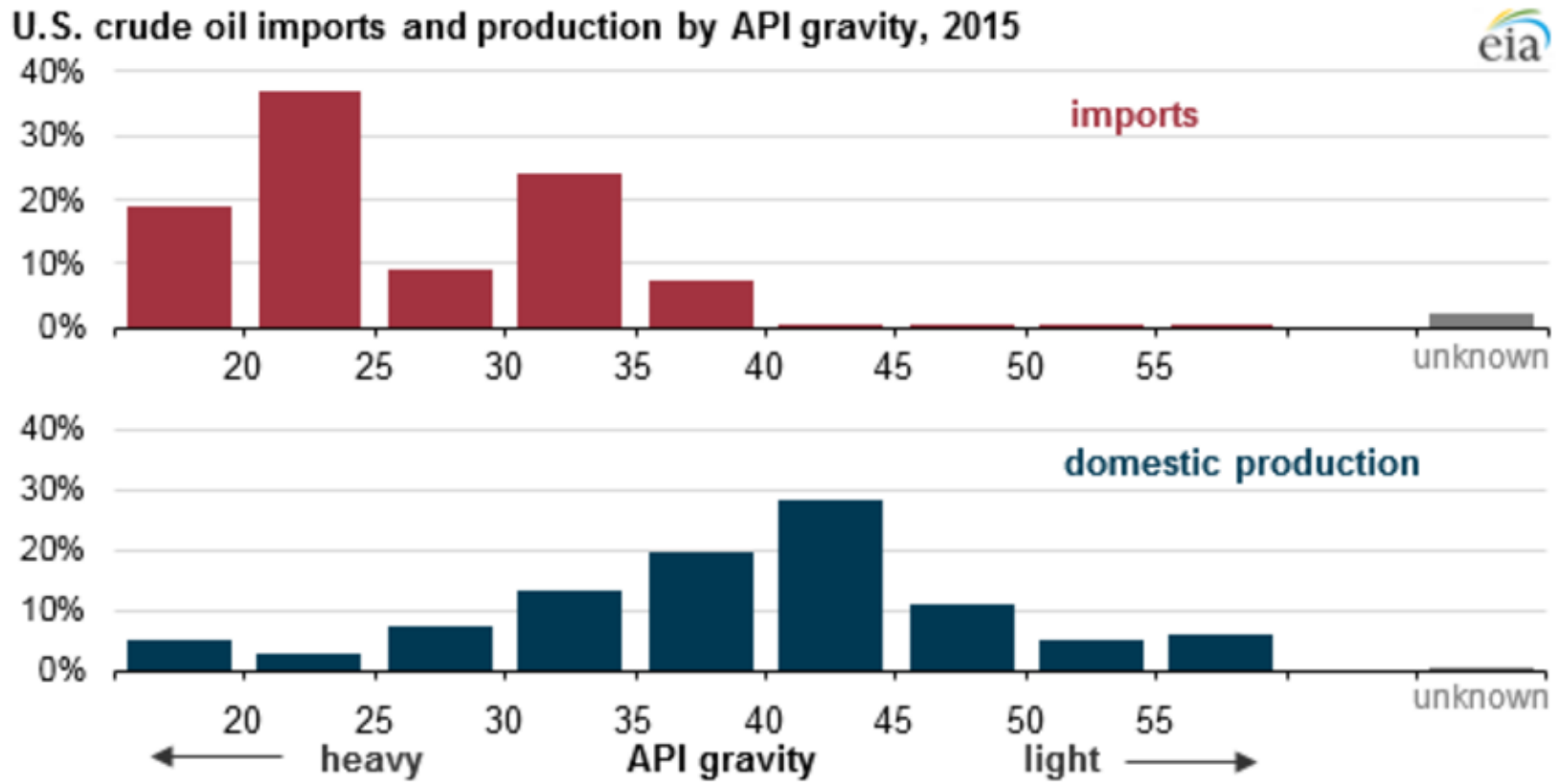
Source: EIA

The US built a lot of Cokers to process heavy sour oil



Source: U.S. Energy Information Administration
Note: As of January 1, 2014, there were 133 operating refineries with atmospheric crude oil distillation units (ACDU) totaling capacity of 18.9 million barrels per stream day. Heavy capacity denotes refineries with coking capacity; light capacity denotes refineries without coking capacity.

We want the heavy oil not because it is better but because it is cheaper



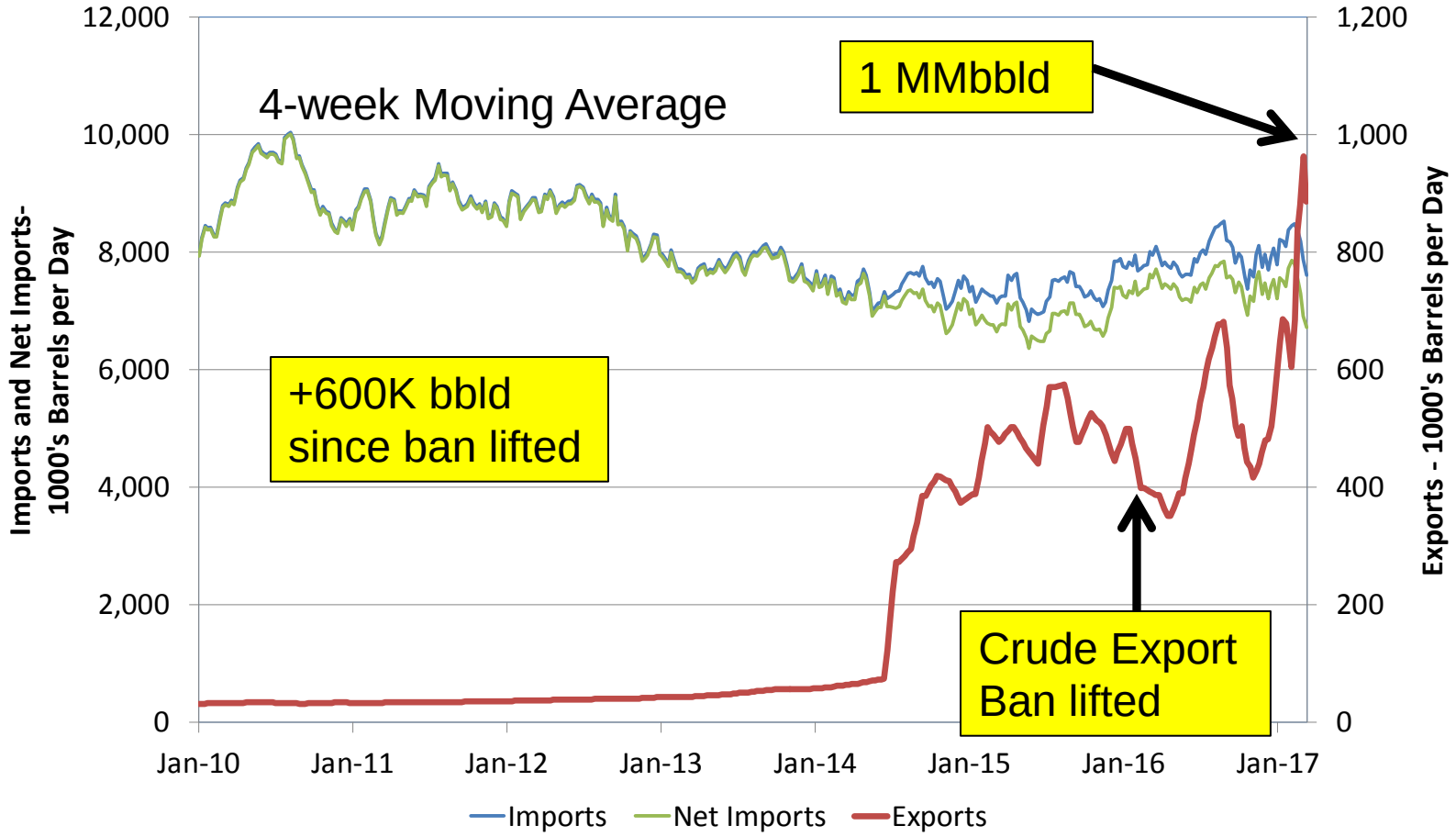
Source: U.S. Energy Information Administration, EIA-914 and EIA-814

What were to Arguments for U.S. Crude Oil Exports?

- Increased U.S. domestic oil prices
  (Narrow US / World price spread – WTI vs. Brent and other indexes)
- Increased US Production
  (and associated economic benefits, GDP, Employment)
- Decreased US refined product prices
  (Save at the Pump)
- Market Efficiency
  (Greater Market Access, Improved Refinery throughput, efficient use of oil transportation system, prudent refinery investments)
- Energy Security – Political Benefits

After Export Ban Lifted Exports trended up

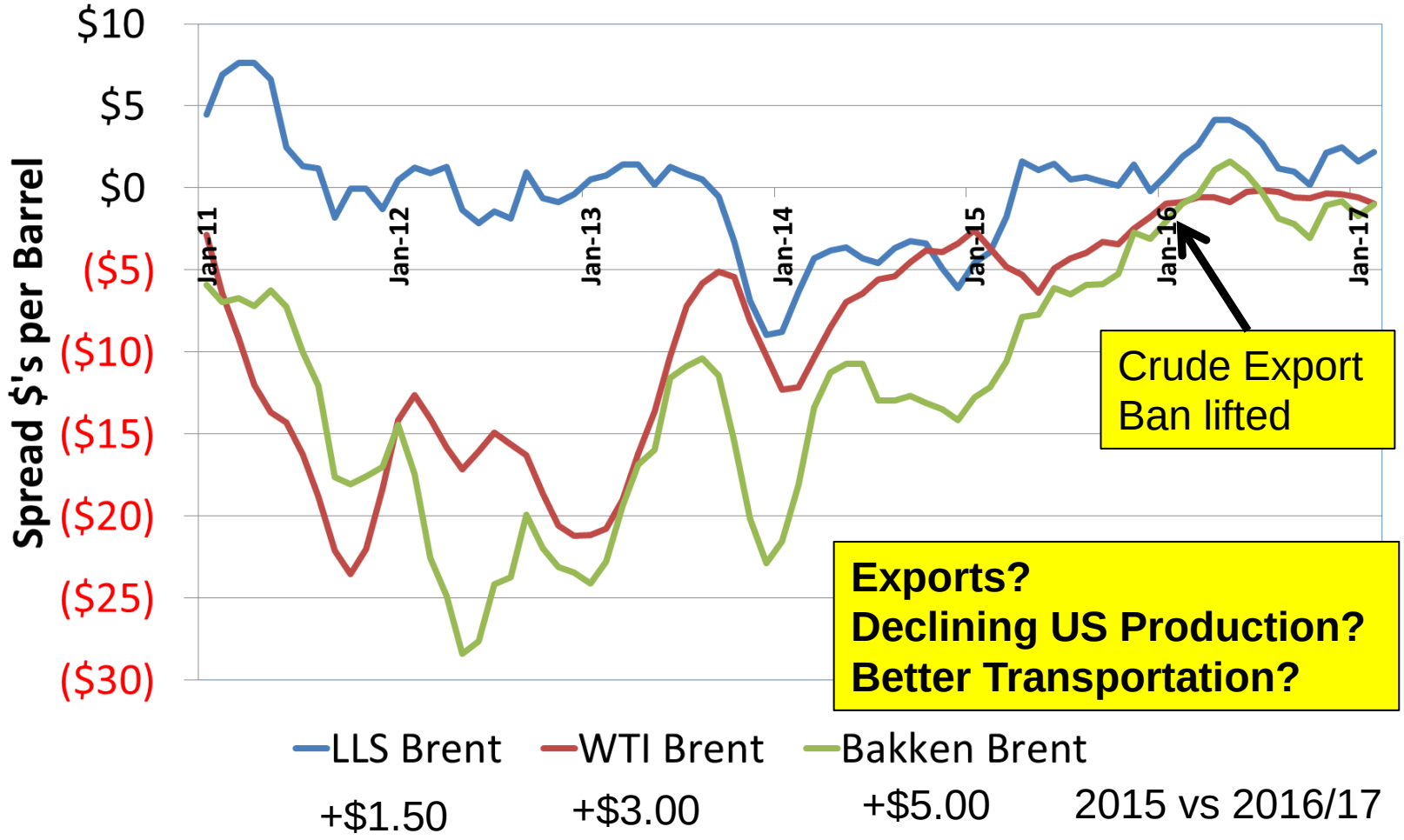
(So did Imports and Net Imports)



A less restricted market – appears to trend with higher exports (and imports)

Did Relative US Oil Prices Improve after Ban Lifted – Yes – But Why?

Source: Bloomberg Terminal – 4 month moving average



Lighter and Sweeter Means More Valuable

$$\ln P_{i,t} = \underset{(0.0449)}{-0.2678} + \underset{(0.0003)}{1.0249} \ln P_{Brent,t} + \underset{(0.0012)}{0.0046}\, API_i - \underset{(0.0074)}{0.0294}\, Sulfur_i + \sum_j \alpha_j D_{ij}$$

Medlock, Kenneth B.. "To Lift or Not to Lift? The U.S. Crude Oil Export Ban: Implications for Price and Energy Security." Baker Institute (2015)

Bonus Question: If Brent is $50 – What is the price of WTI – if it has an API gravity of 40.8 and a sulfur content of 0.4%

Note: You do not need to memorize equation.

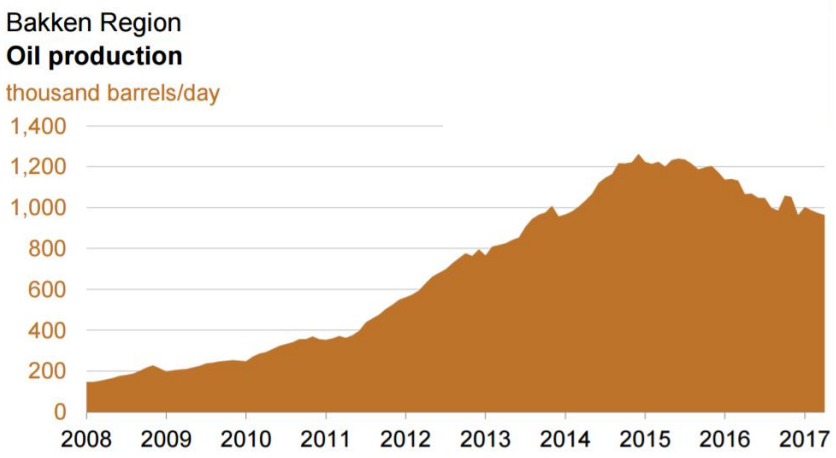
http://bakerinstitute.org/research/lift-or-not-lift-us-crude-oil-export-ban-implications-price-and-energy-security/.

Lighter and Sweeter Means More Valuable

Value in the international market – Transportation costs may apply.

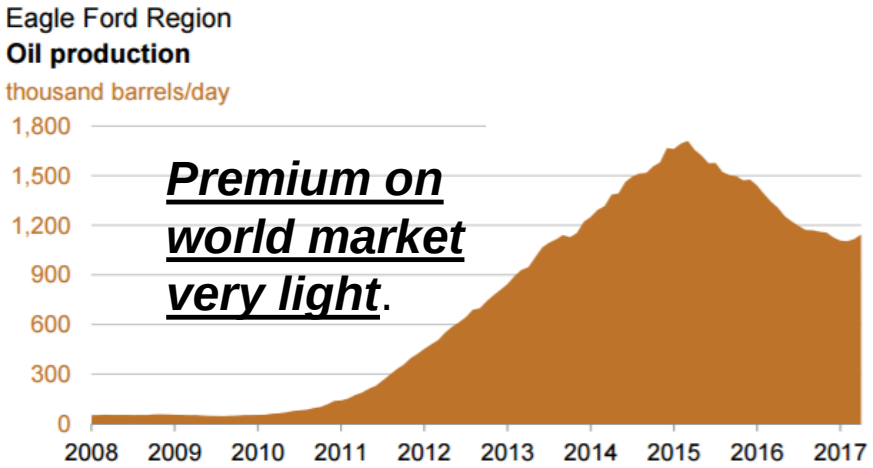
Crude Oil	API	Sulfur	
Brent	**37.5**	**0.40**	**$ 50.00**
WTI	40.8	0.34	$ 50.85
LLS	38.0	0.40	$ 50.11
Eagle Ford Crude I	47.7	0.10	$ 52.85
Eagle Ford Crude II	58.8	0.04	$ 55.71
Bakken I	36.7	0.10	$ 50.26
Bakken II	46.3	0.06	$ 52.58
Oriente (Ecuador) The Import Competition	24.0	1.49	$ 45.40

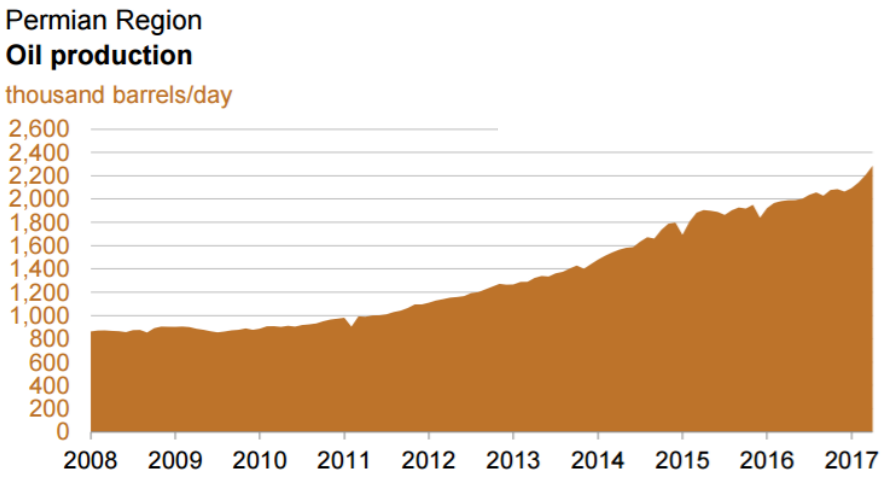
Did US Production go up do to Crude Exports? Maybe?



Relative higher prices = more production = whole host of economic benefits

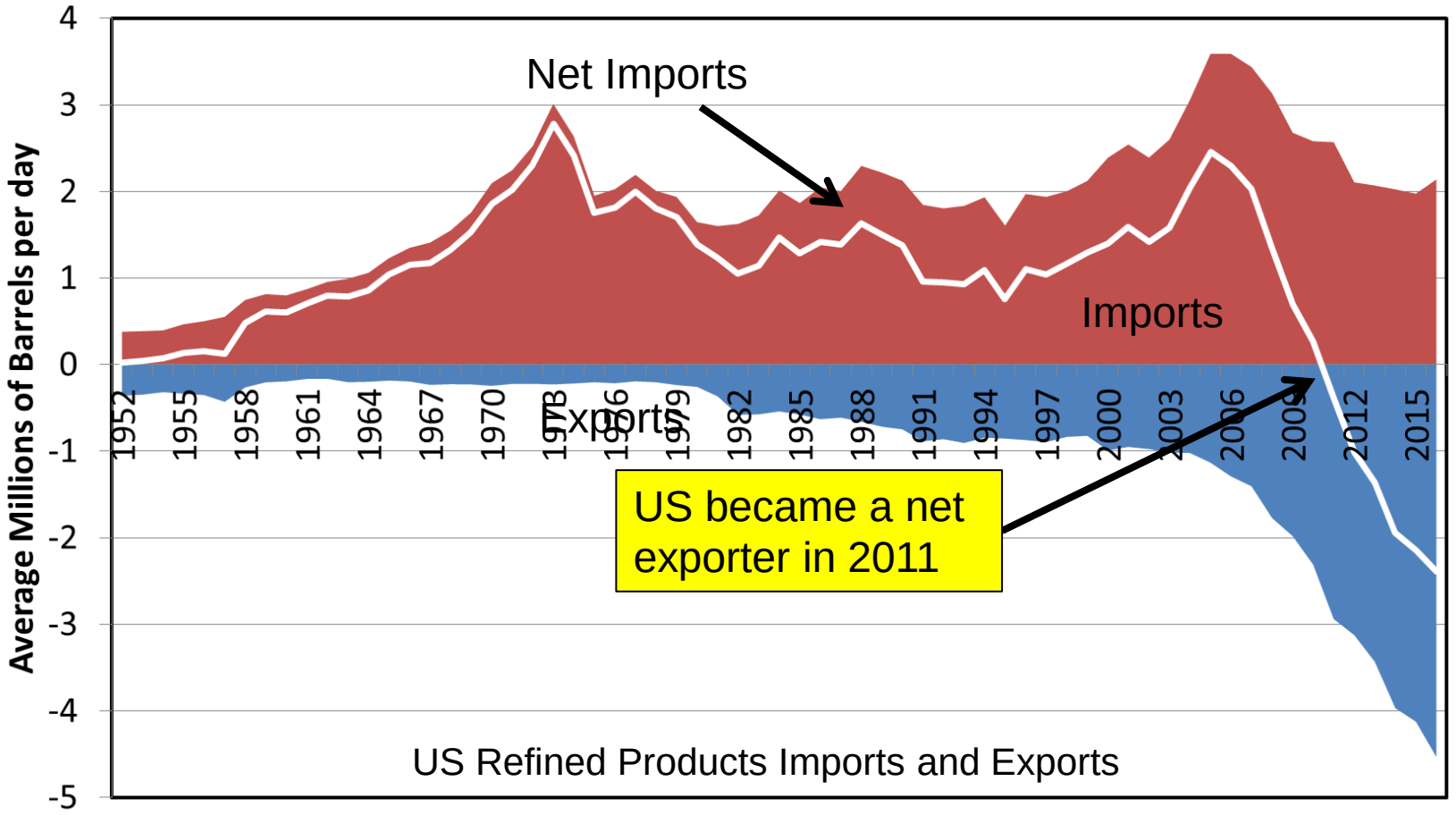
Future higher US production will be less constrained.





Source: EIA Drilling Productivity Report – March 13, 2017

US Refined Products are linked to World Market – US Pump Prices Follow



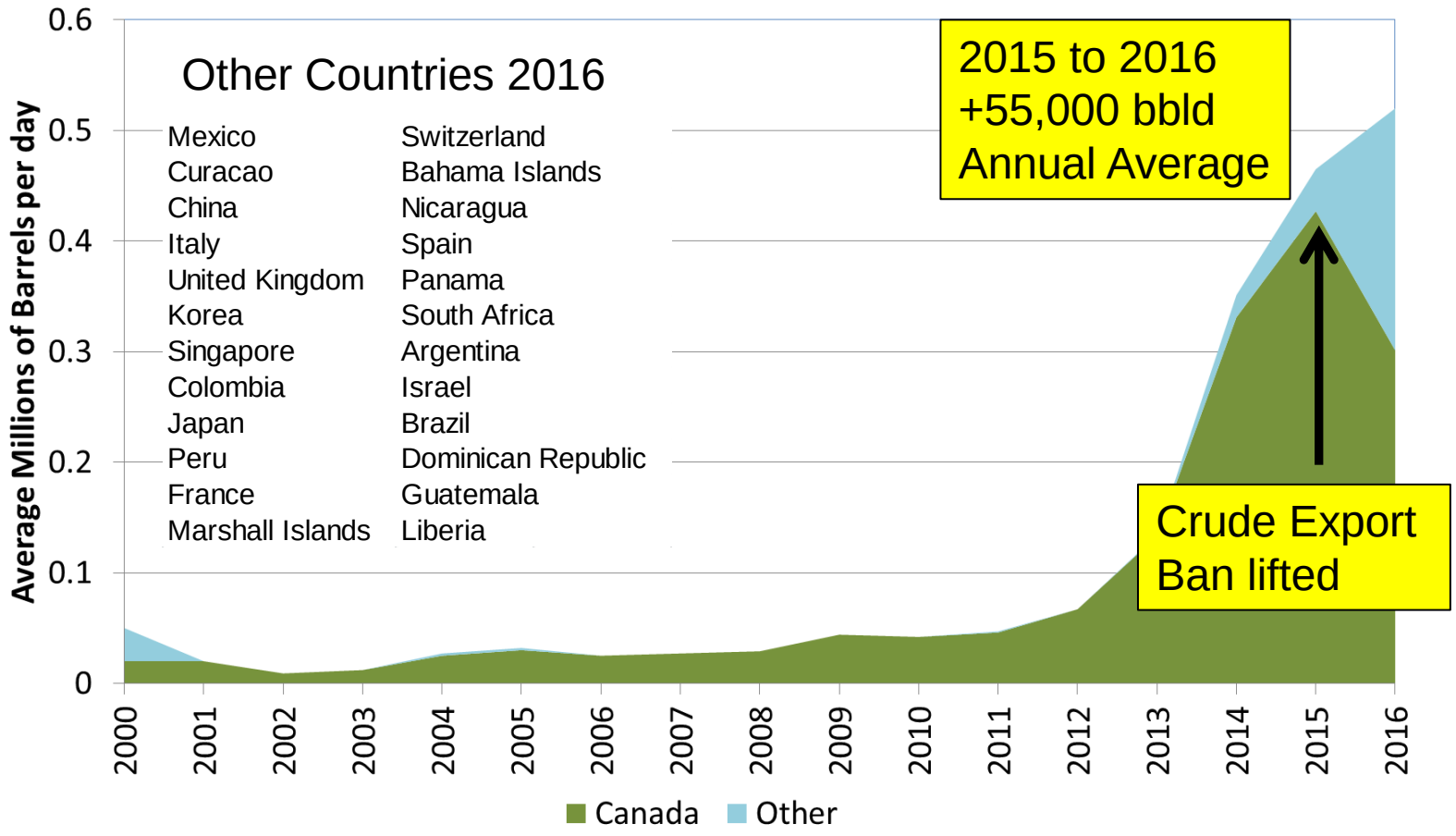
Source: EIA

Lower Pump Prices are a function of World Supply and Increased US production

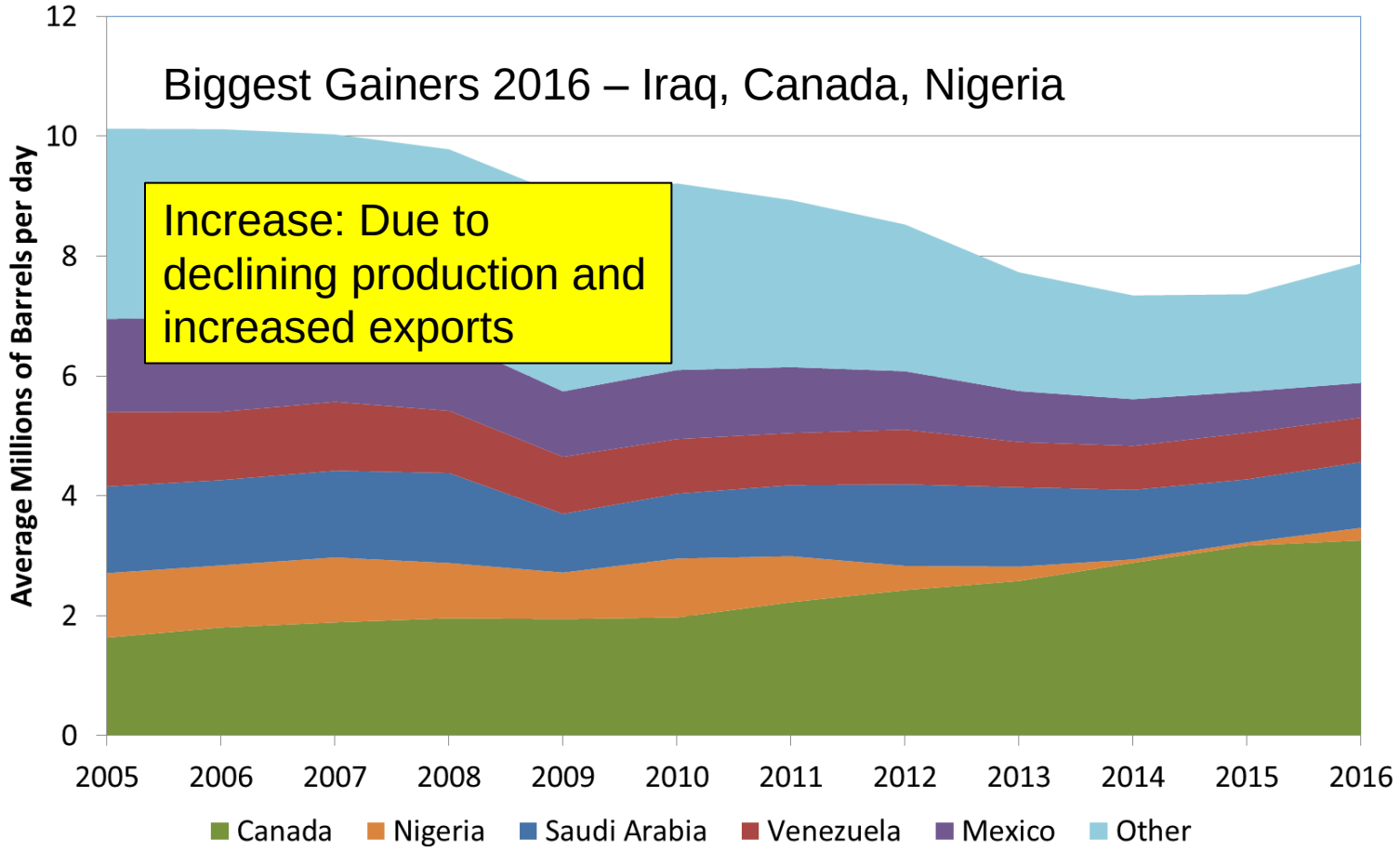
Summary of Major Economic Studies	Estimated Decline in U.S. Price per Gallon of Motor Fuels
Resources for the Future	**1.7 to 4.5 cents**
IHS	**8 cents average**
ICF	**Up to 3.8 cents** (2.3 cents average)
Brookings & Nera	**Up to 12 cents** (9 cents average)
Aspen & MAPI	**Up to 9 cents**
GAO	**1.5 to 13 cents**
CBO	**5 to 10 cents**
Columbia University	**Up to 12 cents**
EIA	**1 cent***

*Assumes non-U.S. oil suppliers partially reduce production in response

In 2016 US crude went around the world (Canada still #1)



Crude Oil Imports went up in 2016 (+500K bd)

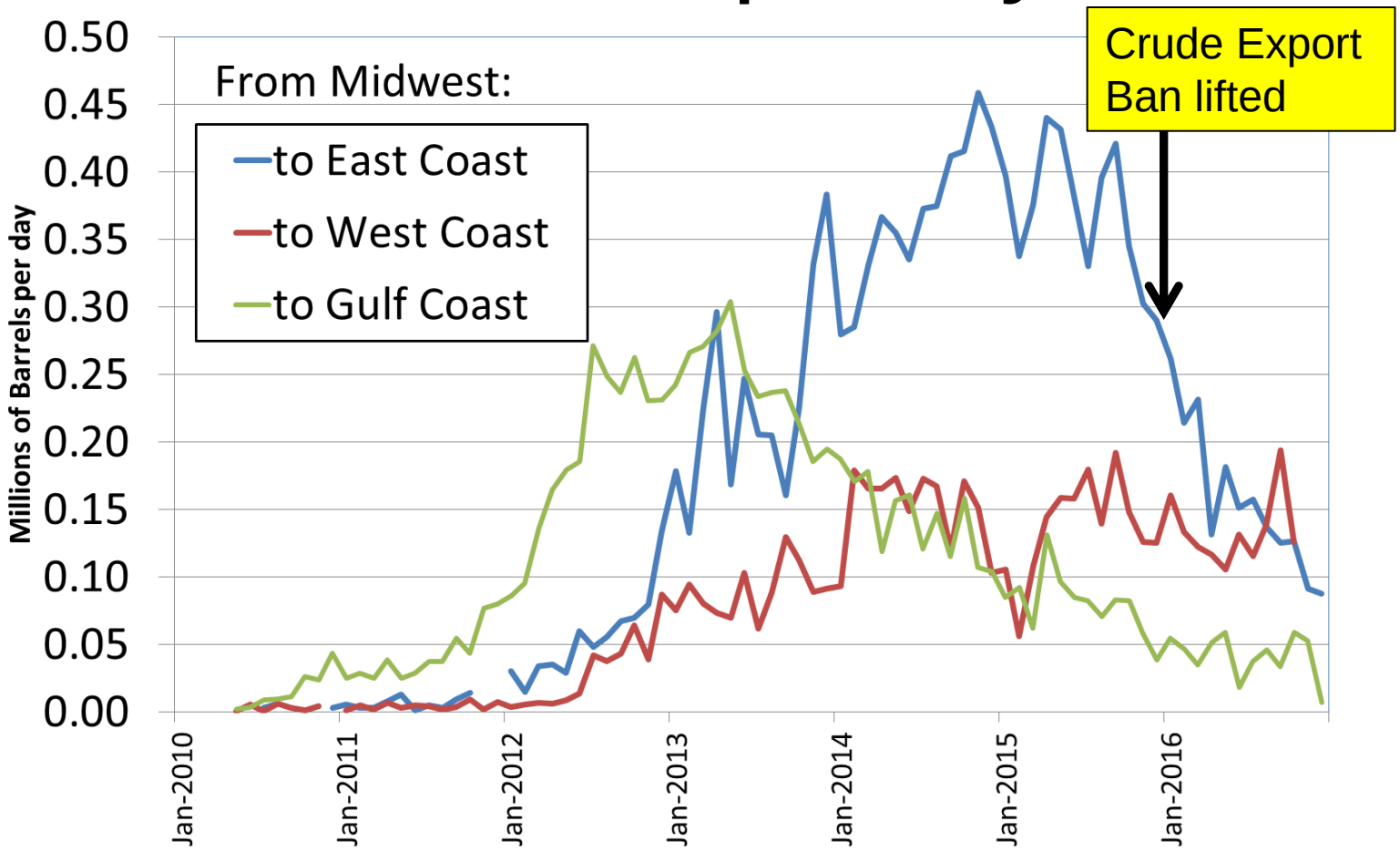


Oil transport – Rail is more flexible and more expensive

Pipeline			
Origin	Destination	Crude	Rate $/bl
Alberta, CAN	Cushing, TX	Light	$3.78
Alberta, CAN	Cushing, TX	Heavy	$4.54
Cushing, OK	Houston, TX	Light	$2.71
Cushing, OK	Houston, TX	Heavy	$3.26
Rail			
Origin	Destination	Crude	Rate $/bl
North Dakota	Houston, TX	Bakken	$10.38
North Dakota	NY Harbor	Bakken	$10.55
Alberta, CAN	Houston, TX	Canadian Heavy	$16.73

Source: Argus, *Petroleum Transportation North America*, Aug. 22, 2014

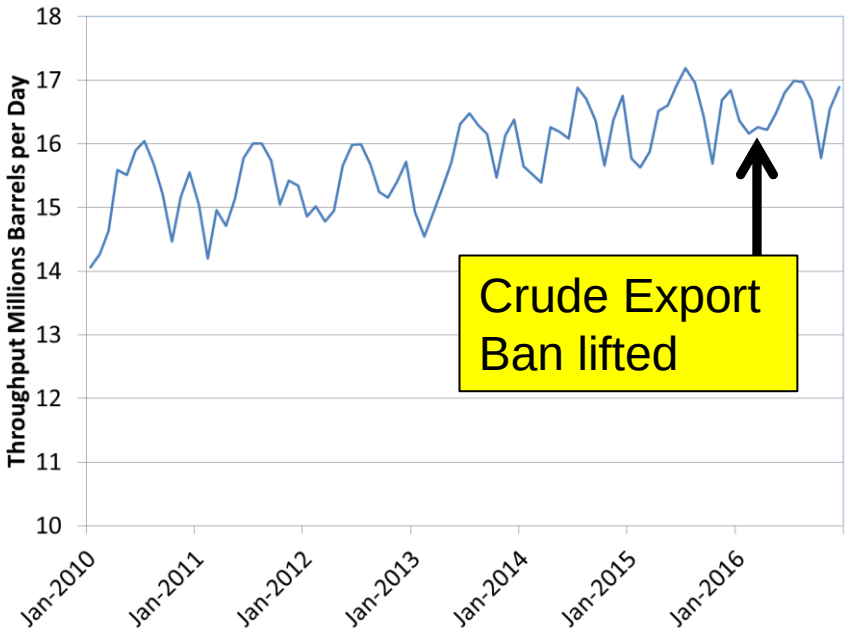
More efficient use of oil transport system?



East Coast Refineries receiving more foreign imports vs. rail shipments

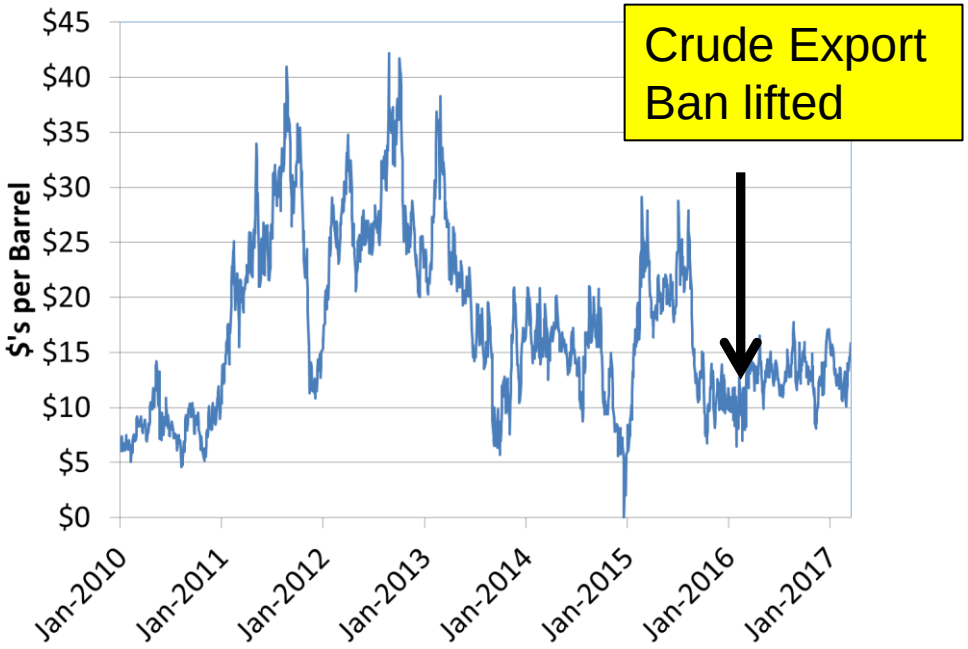
Change Refinery Throughput Engineering v. Economics

US Refinery Throughput



2015 vs 2016 +86,000 Bbld
16.4 to 16.5 MMbbld

WTI – Gulf Coast 321 Crack Spread



2015 vs 2016/17 -$4.25 / Bbl
$17.00 to $12.75 / Bbl

More Prudent Refinery Investments?

"The respondents reported over **$5 billion** dollars of project investments during this time *(2013 – 2016)* to gain about 2 million barrels per day of increased capacity to process the light crude oil. In context, the total U.S. refining sector accounts for about $10 billion per year of capital expenditures."
American Fuel and Petrochemical Manufacturers (AFPM) March 2015

"As of late May *(2015)*, eight companies had announced plans to build condensate splitters, in addition to one running already at Port Arthur, Texas. The total investment is more than **$1 billion**." RBN Energy

Political Benefits

Leon Panetta, former Secretary of Defense and Director of the Central Intelligence Agency under President Barack Obama, and Stephen Hadley, former National Security Advisor under President George W. Bush, in a Wall Street Journal op-ed:

"The pathway to achieving U.S. goals also can be ***economic—as simple as ensuring that allies and friends have access to secure supplies of energy."***

Petr Gandalovič, Czech Republic Ambassador to the United States
"The larger the number of stable democracies among the world energy exporters, the more robust the energy security of the Czech Republic and the European Union will be."

Crude Export Benefit Recap

- Increased U.S. domestic oil prices
- Increased US Production
- Decreased US refined product prices
- Market Efficiency
  (Greater Market Access, Improved Refinery throughput, efficient use of oil transportation system, prudent refinery investments)
- Energy Security – Political Benefits

Potential Benefits in the Future

Concluding Remark

Business Columnist David Nicklaus, St. Louis Post-Dispatch

“Disco music, wide lapels and other 1970s artifacts have been out of fashion for a long time. It’s time for that era’s energy policy to join them on the scrap heap of history.”