Oil Market Outlook

Nachspiel - cheaper oil but not cheap

The DNB oil story in pictures & graphs

August 2013 - Torbjørn Kjus

DNB Markets' Oil Story In Graphs/Pictures/Tables

- **DNB Markets oil price forecast – remains unchanged since last year** **3**
- **What has happened to spot prices and the forward curve since last year?** **4**
- **Historically it has been more normal for oil prices in real terms to trend lower, rather than higher** **5**
- **Score card for the 2014 oil market – Call on OPEC is lower – Oil prices forecasted lower to 102 $/b** **6**
- **The stone age did not end due to a lack of stones** 7**-10**
  - Quotes from almost 100 years ago from the US Bureau of Mines
  - Global proven oil reserves keep on increasing
  - Global shale oil reserves estimated by the EIA to be 345 billion barrels – Russia larger than the US
- **Global oil demand** 11**-19**
  - Oil's market share in the global energy mix is decreasing – Coal is the key winner last ten years
  - Global trend line demand for oil never recovered after the oil price increases in the 1970's
  - IEA does not have the answer – Has chopped off 15 million b/d of the 2030 forecast
  - Less back for the buck with respect to economic growth vs oil demand growth
  - Even if you hit spot on the global economic growth, you will not be correct with respect to global oil demand growth
  - Influential players now believe global oil demand could peak by 2020
  - Climate change effect on oil demand – we see no meaningful change in global policy by 2020 – no global price of carbon emissions in sight
- **OECD oil demand** **20-27**
  - As oil prices started to increase - oil demand growth in the OECD started diminishing
  - 10% of OECD oil demand is already lost – and most of this will not be able to return even with an improving economy
  - Oil demand in Japan – Europe - US will continue to trend lower in coming years
- **The US is recovering from its oil over-dose** **28-45**
  - Why is not total vehicle miles driven (VMT) recovering? - Baby boomers getting older and generation Y is different
  - US efficiency improvements now visible in the data – and this is only the start
  - Substitution from oil to natural gas in the transportation sector will kick in with meaningful volumes by 2020
  - Compelling economic incentives to switch in the trucking sector
  - Refuse trucks switching over to natgas – a good example of the gigantic momentum
  - Global NGV vehicle fleet increasing by 25% per year – Electrical cars starting from scratch, but look at Tesla
- **Non-OECD oil demand** **46-51**
  - The accelerating growth in demand we used to expect from non-OECD is really not materializing
- **Chinese oil demand** **52-65**
  - Refinery throughput not growing like it used to
  - Gasoline demand performing strongly on the back of large car sales, but diesel demand growth is stalling
  - Greener energy sources are starting to compete with diesel in the Chinese stationary sector – Wind is the best example
  - Electricity output growth only 4%, used to be 13-17% in the good periods – Chinese GDP growth might be lower than reported
  - The Chinese economy will grow slower than we have been used to going forward
  - Chinese oil demand growth is getting weaker – not stronger
- **Global oil supply** **67-69**
  - Flattish E&P CAPEX does not necessarily translate to flat non-OPEC production the next 5-7 years – There are large lag effects at play
  - Oil production outside of core-OPEC is growing more quickly than global oil demand
  - OPEC's export capacity no lower in 2015 than in 2008?
- **The US shale oil revolution** **70-90**
  - US production of crude oil has increased 1.7 million b/d in just two years
  - Production exploding to the upside in North-Dakota, Texas, New-Mexico and Oklahoma
  - No-one saw this coming – US oil production growth in 2012 surprised 2000% to the upside vs the IEA estimate
  - Shale oil is not unconventional oil but it is unconventionally extracted
  - Decline rates are high but production effect is so far more than offset by increased drilling and efficiency improvements in the rig fleet
  - IP rates in the Bakken looks to be improving
  - Even with a 20% drop in drilling intensity, production in the Bakken will continue to increase, albeit at a slower pace than in 2012
  - Resource base looks large enough to maintain growth at least beyond 2020
  - US refineries mainly centered at the GOM and the eastern parts
  - Shale production has been expensive to move – but now pipeline capacity has expended and is expanding
  - Result of pipeline expansions is cheaper available domestic crude for US refineries – result is that imports is being pushed away
- **Cheaper oil but not cheap oil** **91-110**
  - Break even for the most prolific US shale oil plays range from 70-85 $/b – This is fairly high up on the cost scale
  - Processes are improving rapidly in the shale industry – particularly the rig efficiency – and there is big potential for cost reductions
  - Shale oil is high up on the global cost ladder compared with most other resources
  - Still there are more expensive projects that have started to suffer – Oil sands, Off-shore (Mad Dog in the GOM, Johan Castberg in Norway, etc)
  - The new shale oil industry offers a much quicker response time and for the first time OPEC will have support from non-OPEC on price drops
  - Spare capacity is still low – and geopolitical risk has been on the rise and will stay high – regional, external and domestic pressure points
  - The J-curve and very different demographics from the western world suggest further unrest in the MENA
  - The oil market has lost more than 2 million b/d in unplanned disruptions last two years – this has more than offset the growth in US shale oil
  - But can unplanned outages continue to grow in the same pace? Will we loose another 2 million b/d in outages the next 2-3 years – probably not
- **Which strategy will Saudi Arabia choose?** **111-113**
  - If the current trends in supply vs demand continues Saudi Arabia will have to cut 1-1.5 million b/d by 2015 to balance the market
  - In the 1980's Saudi cut massively to protect the oil price, but remember that Saudi do not need a certain oil price, they need revenues
  - Saudi revenues is a combination of both price and volume – Same revenues at 84 $/b and maintaining current output as if cutting 1.5 mbd to defend 100 $/b oil
- **Net decline rates are not as high as many think – We do not need to find and develop 4 new Saudi Arabia by 2020** **114-116**
  - If net decline is 2% and global demand grows 0.8% - then already existing projects will cover all the oil we need by 2020 – we do not need to find anything new in that time frame
  - If net decline since year 2000 was 3.8% it means the world has put on 41 million b/d of new production the last 12 years – no way

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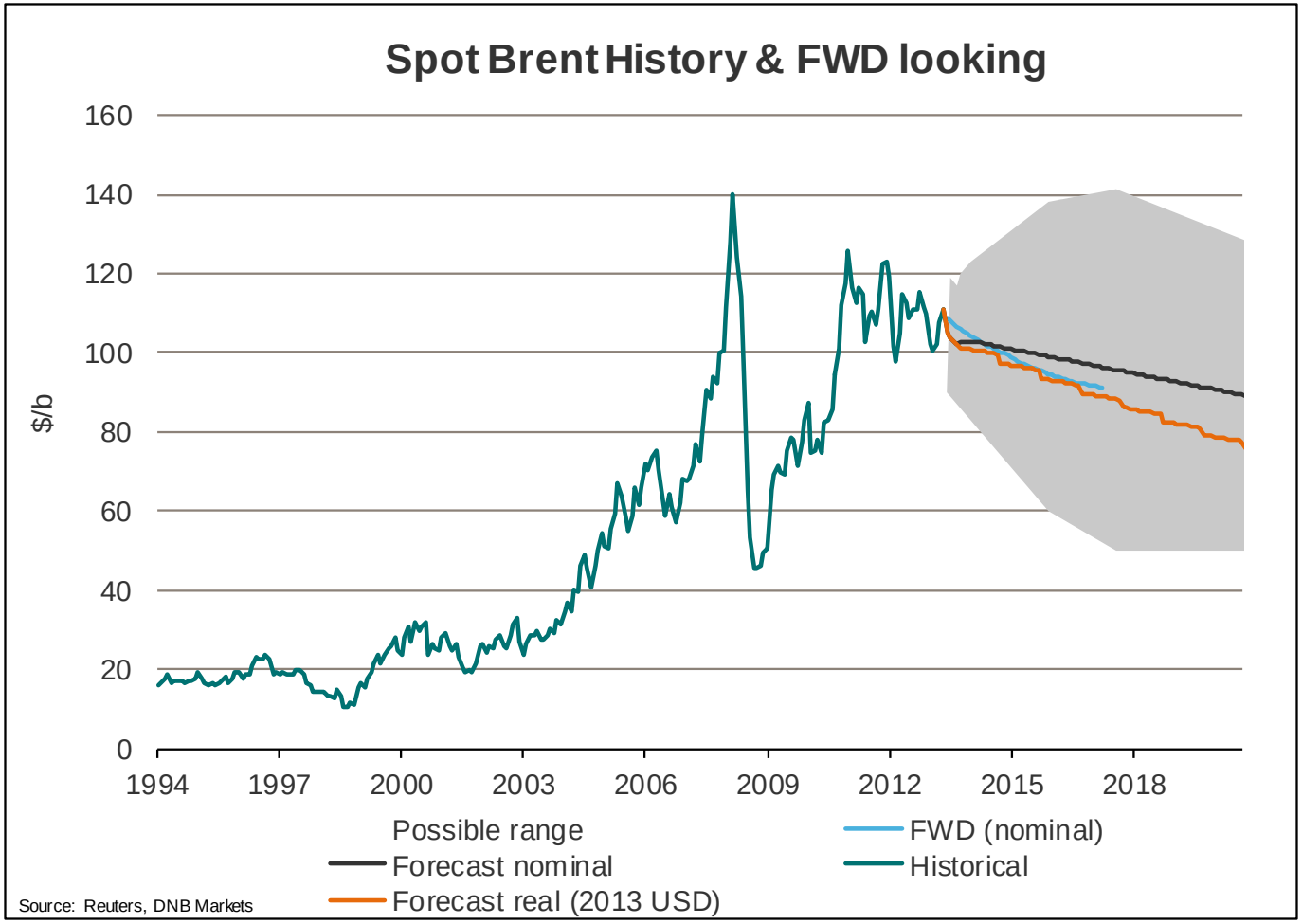
Long Term Oil Price Forecast

(The forecast is for the average of the rolling 1st month ICE Brent future contract)

	Historical Nominal $/b	Historical Real (2011) $/b
2001	24.9	31.1
2002	25.1	31.3
2003	28.5	35.3
2004	38.1	46.6
2005	55.0	62.8
2006	66.2	72.7
2007	72.7	78.5
2008	98.7	101.6
2009	62.6	64.7
2010	80.4	82.0
2011	110.8	110.8
2012	111.7	111.7
	Forecast Nominal $/b	**Forecast Real (2012) $/b**
Q1-13	113	113
Q2-13	103	103
Q3-13	105	105
Q4-13	103	103
2013	106	106
2014	102	100
2015	100	96
2016	98	92
2017	96	89
2018	94	85
2019	92	81
2020	90	78



Source: Reuters, DNB Markets

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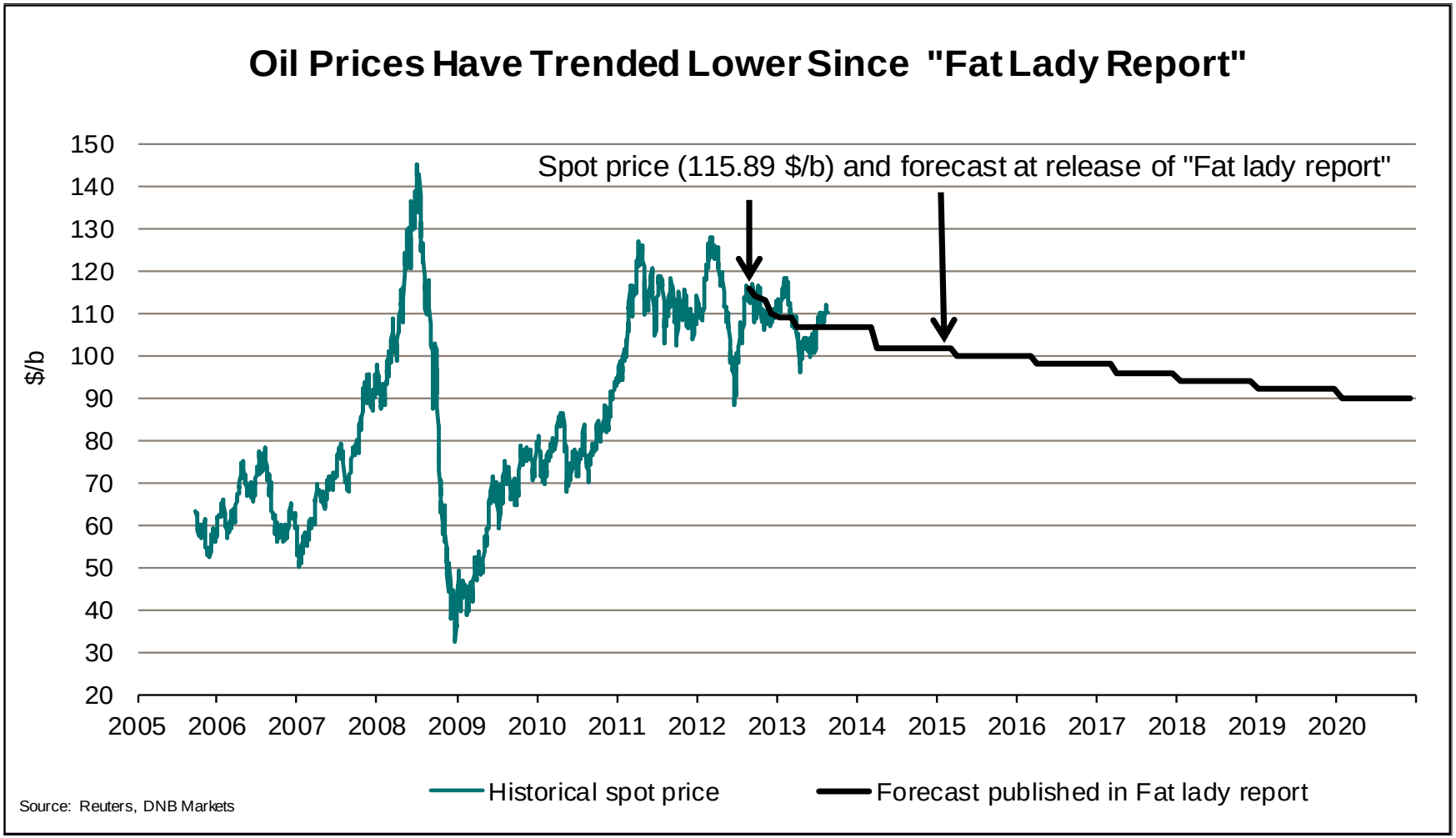
What Has Happened To Oil Prices Since “The Fat Lady Report”

- The market has continued to overshoot and undershoot, but has trended lower



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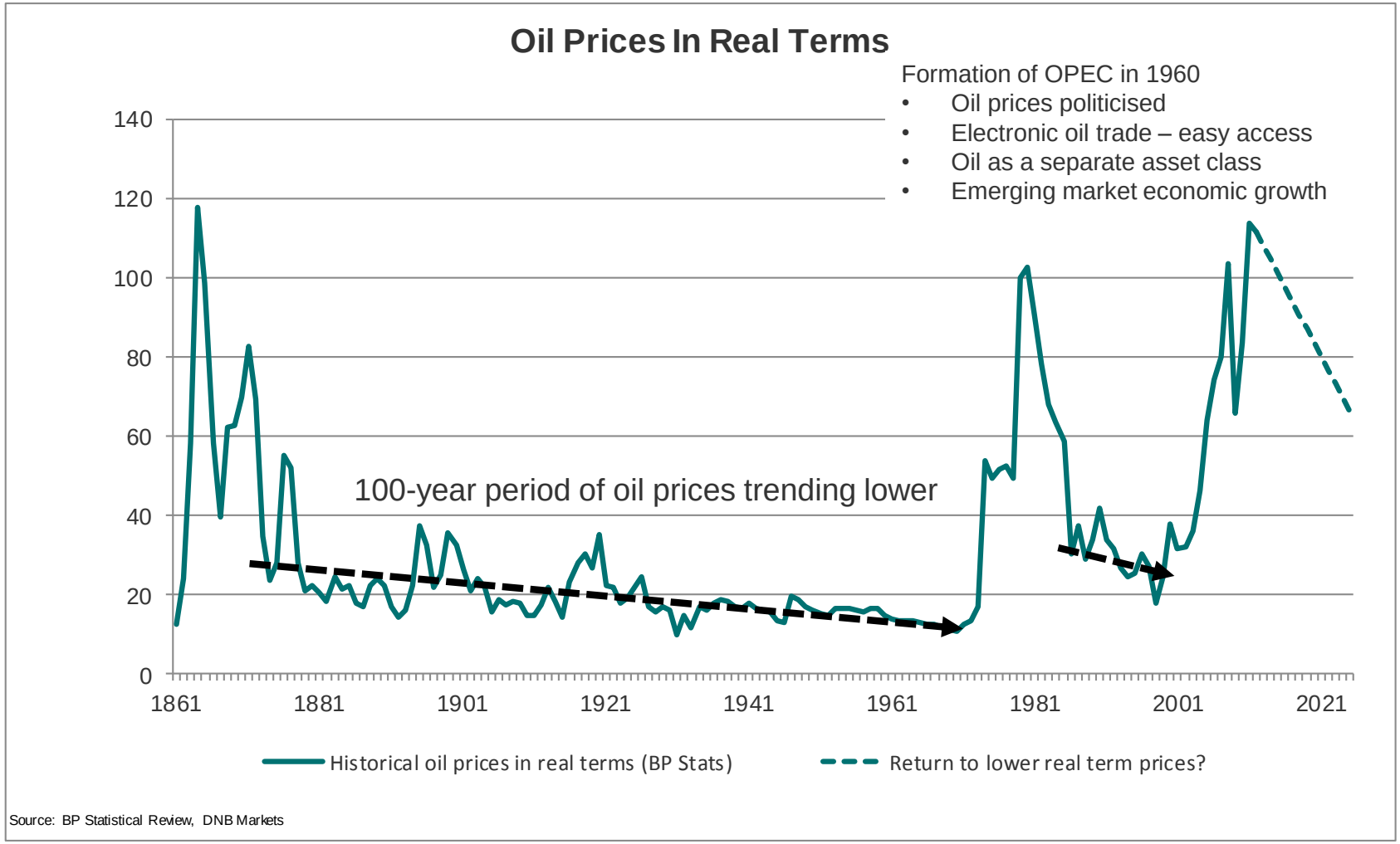
More Normal For Oil Prices To Trend Lower Than Higher



Source: BP Statistical Review, DNB Markets

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2014 Oil Price Scorecard

2014 Oil Price Scorecard	Comments	Oil Price	Weight
Overall Outlook	We forecast that oil prices will continue to slide lower on average in 2014, just like they have done so far in 2013. Non-OPEC supply growth is forecasted to outpace global oil demand growth, creating a need for less oil from OPEC. Geopolitical risk will however be very supportive for oil prices also in 2014.	**Average price 102 $/b**	
Fundamentals			
Global Fundamental Balance	We believe the "Call on OPEC" will decrease in 2014, unless unplanned disruptions in oil production continue to increase.	**BEARISH**	**HIGH**
Crude vs Product Balance (Margins)	Expansions of global refinery capacity is set to outpace the growth in demand for refined products and this is not good for margins.	BEARISH	MEDIUM
OECD Stock levels	Total OECD oil stocks are at the top of the 5-year range and will continue to be high during 2014.	BEARISH	LOW
OPEC Spare Capacity	OPEC spare capacity will increase as Saudi Arabia will trottle back some output, but unplanned outages create a wild card.	BEARISH	MEDIUM
US Oil Statistics - Fundamentals	In the US, oil demand will be flattish and oil productioin will continue to grow, creating less need for imports.	BEARISH	MEDIUM
Global Demand Growth	Global oil demand will grow more in 2014 than in 2013 due to better economic growth in Europe/US, but China is a big wild card.	BEARISH	MEDIUM
OPEC Supply	Total OPEC supply is dependant on unplanned disruptions. If disruptions does not increase, Saudi will have to cut output.	NEUTRAL	MEDIUM
Non-OPEC Supply	Non-OPEC supply continue to grow more than demand in 2014, mainly du to the shale revolution in the US.	BEARISH	MEDIUM
Political Risk			
Iraq, Iran, Nigeria, Venezuela, US, Russia, Israel, MENA, etc	Political risk will continue to be as high in 2014 as in 2013.	**BULLISH**	**HIGH**
Other Factors			
Financial Money Flow	Investors are starting to doubt the need to own commodities as part of their portfolio. And gradually more investors are starting to loose faith in the commodity super-cycle.	BEARISH	MEDIUM

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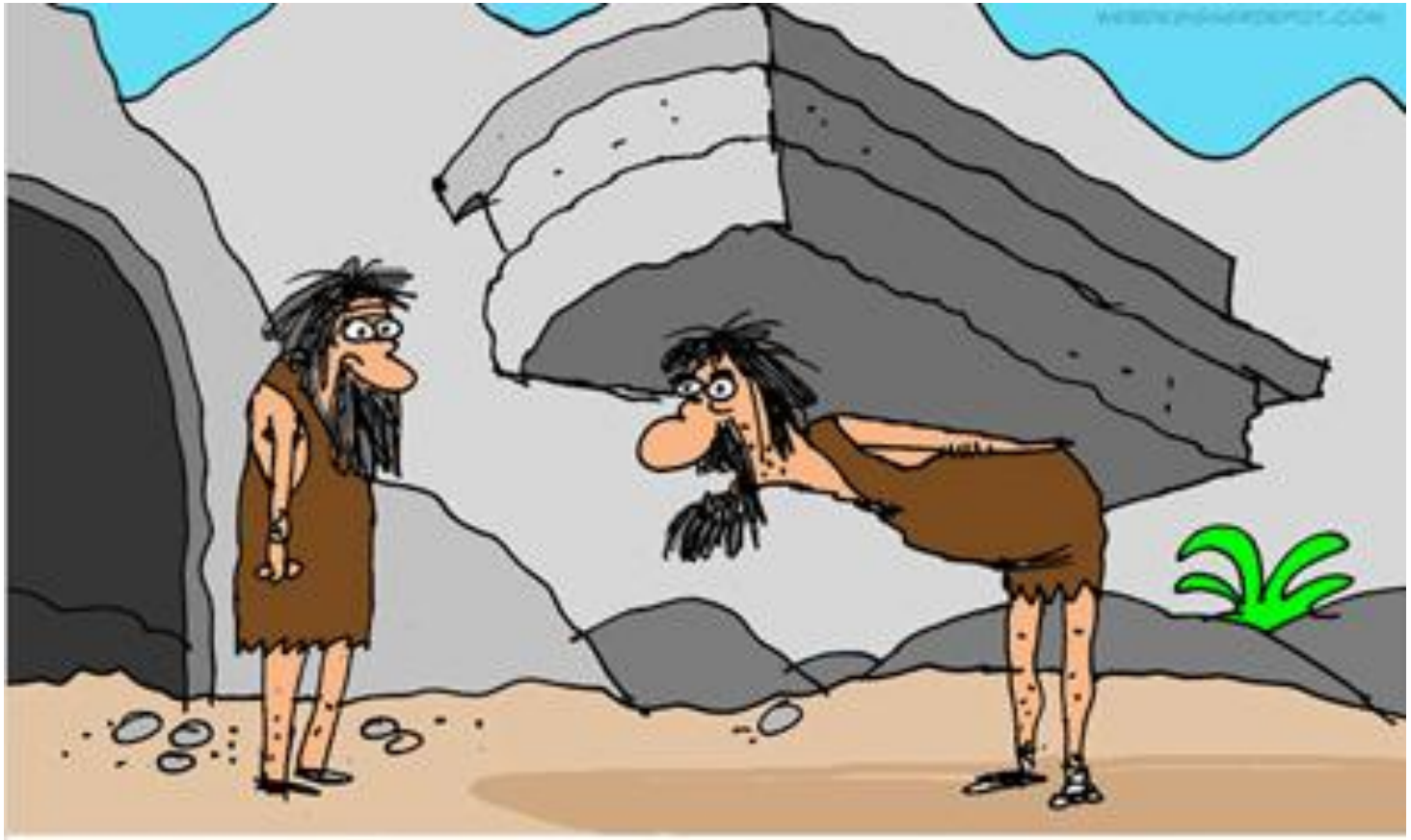
The Stone Age Did Not End Due To A Lack Of Stones…

- And the oil age will end long before the world runs out of oil…



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The Limit Of Oil Production Is Being Reached - Not

- In 1919 the US had produced 4 billion barrels of oil and the US Bureau of Mines though the country would run out of oil by 1930
- By 2012 the US has produced about 205 billion barrels

•**Carl Beal (US Bureau of Mines in 1919):**

"The limit of production in this country is being reached, and although new fields undoubtedly await discovery, ***the yearly output must inevitably decline, because the maintenance of output each year necessitates the drilling of an increasing number of wells. Such an increase becomes impossible after a certain point is reached, not only because of a lack of acreage to be drilled, but because of the great number of wells that will ultimately have to be drilled.»***

<u>The exact same arguments are used today by sceptics to further growth in shale oil production in the US.</u>

•**MIT professor Morris Adelman:**

•"In the United States in **1930, proved reserves were 13 billion** barrels. Over the next 60 years, the United States, without Alaska, produced **130 billion** barrels. The inventory turned over ten times."

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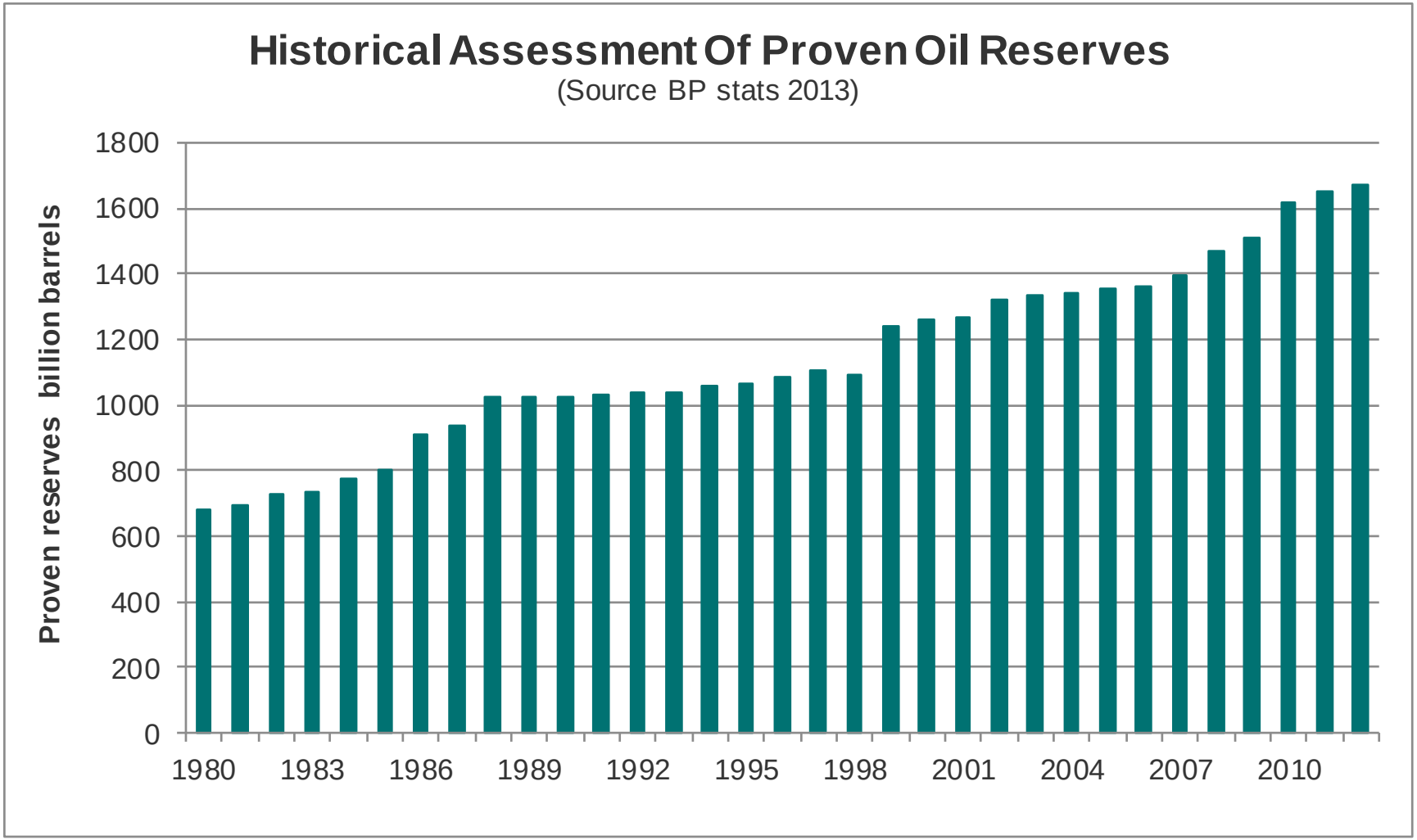
Reserves Growth Set To Accelerate?

- There is already very visible reserves growth but will the shale oil revolution lead to an acceleration in coming years?
- And note that the global recovery rate is only about 35% (IEA WEO 2008 page 197) – there is a large potential here



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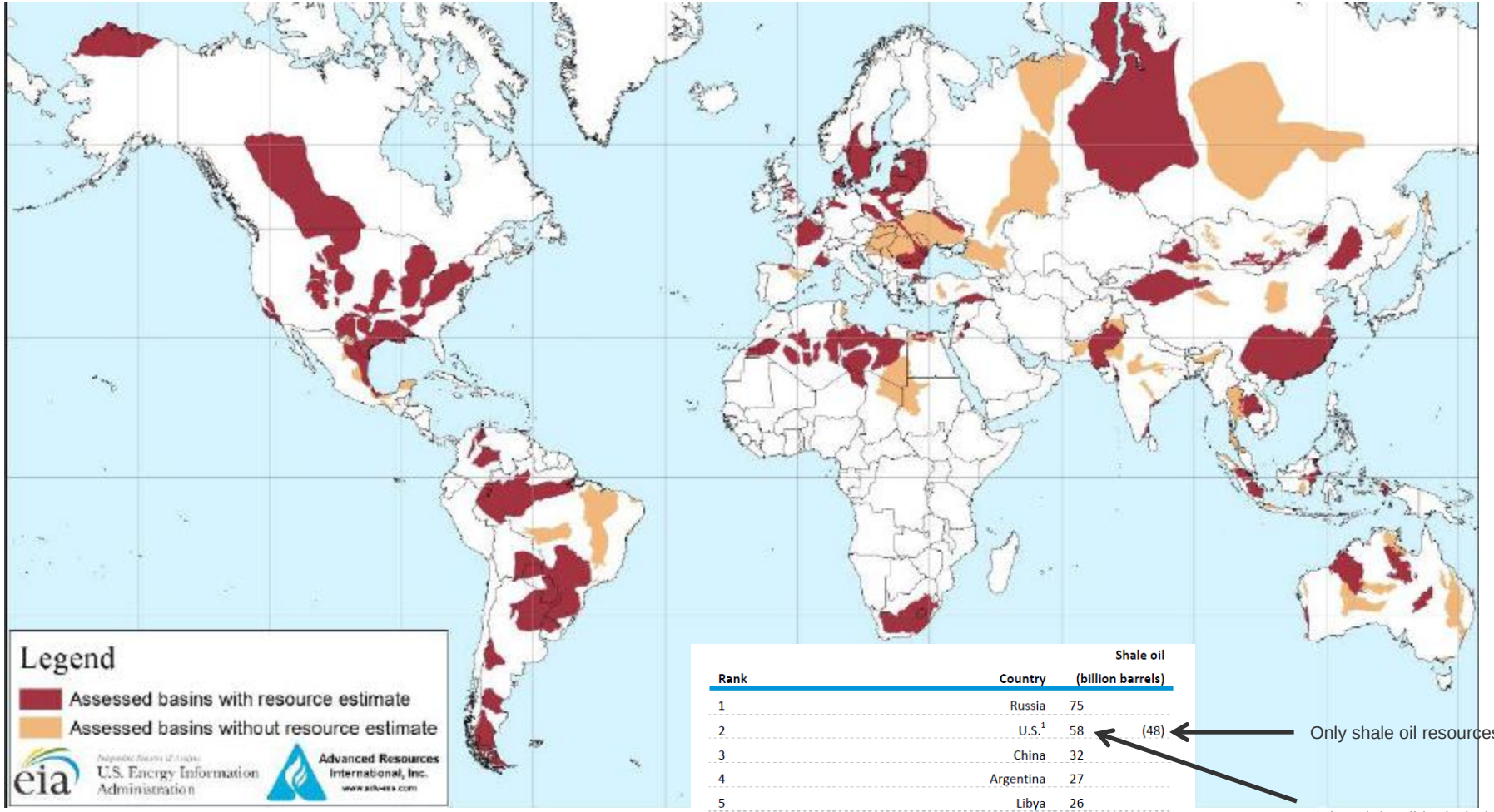
First Estimate Of Global Shale Oil Resources Came June 10th

- Total recoverable shale oil resources estimated at 345 billion barrels (Middle East and Caspian not assessed)



Rank	Country	Shale oil (billion barrels)	
1	Russia	75	
2	U.S.[1]	58	(48)
3	China	32	
4	Argentina	27	
5	Libya	26	
6	Australia	18	
7	Venezuela	13	
8	Mexico	13	
9	Pakistan	9	
10	Canada	9	
	World Total	**345**	(335)

[1] EIA estimates used for ranking order. ARI estimates in parentheses.

Only shale oil resources

Other tight oil included
In addition to shale

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Global Oil Demand

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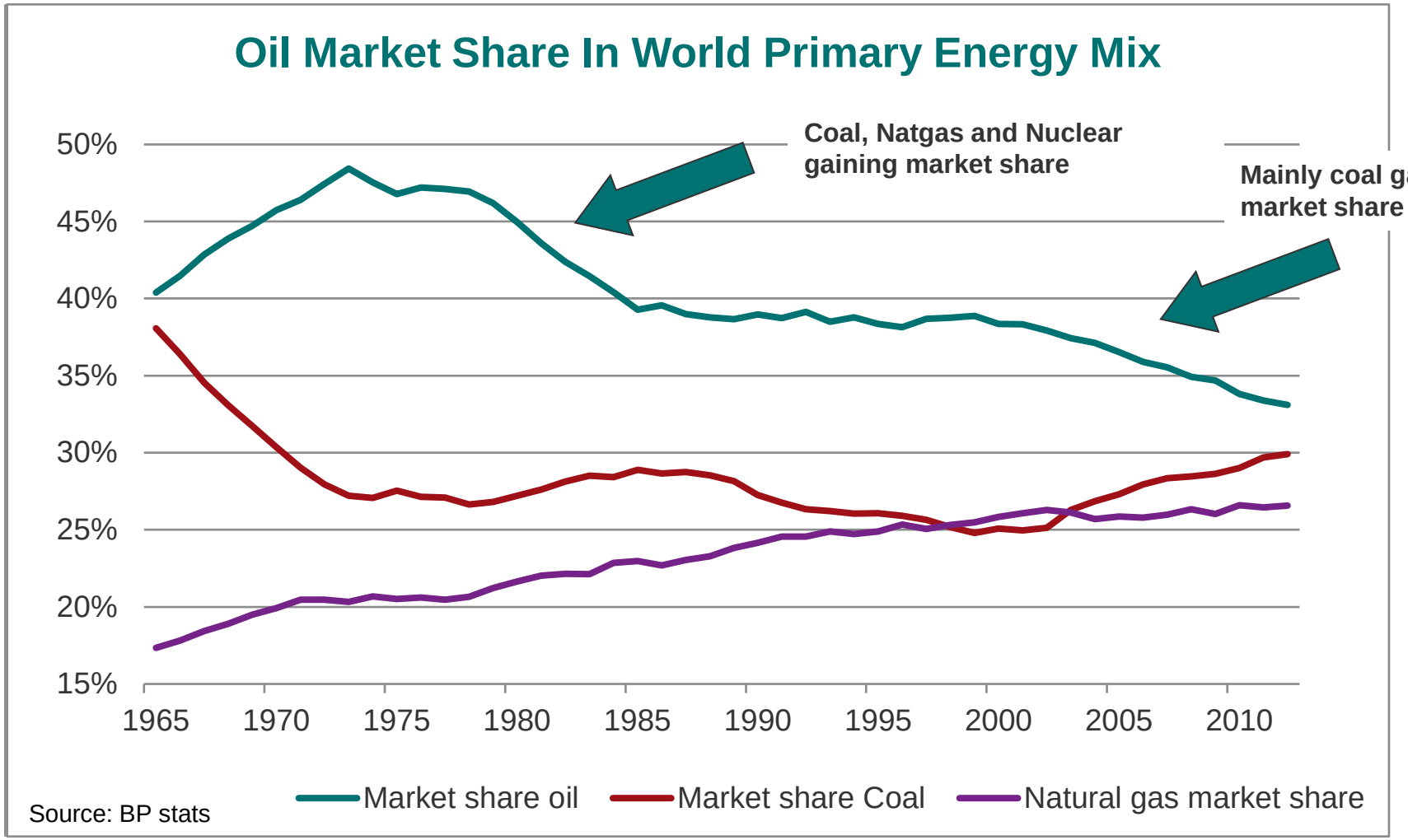
Oil's Market Share Of The Energy Mix Falls On High Oil Prices

- The same happened in the 1970's, and high oil prices are the primary reason



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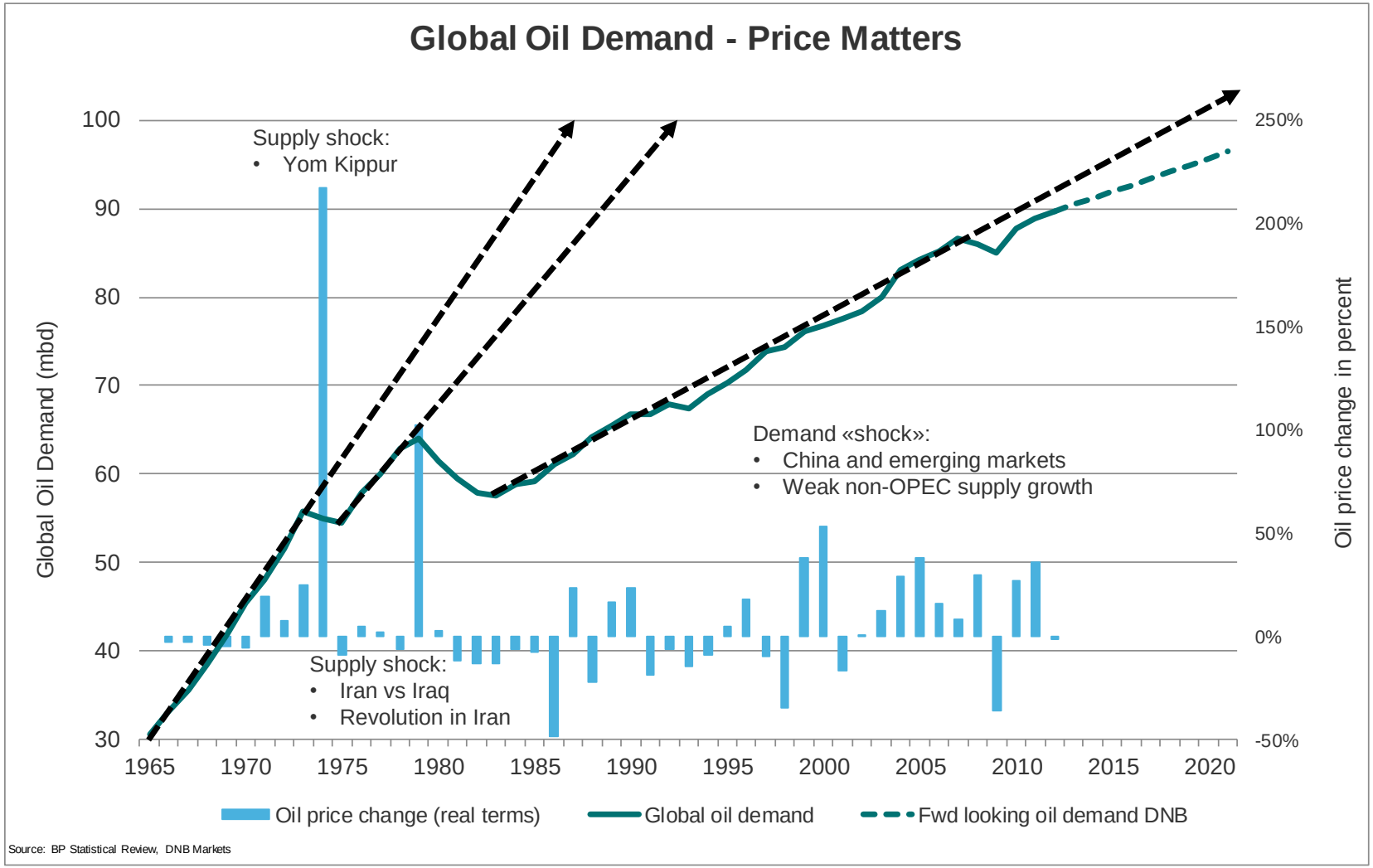
Trend Line Demand Growth Weakening On High Prices

- We do not believe the world is about to return to the latest 30-year long trend line oil demand path which started in 1983



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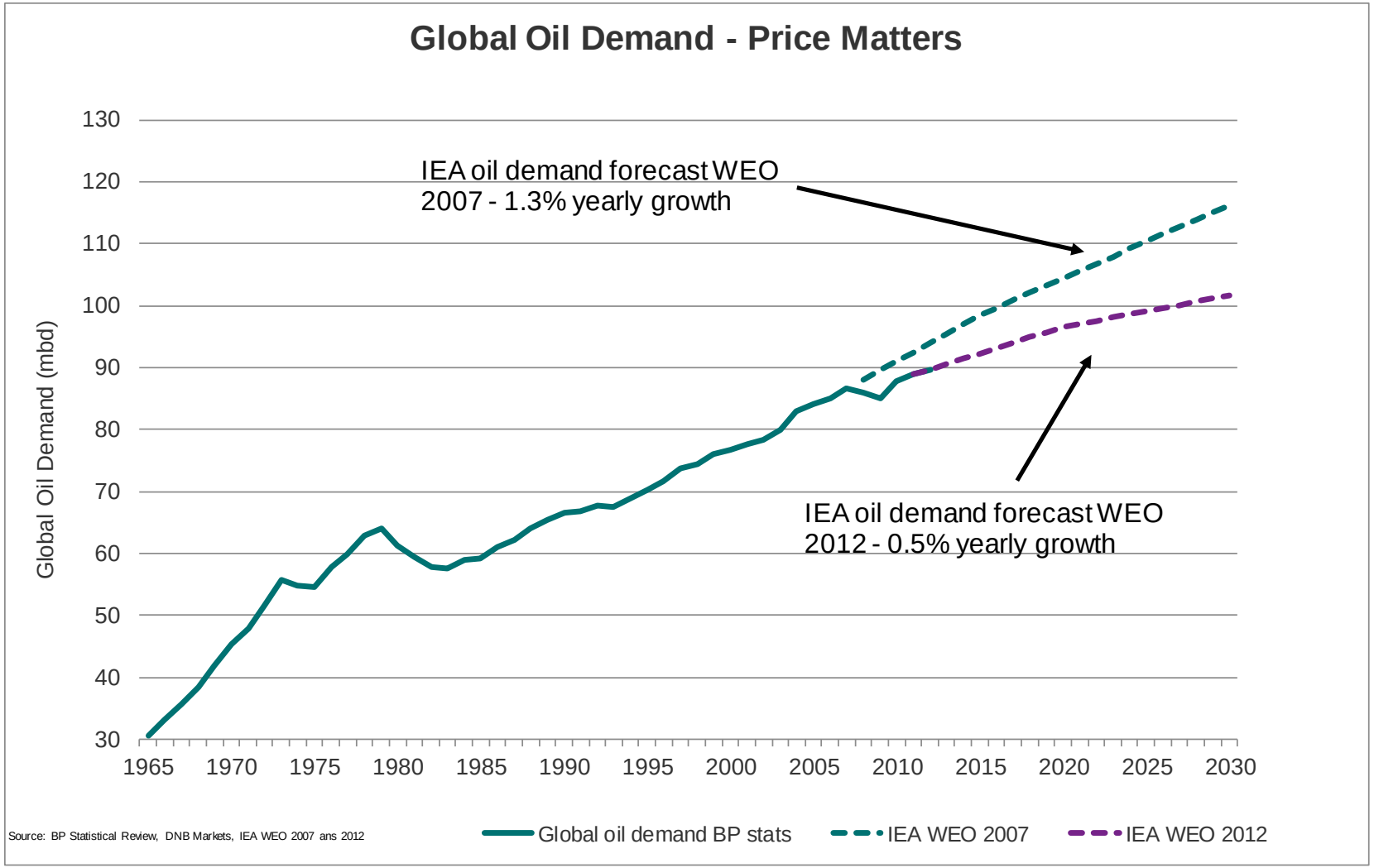
IEA Has Massively Revised Down Their Oil Demand Growth

- Global oil demand seen up from 90.7 mbd in 2013 to 96.6 mbd by 2020 – That is average growth of only 0.8 mbd per year



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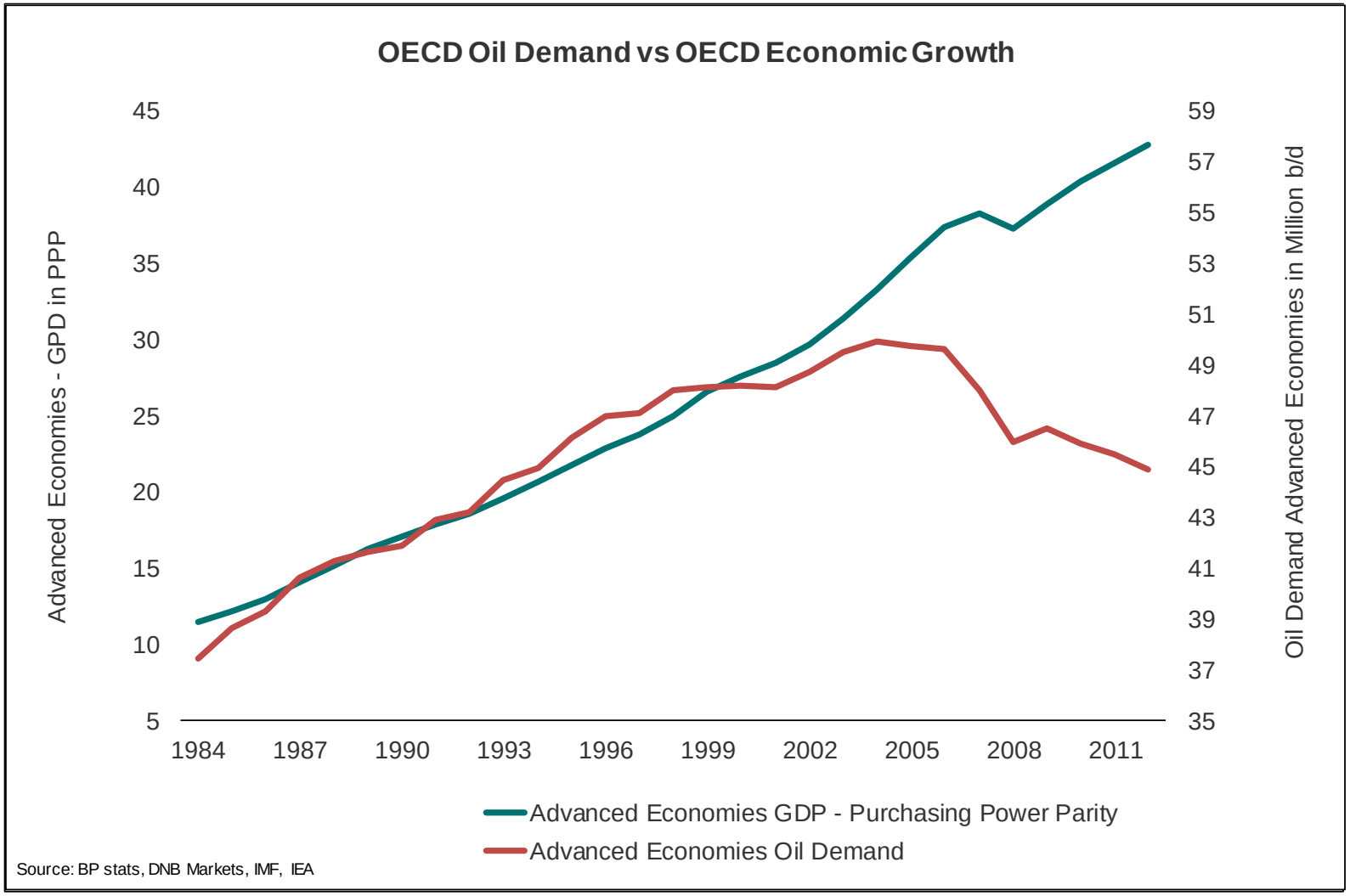
GDP Growth In OECD No Longer Provide Growth In Oil Demand

- The high and rising oil price has started irreversible negative effects on demand for refined oil products in advanced economies



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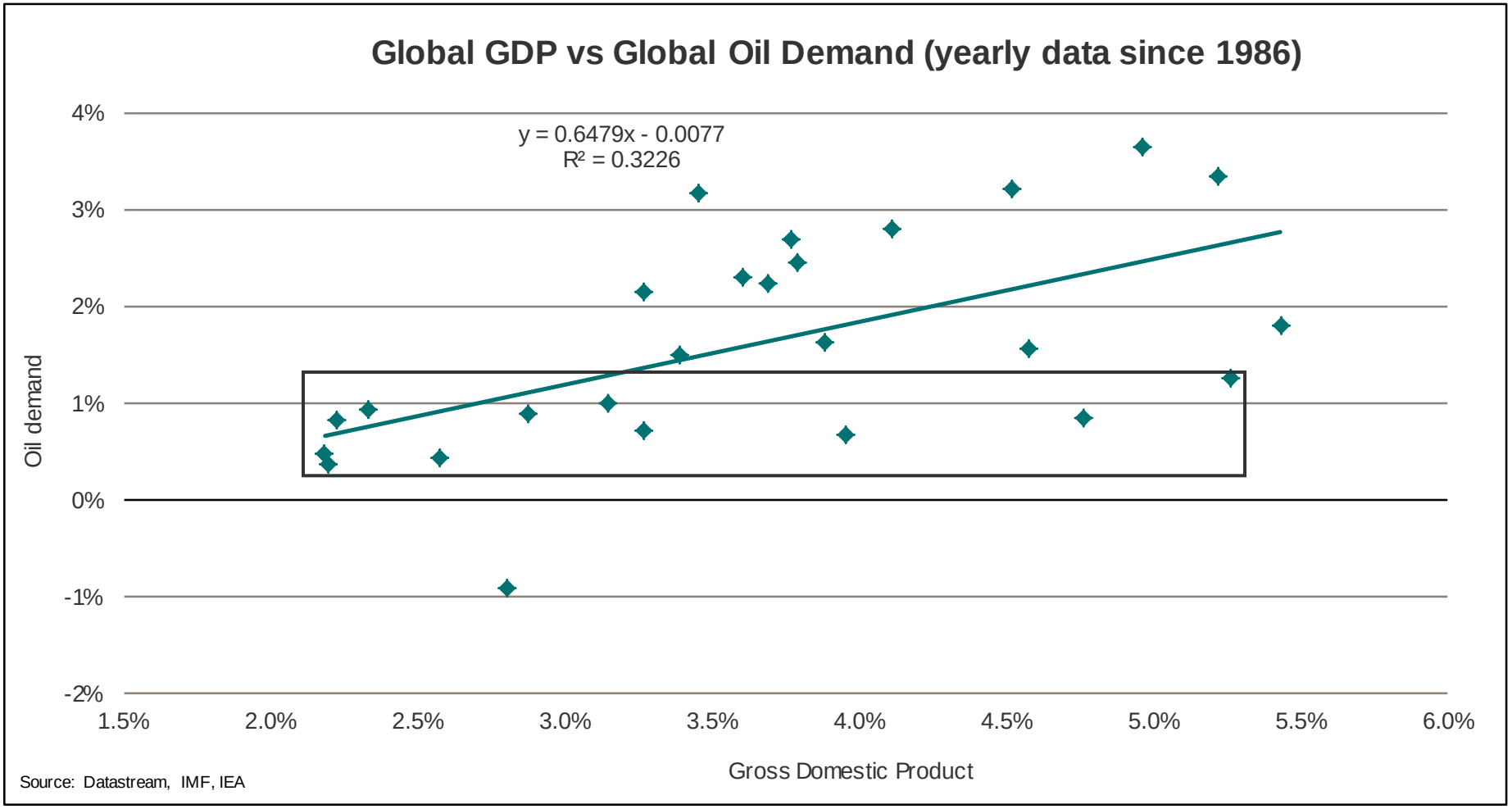
Not Enough To Hit Spot On Global Economic Growth

- Correlation is weaker than many think (only 32% since 1986, the outlier of 2009 is removed from the data)
- 11 incidents of global GDP-growth from 2.2% - 5.3% has provided only 0.4% - 1% global oil demand growth



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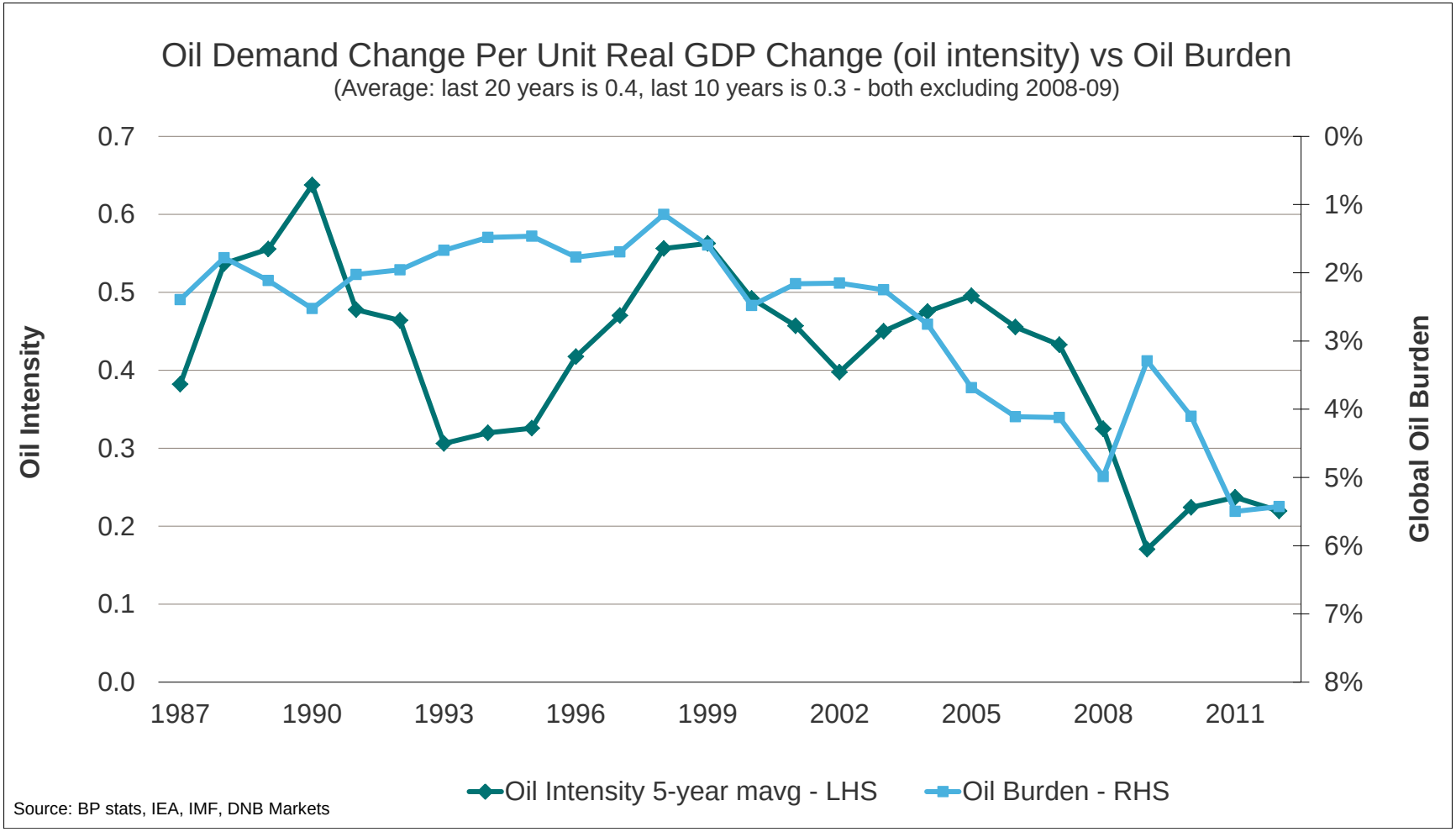
High Oil Pain Equals Lower Payback Per GDP Growth Unit

- When the oil burden becomes high, then GDP-growth yields less oil demand growth



Source: BP stats, IEA, IMF, DNB Markets

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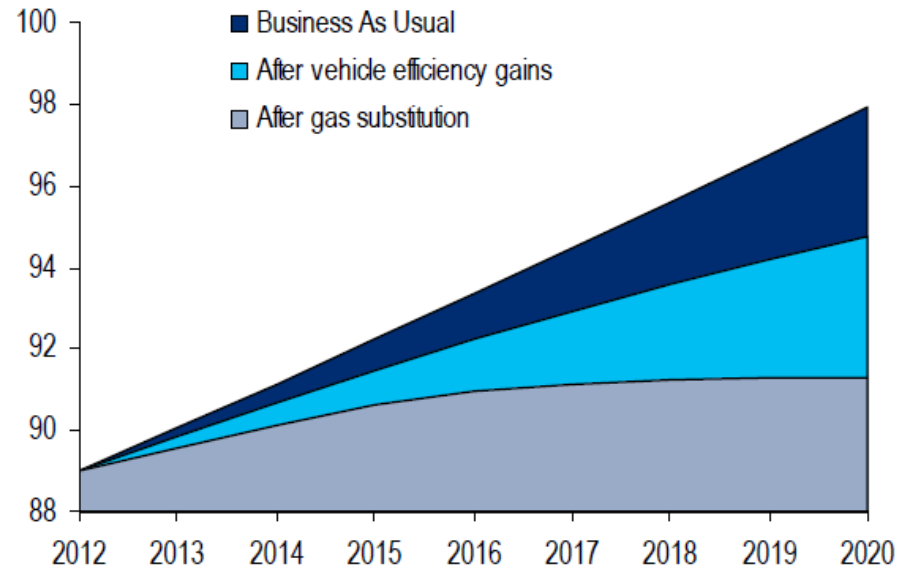
Could Also *Global* Oil Demand Peak Earlier Than People Expect?

- Citi's automobiles team estimates that new car fuel efficiency is now improving by 3-4% per year.
- IEA estimate in the WEO that the global car fleet will grow by 2.8% per year going forward (from 870 million to 1.7 billion by 2035)
- IEA also estimate that the size of the global road network will expand by only 40% by 2035 even if the car fleet will double

- What happens to global oil demand if the yearly efficiency improvements are larger than the growth in the car fleet and at the same time average driving length per car falls back compared with the current situation?

Figure 1. Global Oil Demand Projections:-mb/d



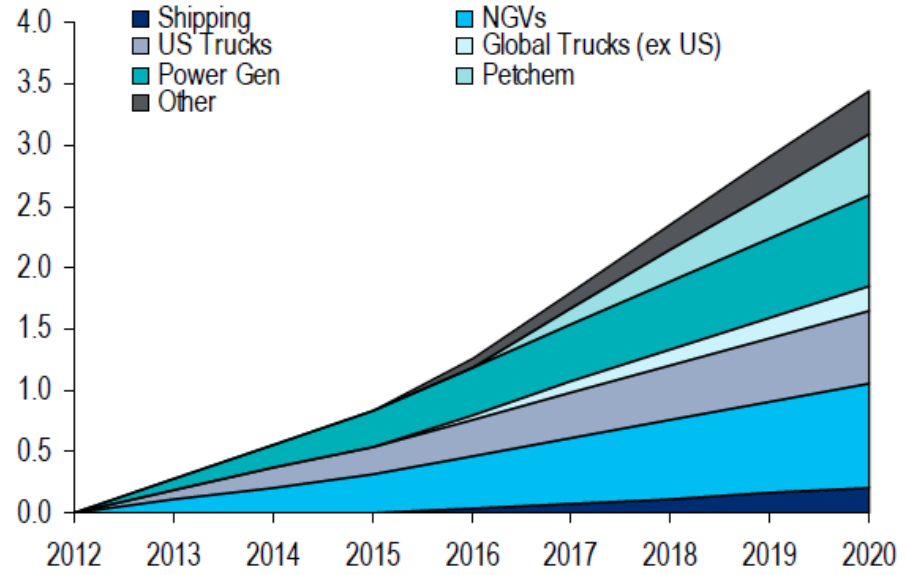
Source: Citi Research

FINANCIAL TIMES
ft.com > markets >
June 3, 2013 7:01 pm

US shale gas to lead to lower oil prices

The US shale gas revolution "virtually guarantees" the end of oil's monopoly as a transport fuel paving the way for lower crude prices, according to Ed Morse, the commodities guru at Citi famed for calling the peak of the oil market in 2008.

Figure 2. Potential Natural Gas Substitution For Oil:-mb/d



Source: Citi Research

PLATTS: 100--S Korea's SK Gas to import shale gas-based LPG from North America over 2016-2017 PGA100 - PLTS

03-Jun-2013 12:05

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Horsey
IT'S SETTLED...
WE AGREE TO SIGN A PLEDGE TO HOLD ANOTHER MEETING TO CONSIDER CHANGING COURSE AT A DATE YET TO BE DETERMINED.
CLIMATE CHANGE
WORLD LEADERS

OECD Oil Demand

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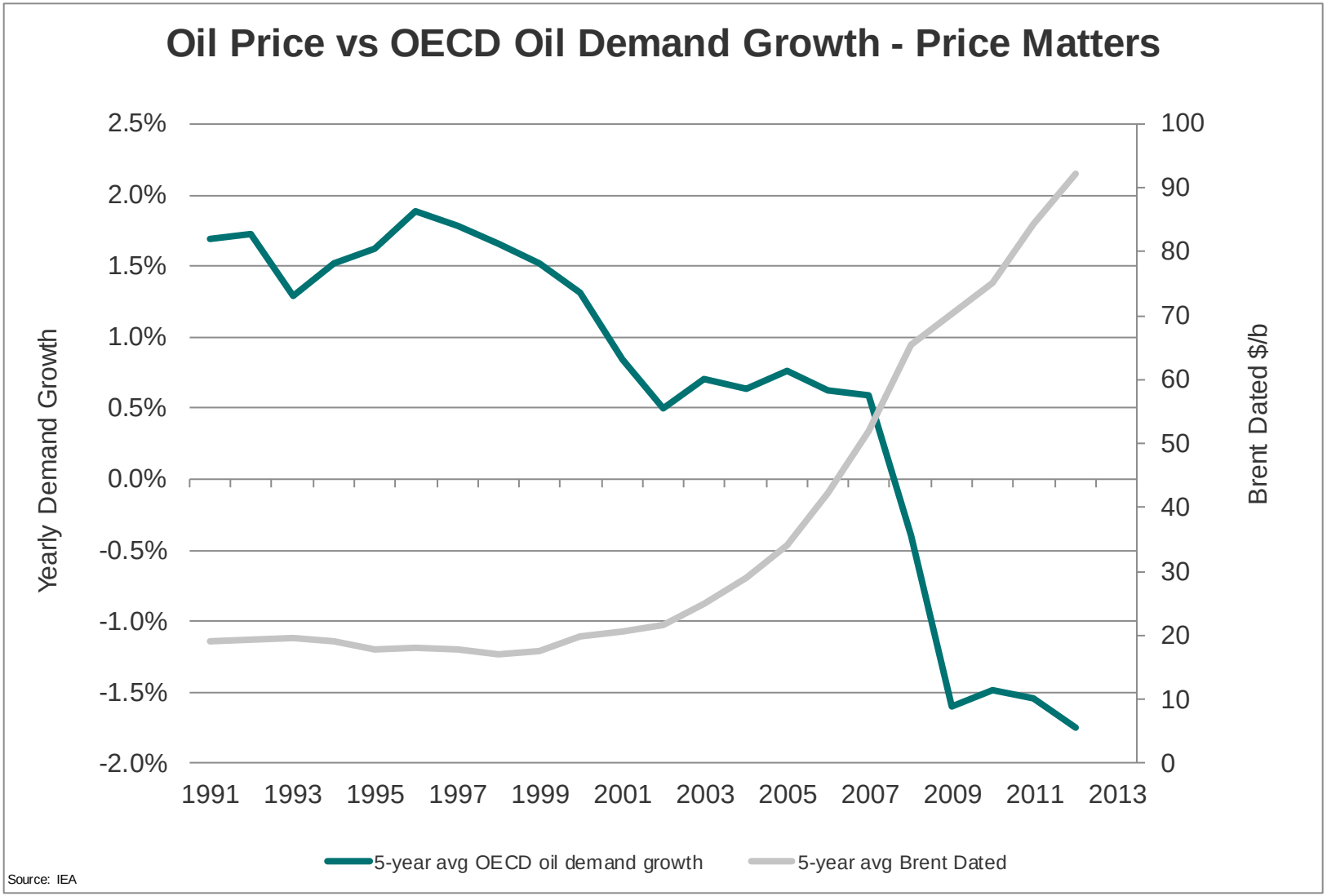
Oil Demand Growth Has Suffered In The OECD

- And we believe this will continue to be the case in the current decade



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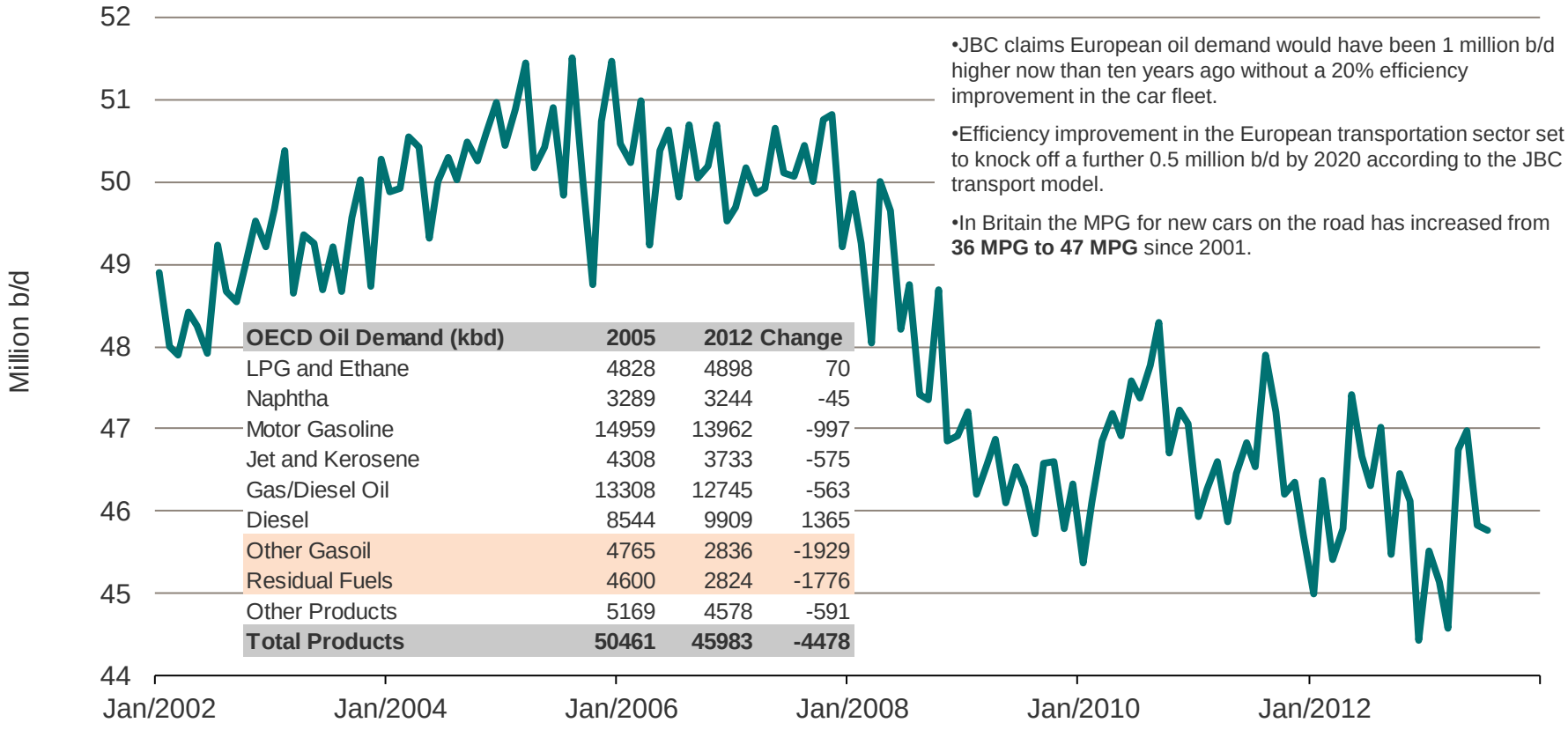
Peak Oil Has Already Happened

- At least when talking about demand in the developed world – and a large chunk of this looks structural and not cyclical



OECD Oil Demand (kbd)	2005	2012	Change
LPG and Ethane	4828	4898	70
Naphtha	3289	3244	-45
Motor Gasoline	14959	13962	-997
Jet and Kerosene	4308	3733	-575
Gas/Diesel Oil	13308	12745	-563
Diesel	8544	9909	1365
Other Gasoil	4765	2836	-1929
Residual Fuels	4600	2824	-1776
Other Products	5169	4578	-591
Total Products	**50461**	**45983**	**-4478**

- JBC claims European oil demand would have been 1 million b/d higher now than ten years ago without a 20% efficiency improvement in the car fleet.
- Efficiency improvement in the European transportation sector set to knock off a further 0.5 million b/d by 2020 according to the JBC transport model.
- In Britain the MPG for new cars on the road has increased from **36 MPG to 47 MPG** since 2001.

Source: IEA

24/01/2013

EU LAUNCHES CLEAN FUEL STRATEGY

The European Commission today announced an ambitious package of measures to ensure the build-up of alternative fuel stations across Europe with common standards for their design and use. Policy initiatives so far have mostly addressed the actual fuels and vehicles, without considering fuels distribution. Efforts to provide incentives have been un-co-ordinated and insufficient.

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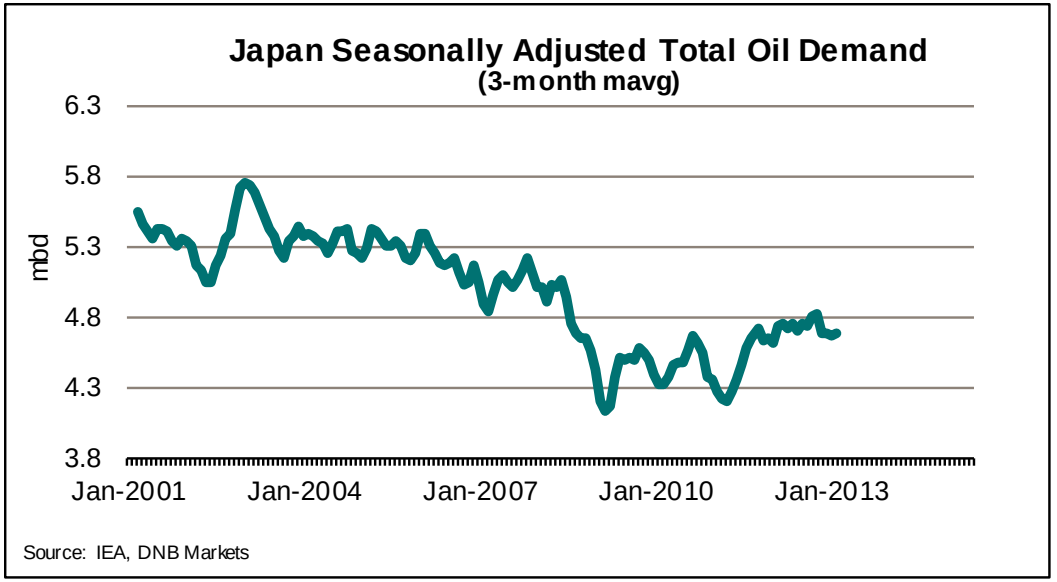
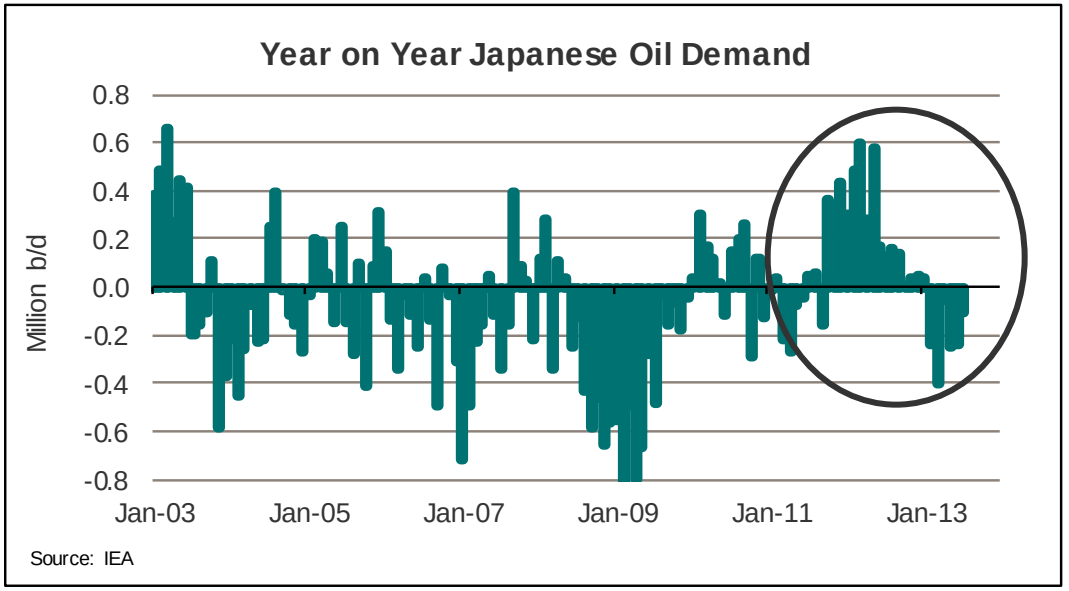
Japanese Oil Demand Growth Very Strong In 2012 - Quake

- Strong Demand growth in Japan in 2012 – But caused by the 2011 quake and not structural – Now growth is reversing





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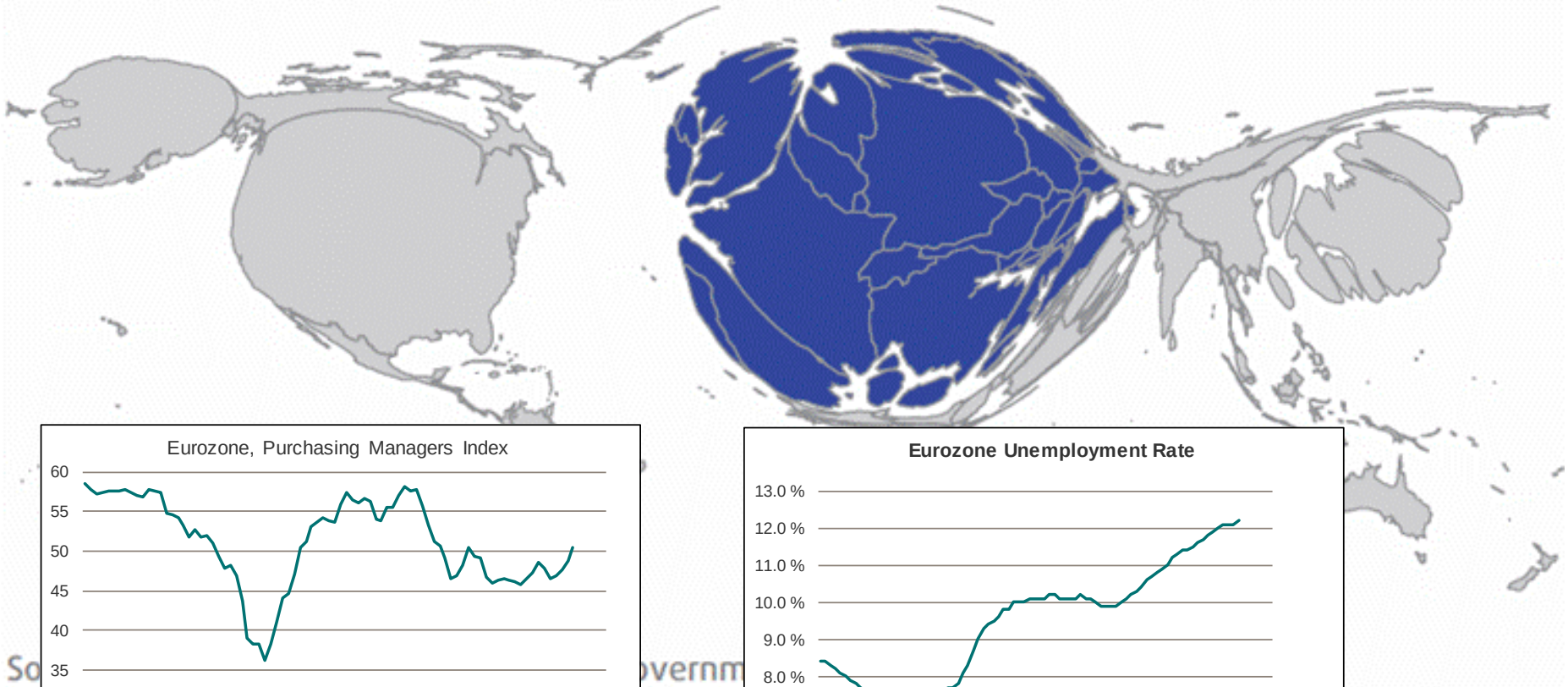
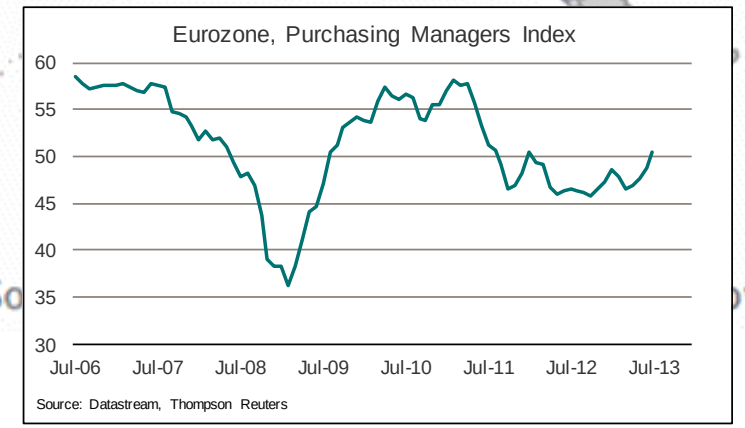
Europe's Structural Problem - Large Government Spending

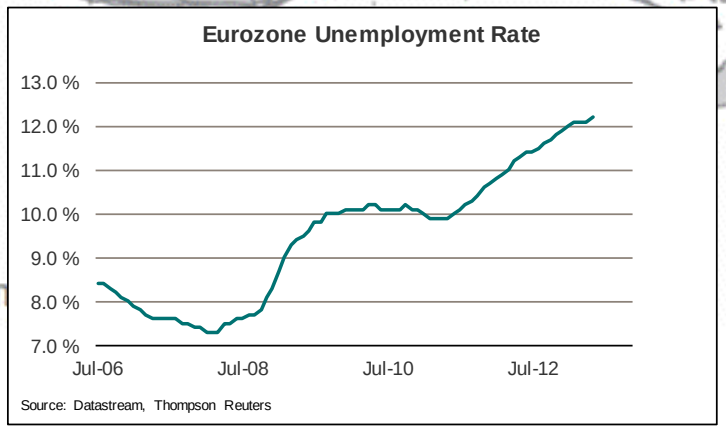
- And to make it worse by 2060 one out of three Europeans will be above 65 years of age, so who's going to contribute??
- Living standards will be forced down as states are trying to reduce debt, wages are lowered and public benefits reduced

Figure 16: Governments in Europe are big

(the world resized by government spending in dollars, 2009)







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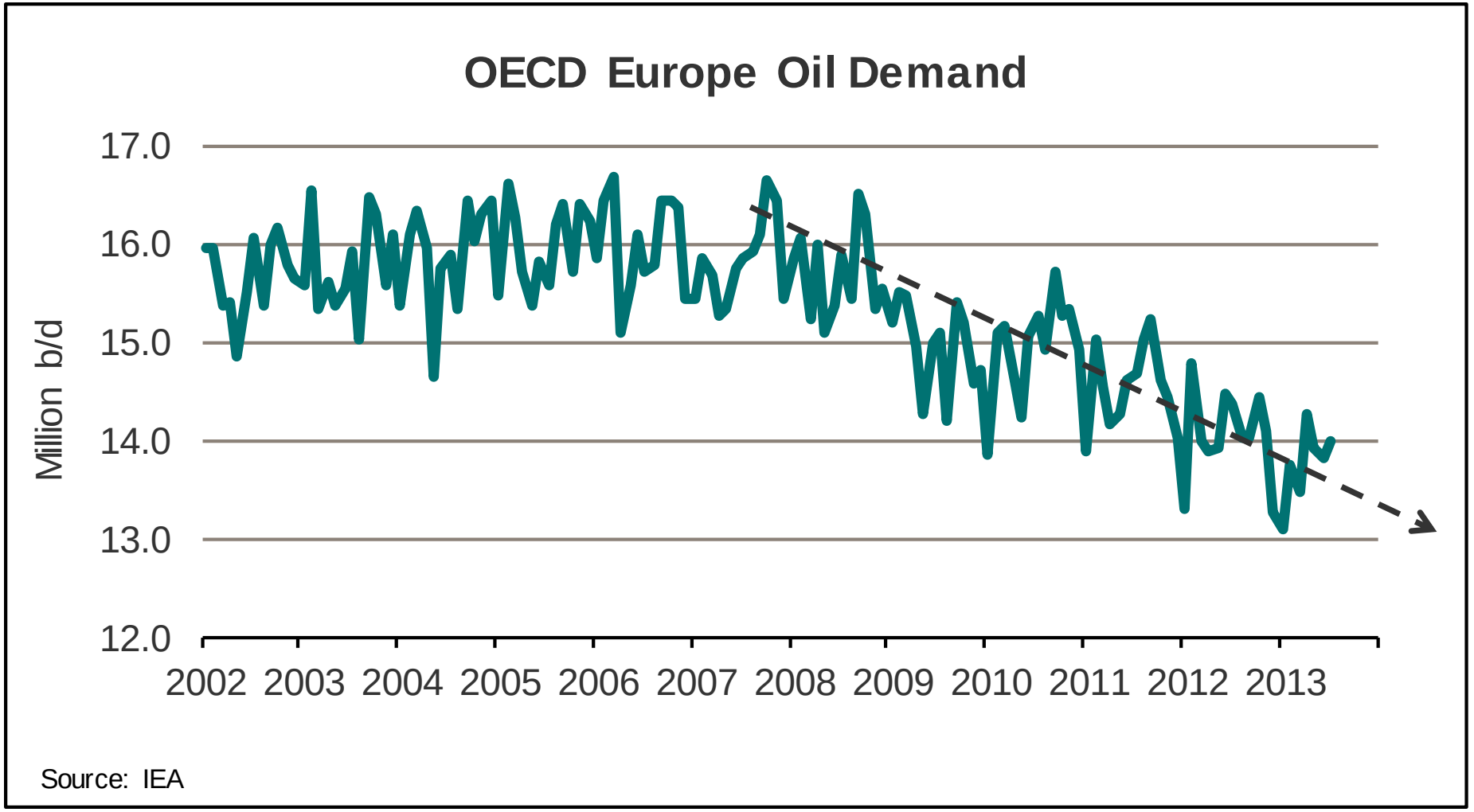
Oil Demand Trending Lower In Europe

- Europe will struggle for a long time to create economic growth



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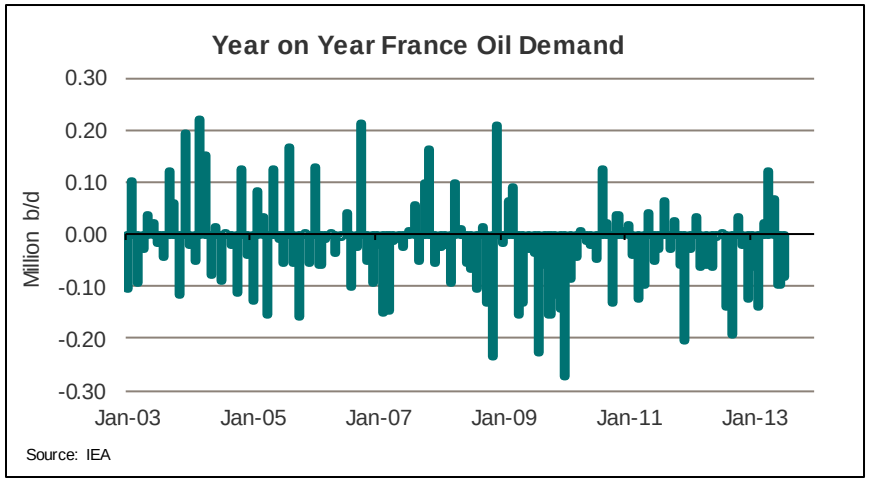
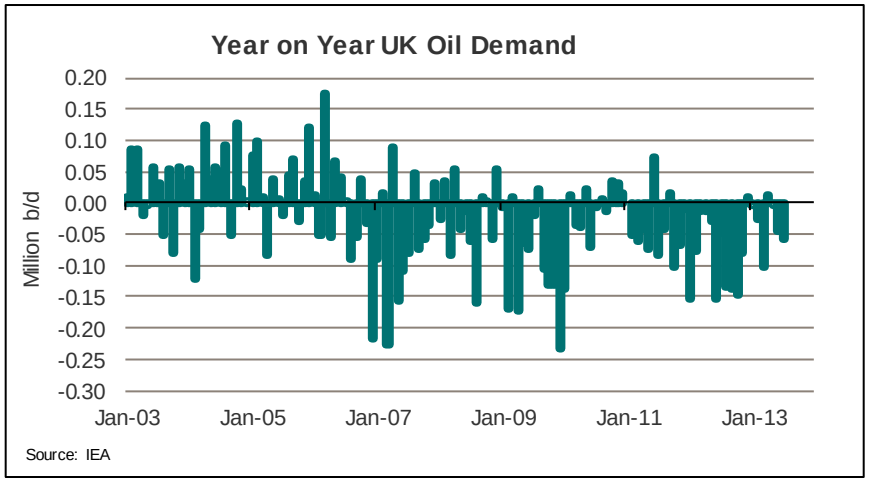
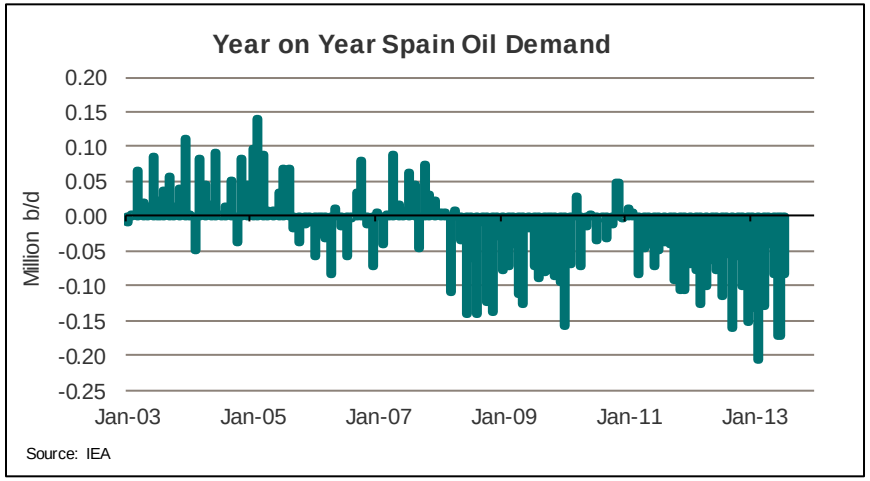
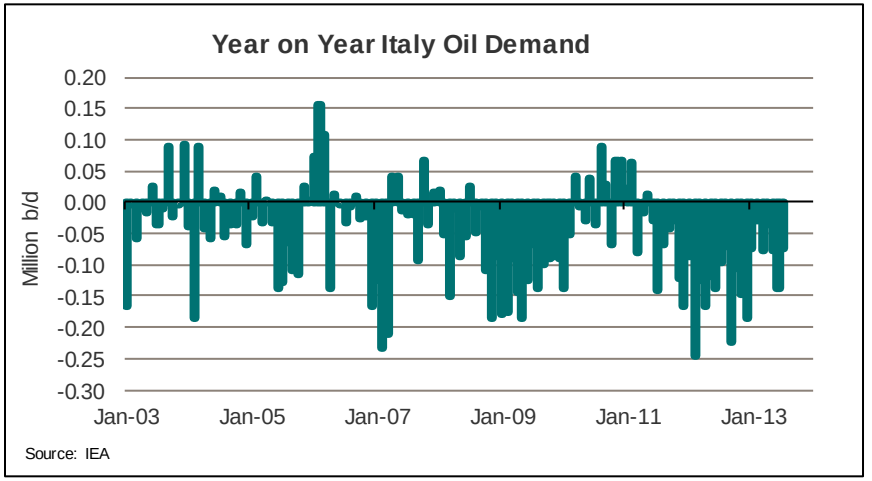
Key European Countries Are Struggling – Weak Oil Demand

- Even if the economy could improve we will continue to see structural efficiency improvements in Europe









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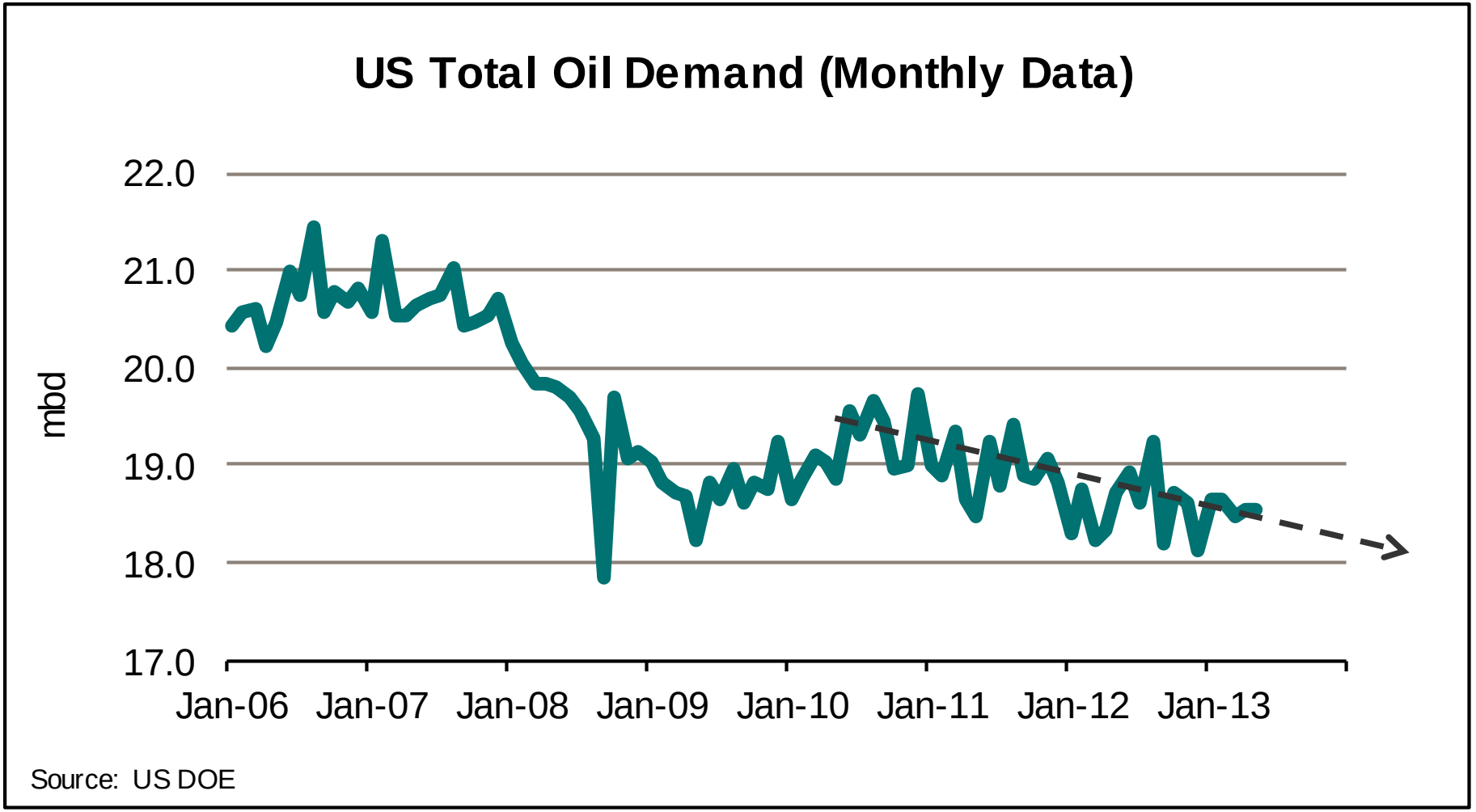
Oil Demand Trending Lower In USA

- US is set up for efficiency gains and substitution – Demand for refined products will not grow, but continue to trend lower



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US Is Recovering From Its Oil Overdose

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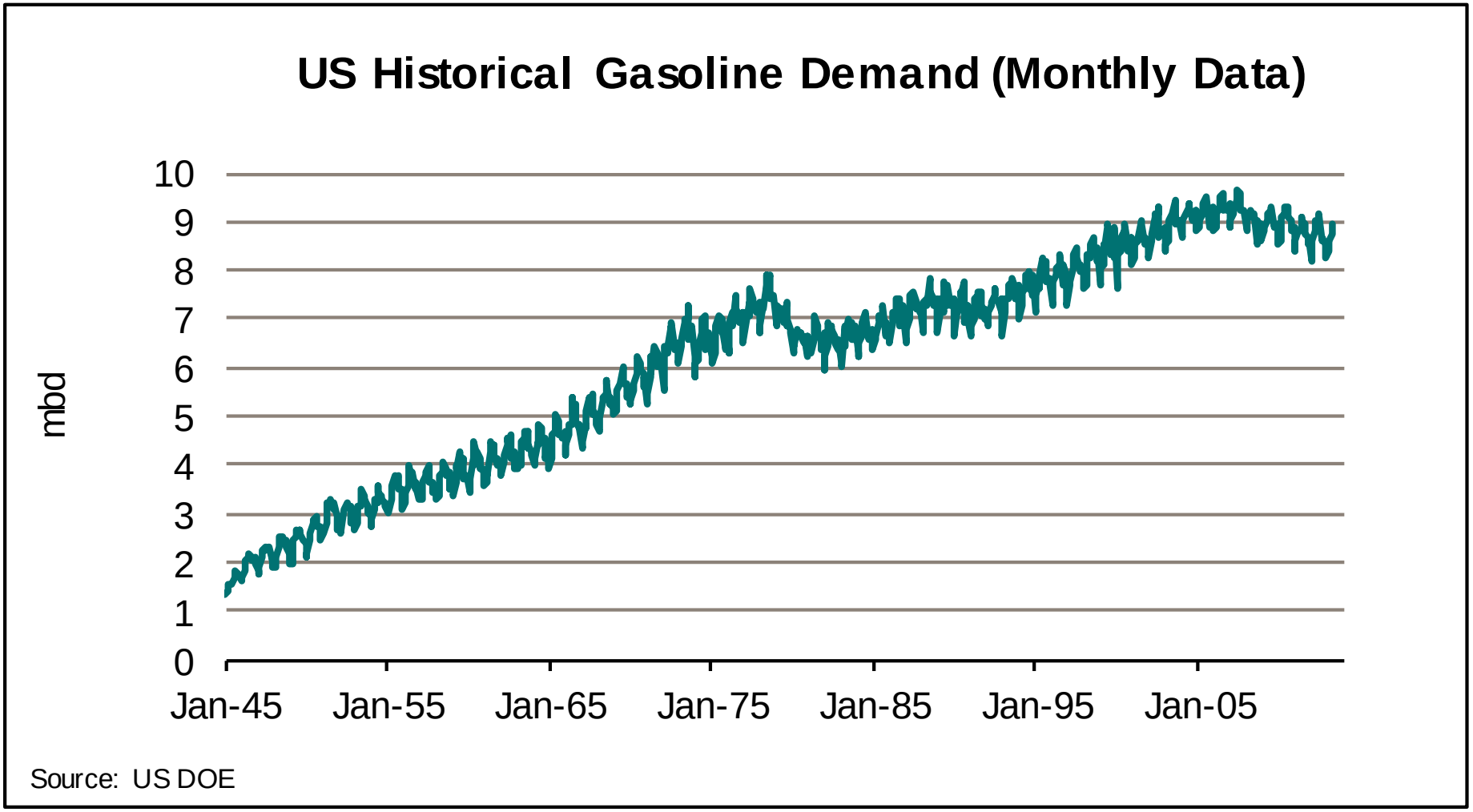
Overdose

"You're a habit I don't wanna break
just write on my grave
I overdosed on you"
(AC/DC - Let there be rock)

The US has however been on a very good track in recovering from its addiction to oil after its overdose.

US Gasoline Demand Will Continue To Decline

- This is the single most important chunk of the global oil market (10% of global oil demand and half of US total oil demand)



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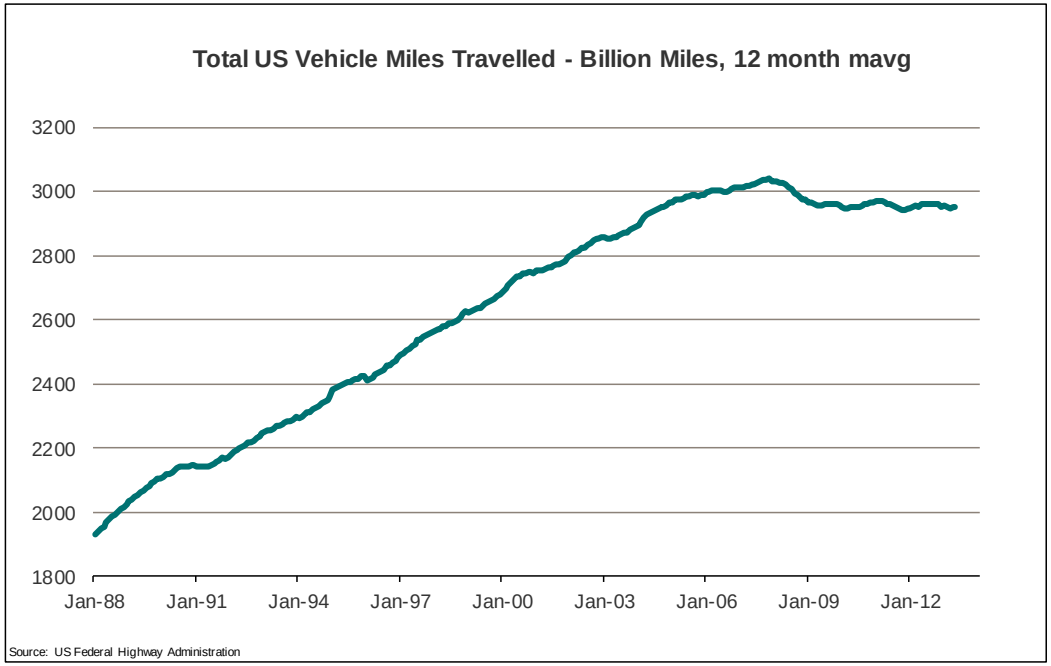
Americans Driving Less Than Before – Structural Shift?

- Surveys suggest young Americans are not as eager as before in acquiring a car – Culture change?



Deloitte. January 2012

Fourth annual Gen Y automotive survey

used car in the next two years.[3] At the same time – and perhaps most concerning to automotive manufacturers – recent research suggests the basic desire for personal mobility is changing for Gen Y and cars may not have as much appeal to this generation when compared to older generations. In fact, according to a recent study, 46% of 18 to 24-year-olds would choose internet access over owning a car.[4] These characteristics and trends create both challenges and opportunities for automotive companies as they seek to capture their fair share of this important market.

Why Are Young People Ditching Cars for Smart Phones?

For cash-strapped 20-somethings, staying connected may be worth more than a set of wheels.

by Jordan Weissmann

SEPTEMBER 2012

The Cheapest Generation

Why Millennials aren't buying cars or houses, and what that means for the economy

Don't blame Ford. The company is trying to solve a puzzle that's bewildering every automaker in America: How do you sell cars to Millennials (aka Generation Y)? The fact is, today's young people simply don't drive like their predecessors did. In 2010, adults between the ages of 21 and 34 bought just 27 percent of all new vehicles sold in America, down from the peak of 38 percent in 1985. Miles driven are down, too. Even the proportion of teenagers with a license fell, by 28 percent, between 1998 and 2008.

Perhaps. But what if these assumptions are simply wrong? What if Millennials' aversion to car-buying isn't a temporary side effect of the recession, but part of a permanent generational shift in tastes and spending habits? It's a question that applies not only to cars, but to several other traditional categories of big spending—most notably, housing. And its answer has large implications for the future shape of the economy—and for the speed of recovery.

WHEN ZIPCAR WAS founded, in 2000, the average price for a gallon of gasoline was $1.50, and iPhones didn't exist. Since then, it has become the world's largest car-sharing company, with some 700,000 members. Zipcar owes much of its success to two facts. First, gas prices more than doubled, which made car-sharing alluring. Second, smartphones became ubiquitous, which made car-sharing easier.

From a distance, the sharing of cars, rooms, and clothes may seem a curiosity, more hippie than revolutionary. But technology is allowing these practices to go mainstream, and that represents a big new step for consumers. For decades,

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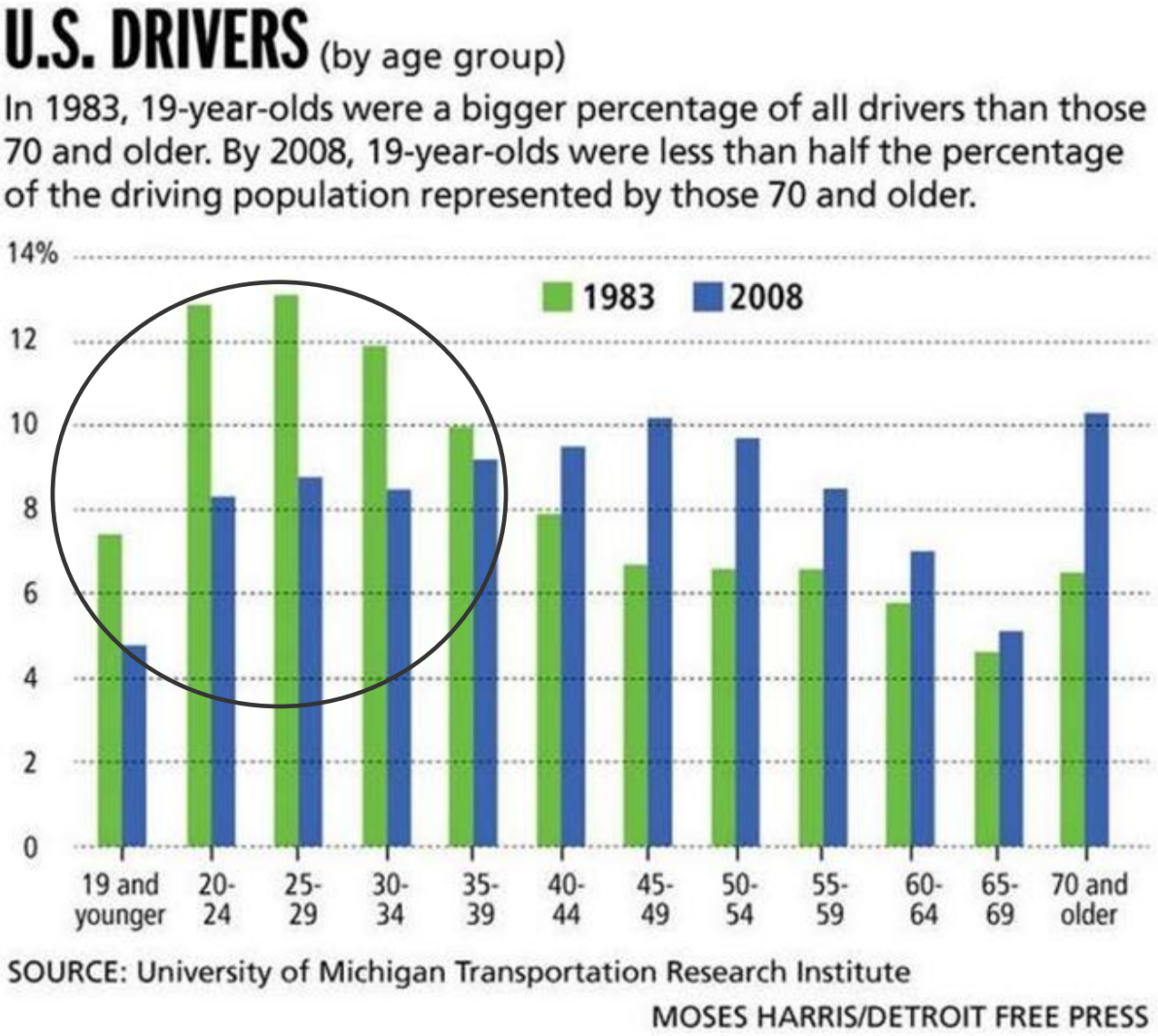
Young Americans Not As Keen Drivers As They Used To Be

- 19-year-olds without a driver license has increased from 12.7% in 1983 to more than 30% in 2010



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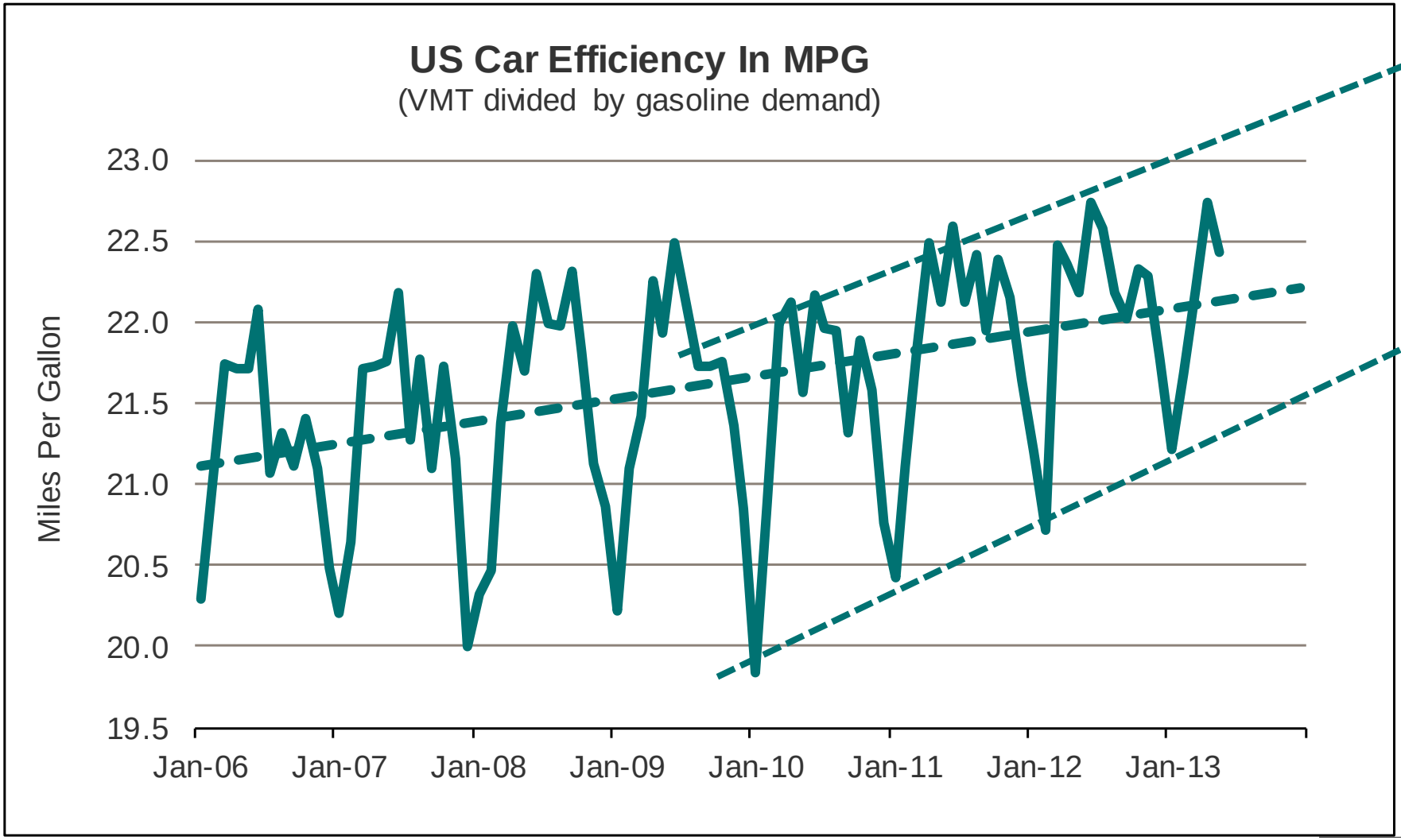
Efficiency Improvements In The US Car Fleet Now Visible

- This is set to improve further in the coming years



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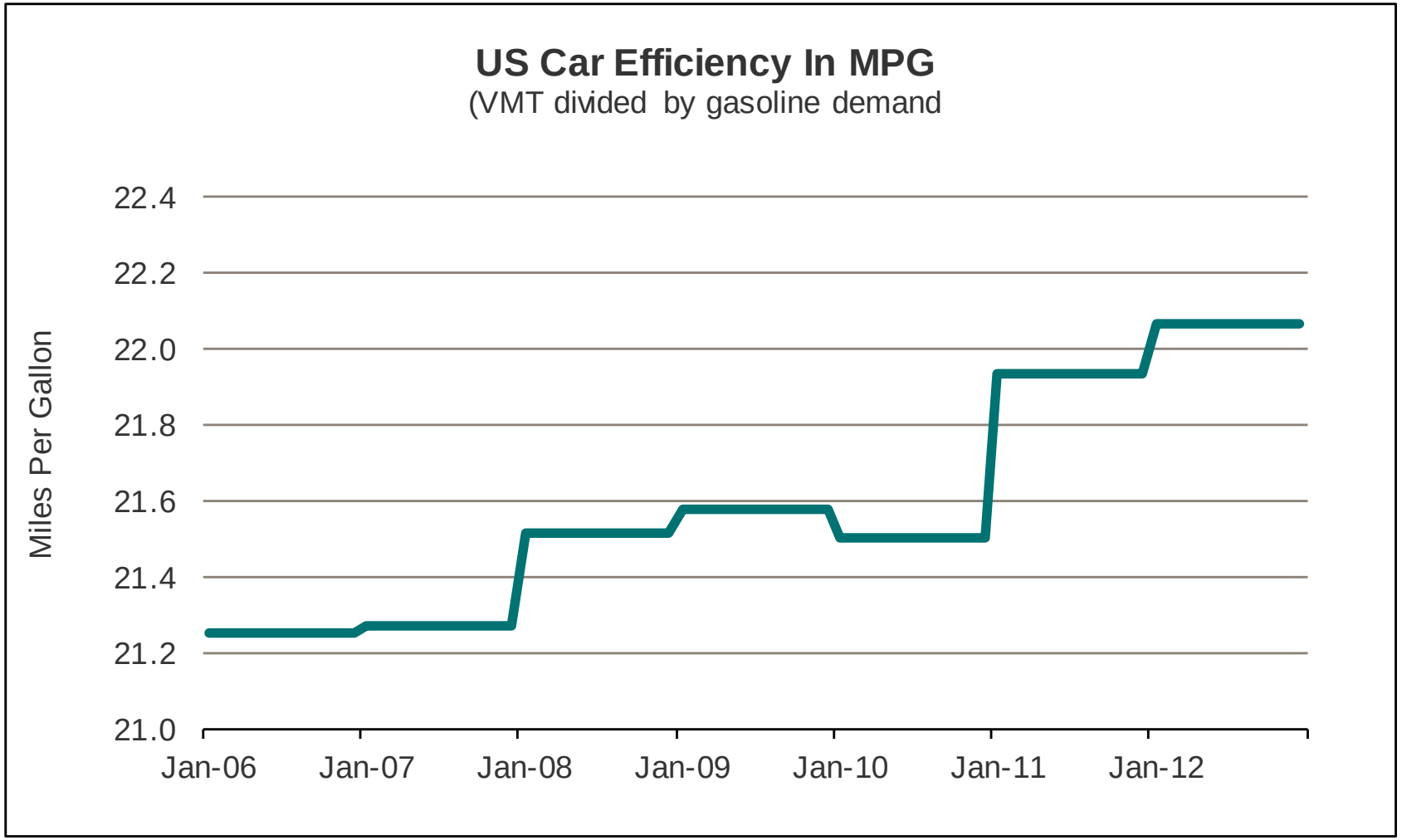
Efficiency Improvements In The US Car Fleet Now Visible

- And remember; this is only the start – Much larger effects will kick in during the coming years



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US Fuel Efficiency Standards To Significantly Improve By 2025

-CAFE-standards to reach 49.6 MPG by 2025

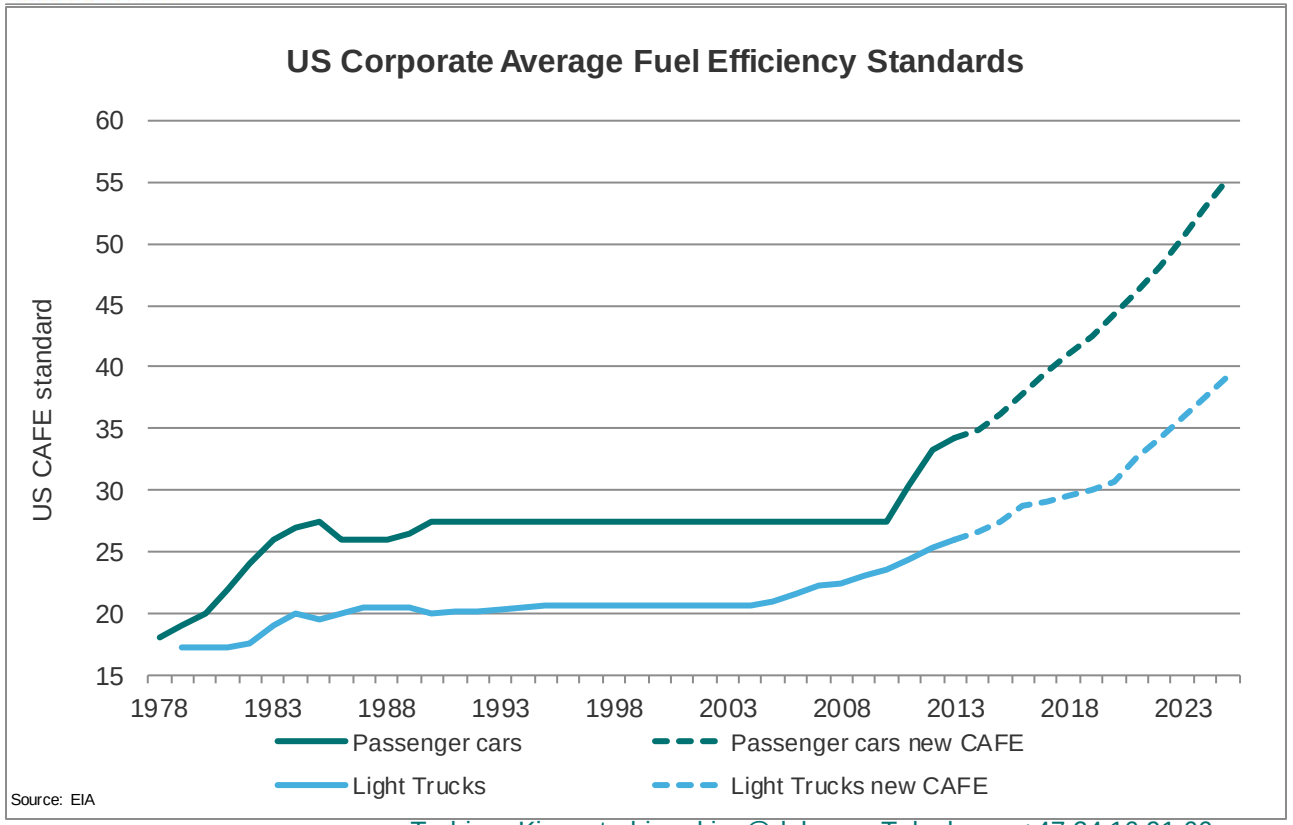
The formal proposal follows President Obama's agreement with 13 major automakers, announced in July, to gradually boost these vehicles' fuel economy to the equivalent of 54.5 miles per gallon -- up from the current standard of 27.3 mpg. Last year, the administration finalized rules to hike the standard to 35.5 mpg by 2016.

CAPTION By Brendan Smialowski, Getty Images

Source: EPA/Department of Transportation Corporate Average Fuel Economy Standards; Final Rule – July 2010

TABLE I.B.2–1—AVERAGE REQUIRED FUEL ECONOMY (mpg) UNDER FINAL CAFE STANDARDS

	2011-base	2012	2013	2014	2015	2016
Passenger Cars	30.4	33.3	34.2	34.9	36.2	37.8
Light Trucks	24.4	25.4	26.0	26.6	27.5	28.8
Combined Cars & Trucks	27.6	29.7	30.5	31.3	32.6	34.1



Source: EIA

Source: Annual Energy Outlook – EIA April 2013

Table 1. NHTSA projected average fleet-wide CAFE compliance levels (miles per gallon) for passenger cars and light-duty trucks, model years 2017-2025, based on the model year 2010 baseline fleet

Model year	Passenger cars	Light-duty trucks	Combined
2017	39.6	29.1	35.1
2018	41.1	29.6	36.1
2019	42.5	30.0	37.1
2020	44.2	30.6	38.3
2021	46.1	32.6	40.3
2022	48.2	34.2	42.3
2023	50.5	35.8	44.3
2024	52.9	37.5	46.5
2025	55.3	39.3	48.7

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SUVs Will Not Get Off The Hook This Time

- Americans can still drive SUVs but they will also become more efficient in coming years

Composite Materials Will Lead to Greener Cars

13.06.12 **- The use of composite materials is rapidly entering into the automotive industry thanks to a technique developed by the EPFL spin-off EELCEE. This technique promises lighter cars that burn less fuel and, consequently, emit less CO2.**

In 2013, we may see car bumpers, doors, and frames made from composite materials, which are engineered or naturally occurring materials such as fiberglass made from two or more constituents with different physical or chemical properties. Since new composites are more durable and yet still lighter than their metal counterparts, they make for lighter cars that consume less gas and release less CO2.

Another way of making cars cleaner and more fuel-efficient is to make them lighter. When JLR launched a new version of its Range Rover last year, it replaced most of its steel bodywork and frame with an aluminium shell, or monocoque, cutting the vehicle's weight by 40%. Studies suggest that lighter materials combined with better aerodynamics could potentially double cars' fuel efficiency—and make them more enjoyable to drive.

COMPOSITE MATERIALS HELP MAKE FUEL EFFICIENT CARS

"Reducing weight is one of the main goals in the automotive industry when it comes to reducing fuel consumption thereby reducing emissions of greenhouse gases," says Jan-Anders Månson, founder of EELCEE and professor at the Ecole Polytechnique Fédérale de Lausanne (EPFL) in Switzerland.

"For over 20 years we have conducted research and development of composite materials with the objective of finding manufacturing processes that enable large volumes. One of our target groups has been the automotive industry. We now have a unique and patented technology and plan for the manufacturing of prototypes and products in Sweden," says Månson.

"Composites are relatively expensive, but with our technology, it is possible to use traditional injection molding machines and with short cycle times we can keep production costs down. We are currently working with several major customers in the automotive industry and with the help of capital from the Swedish company Fouriertransform, we will have the means to further develop the technology," continues Månson.

Boeing 787 Dreamliner

Dreamliner beating fuel-saving predictions

Post by John Gillie / The News Tribune on June 27, 2012 at 3:08 pm

According to Boeing, the 787 consumes 20% less fuel than the similarly-sized 767.

the world's first major airliner to use composite materials for most of its construction.

Number of regular cars in the US currently	255
Fleet size in 2025 assuming 10% increase	281
Annualized new car sales in millions	15
Total million cars sold between 2013 to 2025	180
New CAFE-cars share in 2025 assuming 10% larger fleet size	64%
Replacement per year	4.9%
Improved average efficiency from now to 2025 in MPG ((48.7-30.5)/2/30.5)	30%
Total average efficiency gain per year for the whole fleet	1.5%
Gasoline demand in 2013	8.7
Reduction in demand 2013-2025, based on 8.7 mbd*64%*30%	1.7
Million b/d gasoline demand in 2025	**7.0**

Real life MPG of the fleet is 22 MPG while the current CAFE standard is 30.5 MPG

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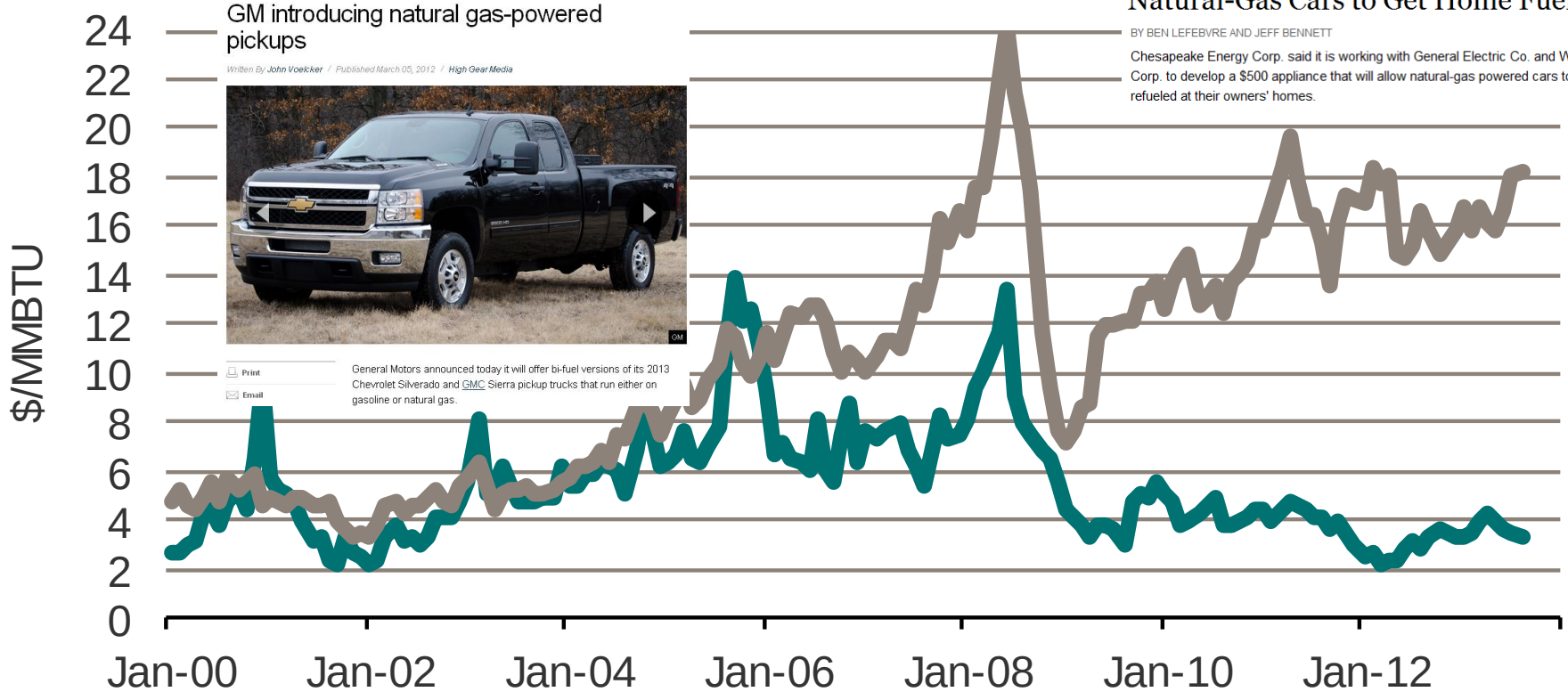
The Huge US Oil-Gas Spread Provides Substitution Possibilities

-General Motors will soon produce dual fuel pick ups and trucks that can switch between gasoline and CNG



GM introducing natural gas-powered pickups

Written By John Voelcker / Published March 05, 2012 / High Gear Media

Print

Email

General Motors announced today it will offer bi-fuel versions of its 2013 Chevrolet Silverado and GMC Sierra pickup trucks that run either on gasoline or natural gas.

THE WALL STREET JOURNAL.

EUROPE EDITION ▾ Tuesday, November 13, 2012 As of 6:14 PM EST

Natural-Gas Cars to Get Home Fueling

BY BEN LEFEBVRE AND JEFF BENNETT

Chesapeake Energy Corp. said it is working with General Electric Co. and Whirlpool Corp. to develop a $500 appliance that will allow natural-gas powered cars to be refueled at their owners' homes.

Source: Reuters

Key Economic Impacts Relative to the Zero Exports Case

Impact (2016-2035 Averages)*	LNG Export Case (Change from Zero Exports Case)		
	ICF Base Case (up to ~4 Bcfd)	Middle Exports Case (up to ~8 Bcfd)	High Exports Case (up to ~16 Bcfd)
Employment Change (No.)	73,100-145,100	112,800-230,200	220,100-452,300
GDP Change (2010$ Billion)	$15.6-$22.8	$25.4-$37.2	$50.3-$73.6
Henry Hub Price (2010$/MMBtu)	$5.03	$5.30	$5.73
Henry Hub Price Change (2010$/MMBtu)	$0.32	$0.59	$1.02

*Source: ICF estimates. Note: * Includes direct, indirect, and induced impacts*

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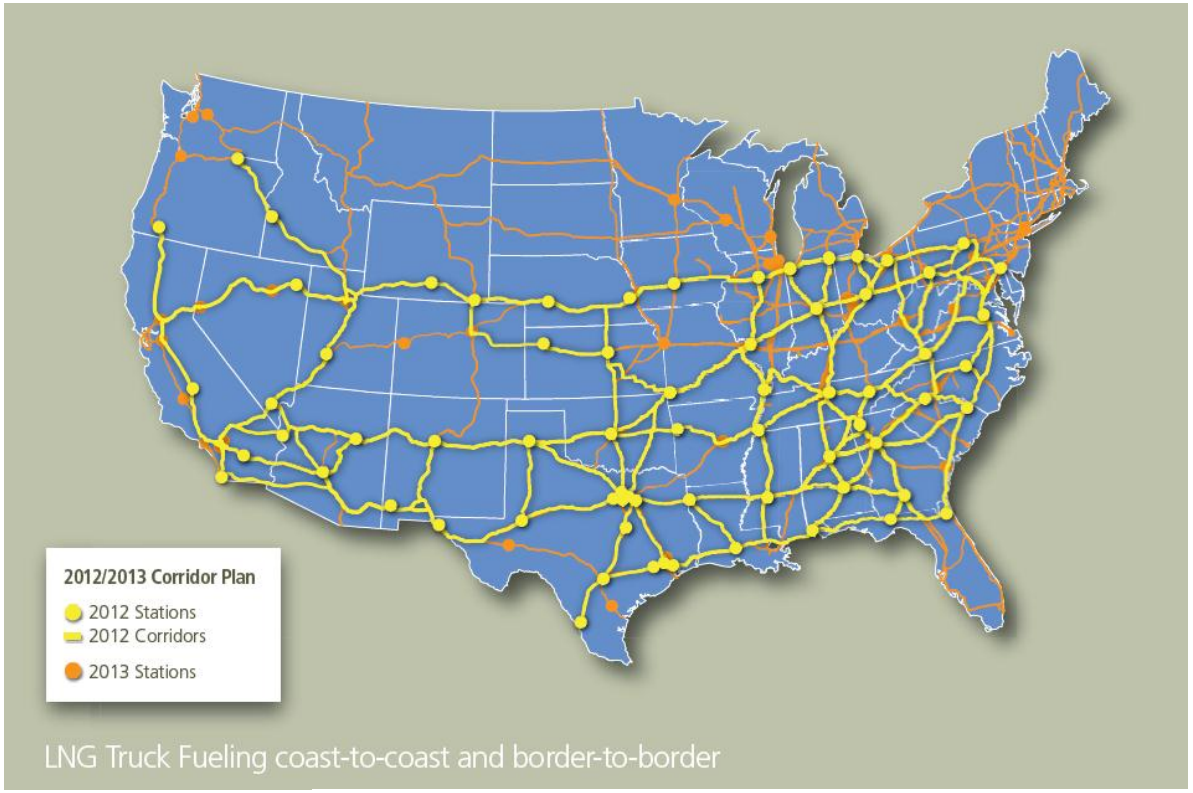
LNG Trucking Corridor Already On It's Way

- On highway diesel demand is about 2.4 million b/d in the US - Railroad demand for diesel is about 230 kbd
- Clean Energy is building 150 LNG filling stations in 2012/13 – Shell to build 100 new locations as well – And ENN Group 50



LNG Truck Fueling coast-to-coast and border-to-border

3/27/2013

Volvo Trucks and Shell Announce Global LNG Fuel Collaboration

by Brandon Borgna

Volvo Trucks and Shell today announced a formal agreement to collaborate and coordinate activities supporting the wider use of Liquefied Natural Gas (LNG) as a fuel for heavy-duty commercial vehicles.

6/13/2012 @ 12:42AM | 7,862 views

Shell Investing $300M To Fuel LNG-Powered Trucks

Oil giant Royal Dutch Shell is set to invest more than $300 million to build out a series of liquefied natural gas filling stations at America's biggest chain of truck stops. According to James Burns, Shell's manager of LNG transportation fuels, the oil and gas giant will pay the costs of setting up 200 LNG pumps at 100 locations in the Travel Centers of America chain. Burns

Burns says Shell will entice truck fleets to buy LNG-powered trucks and to pump their LNG by selling long-term contracts that guarantee the price they pay for the natural gas derived fuel will be at least 30% cheaper than diesel (on an energy-equivalent basis) for the lifetime of their trucks. "They can lock in their fuel savings for however long they keep that truck," which is often as long as five years.

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Compelling Economics To Switch to LNG For Truck Owners

- Fuel costs can be cut in two

Diesel Fuel		Natural Gas (LNG Trucks)		
		Henry Hub	$5.00/MMBtu	$4.00/MMBtu
Diesel Btu/Gallon	128,000	LNG Btu/Gallon	75,000	
Diesel Wholesale	$3.15/gal	LNG Wholesale	$0.65/dge	$0.50/dge
		Field to Pump	$0.40/dge	
Markup w/Tax	$0.85/gal	Markup w/Tax*	$1.10/dge	
At the Pump	$4.00/gal	At the Pump	~$2.15/dge	~$2.00/dge
Fuel Efficiency	6 miles/gal	Fuel Efficiency	6 miles/dge	
Miles Traveled/Yr.	120,000			
Diesel Gallons/Yr.	20,000			
Diesel Cost/Yr.	$80,000	LNG Cost/Yr.	$43,000	$40,000

*Assumes shift to taxation on energy equivalent rather than volumetric basis. LNG $/gallon adjusted by 1.7 (128,000/75,000) to diesel gallon equivalent.

Source: PIRA Energy

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Payback In Just One Year With The New LNG Engines

- With a 40.000 USD higher purchasing price for the new 11.9l LNG-engine the payback time is only one year…

	CWI 11.9L Spark Ignition		15L HPDI Single Tank	
LNG Truck Premium	$40,000		$70,000	
LNG Fuel Cost Savings				
Per DGE	$2.15	$2.00	$2.15	$2.00
Annual	$37,000	$40,000	$37,000	$40,000
LNG Net Additional First Year Cost				
LNG Net Cost	$3,000	Break Even	$33,000	$30,000
Payback Period (Years)				
Payback Yrs.	1.1	1.0	1.9	1.7

Per DGE difference reflect $5/MMBtu versus $4/MMBtu Henry Hub gas prices.

Source: PIRA Energy

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NGV Paradigm Shift Underway In The US – Large Momentum

- Significant momentum in Fleets, Infrastructure, Vehicles, Liquefaction, etc

- **Refuse trucks** (garbage trucks) new orders 40-50% NGV's.
  - Total market of 180.000 vehicles which at full conversion would represent 0.5-0.7 bcf/d of natural gas usage (about 90-130 kbd)
- Waste Management has more than 2.000 NGV's in usage already and is on path to convert its fleet of 18.000 to natural gas
- In Q1-2013, Clean Energy Fuels had 10 refuse stations under construction and 42 letters of agreement for stations to be built in the future in addition to its existing stations
- BNSF **railways** (second larges user of diesel in the US after the US Navy) will test LNG-fueled locomotives in late 2013
- **UPS** plans to purchase an additional 700 LNG vehicles to its existing NGV fleet and build 4 refueling stations by the end of 2014
- **Procter and Gamble** included a natural gas requirement for the first time for the fleets that transport its products
- ENN Group (one of China's largest private companies) plans to **build 50 LNG truck stops** in the US in 2013 alone
- Stabilis Energy plans to build 5 **LNG liquefaction facilities** to service the high horsepower oilfield, marine and rail fuel markets
- By 2009 there were 12.300 **natural gas transit buses** in operation, accounting for about 20% of total fuel use in the transit sector. The National Petroleum Council expect that to increase to 65% by 2035. The Los Angeles Metropolitan Transit Authority retired its last diesel bus in 2011 and now operate a CNG fleet of 2.200 buses.
- **Legislation introduced in the US senate aims to accelerate the contraction of a nationwide network** of refueling stations for NGVs (The Alternative Fueled Vehicles Competitiveness And Energy Security Act – S 1230). The bill will, if it passes, allow fuelling infrastructure projects to qualify for federal loans guarantees from the US department of Energy.

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The “NGV-Ball” Has Started To Roll In The US

- Barack Obama quote: “So we’ve got to have an all out, all in, all of the above energy strategy that develops every source of American energy. A strategy that is cleaner and cheaper and full of new jobs. Now a great place to start is with Natural Gas”.

Stripes Convenience Stores joins Apache to offer CNG at its West Texas locations

The convenience store chain, which is a subsidiary of Susser Holdings Corporation, announced that it will start offering natural gas fueling at selected Stripes® locations. The first two chosen facilities are located in the Midland, Texas area: one is expected to be operational by the end of November, and the other will open by the end of the year.

Westport unveils advanced LNG storage solution for natural gas trucks

The technology for heavy duty vehicles using liquefied natural gas will be available in 120 and 150 gallon capacities and begins shipping by mid-2013. It is expected to provide customers with the ability to fuel even the largest spark ignited (SI) engines on a single tank and deliver extended range.

+ Read more...

Linde announces the successful trial of its LNG mobile fueling unit

This mobile fueler allows customers to test the feasibility of using LNG as an alternative to fuels such as diesel. The trial was performed in collaboration with C Cross Transportation, a Mississippi-based hauler with a fleet of more than 100 tractors, to set up the fuel supply for an LNG tractor the company is testing in South Carolina. The Linde team managed the logistics, arranged the installation, safely deployed the equipment and supplied the needed training.

To be used by field division offices across the state

22.11.12 Vehicles

Oklahoma Department of Transportation acquires 160 natural gas vehicles

The initiative was announced by Governor Mary Fallin and Secretary of Transportation Gary Ridley, and includes four Honda Civics, which are ready for use by the agency, and 156 three-quarter ton Dodge Ram pickups, which the agency expects to receive in January and put into use immediately. Vehicles cost $5 million.

Through the Clean Cities initiative

20.11.12 Markets

Energy Department unveils new projects to spur alternative fuel vehicles adoption

As part of the Obama Administration's energy strategy, the Energy Department is investing about $11 million in 20 projects to help states and local governments cut red tape and develop the infrastructure, training, and regional planning needed to meet the demand for alternative fuel cars and trucks, including vehicles that run on natural gas, electricity, and propane. The projects will be undertaken across 17 states.

It will start with Ford pickup trucks

15.11.12 Vehicles

Texas Department of Transportation releases NGV pilot program

In an effort to improve air quality, increase efficiency and utilize the states' abundant natural gas resources, the agency will test CNG-powered vehicles to perform daily operations. “As an agency with one of the largest fleets and most miles traveled, it’s incumbent upon TxDOT to find more efficient ways to do business, yet still provide Texans with exceptional service,” said Texas Transportation Commissioner Bill Meadows during the announcement at Irving Clean Energy station.

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The "NGV-Ball" Has Started To Roll Also Outside the US

- China seems to have chosen LNG for trucking

China Yuchai strengthens natural gas engine sales in Shaanxi Province's market

China's gas-fired road vehicles soar to nearly 1.5 million

The number of vehicles on China's roads fuelled by various forms of natural gas rocketed 48% in 2012 to 1.48 million.

The vehicles are mostly buses, trucks and taxis running on either compressed natural gas (CNG) or LNG, figures published by the research institute of China National Petroleum Corp. (CNPC) showed.

The institute said the big increase, compared with just 6,000 gas-fuelled vehicles in China in 2000, was another indication of the government's accelerated effort to reduce oil consumption and also cut air pollution.

China is consuming 9.6 million barrels per day of oil, second only to the US in national consumption.

This winter has seen worse-than-usual air pollution in many of China's cities, which is increasingly being blamed on rapidly rising vehicle use, especially cars, as well as traditionally smoky coal-burning factories and power plants.

Gas is at least 50% cheaper than petrol and 33% cheaper than diesel, said the CNPC institute. ▸▸

The company announced that the engines manufactured by its subsidiary Guangxi Yuchai Machinery Company Limited (GYMCL) have experienced significant demand by municipal bus, tour coach and school bus operators in various Shaanxi municipalities, including Yulin, Baoji, Yan'an, Tongchuan and Hanzhong. GYMCL has also captured a large share of the country's overall NGV market and its sales for 2012 are expected to increase to 20,000 units compared with the 13,000 units sold in 2011.

Bangkok Mass Transit Authority seeks approval to acquire over 3,000 NGVs

The Cabinet will be asked to back the BMTA's proposal to buy 3,183 compressed natural gas fueled buses worth a total of Bt13 billion (approximately USD 426 million). Transport Minister Chadchart Sittipunt said that he would submit the scheme for the Government's consideration on January 8.

+ Read more...

Malaysian company invests nearly US$ 2 billion in LNG plant and filling stations

The mission undertaken by privately-held Malaysian NGV Sdn Bhd (MNGV) includes the setting up of an LNG regasification plant and 200 CNG stations nationwide. After signing an agreement with Jeffa Holdings Sdn Bhd, the company's president and CEO Rahmat Ahmad said that RM3.6 billion (almost US$ 1.2 billion) has been set aside for the plant and RM2.4 billion (US$ 790 million) for the 1Gas Stations.

Over 207,000 vehicles converted to CNG during the last three years in Bolivia

Progress in the NGV program carried out by the Government is shown by the numbers recently updated by the Departmental Association of Station Owners of Santa Cruz (Asosur). The chamber reported that 207,405 vehicles have been fitted to run on compressed natural gas since 2010 up to date, 61,500 of which have been switched in Santa Cruz.

India: CNG conversions grew almost four times over the last 18 months in Mumbai

According to Mahanagar Gas Ltd (MGL) sources, there were also 25,752 transformations in just nine months, between March and November of last year, which is the highest rise in fittings since conversions began. This expansion indicates how local drivers are trying to deal with fuel price hikes every four to six months over a couple of years.

Argentina: number of CNG conversions increased by 16% in January

Figures for kit installation in the South American country remain favorable, according to up-to-date statistics provided recently by the CNG Management of the National Gas Regulatory Agency (Enargas, as in its Spanish acronym). In January, 10,147 vehicles (number that could grow once official records are completed) switched to natural gas, while there were 8,758 conversions in December 2012.

China's heavy truck fleet to adopt LNG as fuel

China's LNG-fuelled heavy-duty trucks may increase fivefold in less than two years as the country fights air pollution, according to analysis by Sanford C Bernstein.

LNG may power 247,000 vehicles by 2015, up from 51,000 in 2012, reducing China's dependence on oil imports, Hong Kong-based Bernstein analyst Neil Beveridge said in a report, and reported by Bloomberg on March 14. Beveridge said that China currently has 5 million heavy-duty trucks.

"The National People's Congress [NPC], where top legislators meet once a year, coincides with some of Beijing's most polluted days," Beveridge said.

"With the new government taking shape, we expect China to accelerate the pace of taking measures to reduce pollution."

According to the report there may be 694,000 LNG-fuelled trucks by 2020, or 6% out of a total fleet of 11.5 million.

The report added that air quality readings on January 12 by the US Embassy in China for PM2.5 reached 993 in Beijing. PM2.5 refers to airborne pollutants smaller than 2.5 micrometres in diameter, which are able to penetrate deep into lungs and even the blood stream, raising risks of heart and lung diseases.

US Embassy peak readings for the whole of January exceeded the World Health Organisation's (WHO) recommended daily exposure to PM2.5 of no higher than 25.

The report also said China's state oil majors, PetroChina and Sinopec, might spend 52 billion yuan (US$8.4 billion) in the next five years to cut the sulphur content in petrol and diesel to meet new emissions standards.

Under China IV standards, which the country will adopt by 2014, the sulphur content should be 50 parts per million per litre of petrol and diesel. China will adopt the China V standards in 2017, which will cut the sulphur content to less than 10 ppm per litre of fuel, the report said. ■

24/01/2013 EU LAUNCHES CLEAN FUEL STRATEGY

LNG: Liquefied natural gas is also used for trucks, but there are only 38 filling stations in the EU. The Commission is proposing that by 2020, refuelling stations are installed every 400 km along the roads of the Trans European Core Network.

CNG: Compressed natural gas is mainly used for cars. One million vehicles currently use this fuel representing 0.5% of the fleet - the industry aims to increase this figure ten-fold by 2020. The Commission proposal will ensure that publically accessible refuelling points, with common standards, are available Europe-wide with maximum distances of 150 Km by 2020.

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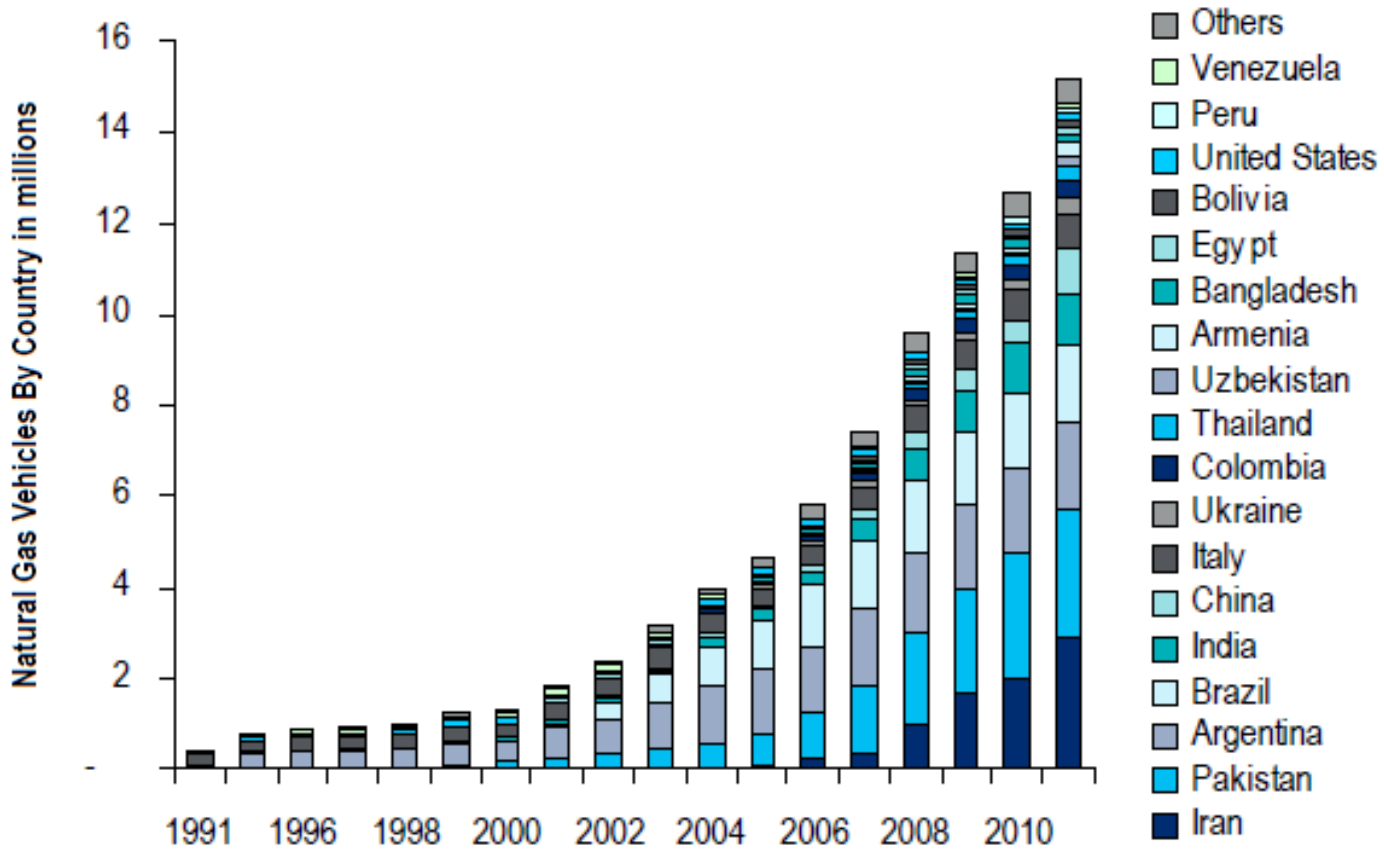
NGV's Gaining Traction Globally

- Has reached 15 million vehicles and note that the US is so far almost invisible in this graph…
- A 20% yearly increase in this fleet (25% is the growth rate the last 10 years) implies 2 million b/d lower oil demand by 2020



Source: NGV Global, Citi Research

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Top Score For Tesla In US Consumer Reports Magazine

- Electric vehicles are starting from scratch in the US, but look at Tesla's plans for infrastructure investments next 2 years

Tesla Model S review

An electric sports car earns our top test score

Consumer Reports magazine: July 2013

TESLA DRAMATICALLY EXPANDS SUPERCHARGER NETWORK, Delivering CONVENIENT, free LONG DISTANCE DRIVING THROUGHOUT U.s. and Canada

Thursday, mAY 30, 2013 – Tesla Motors (NASDAQ: TSLA) today announced significant expansion of the Tesla Supercharger network. Supercharging enables Tesla Model S drivers to travel long distances, for free, indefinitely.

Two years out:

Tesla Motors

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Non-OECD Oil Demand

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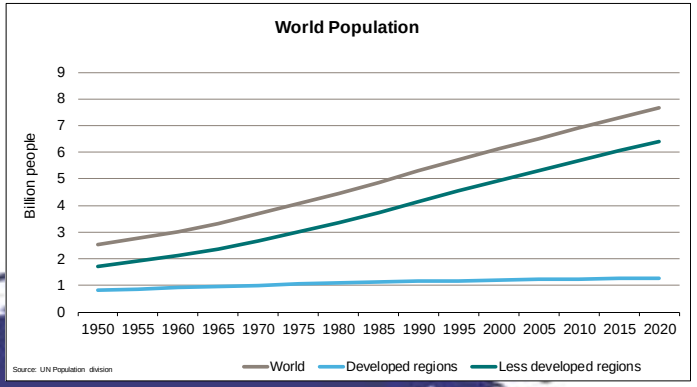
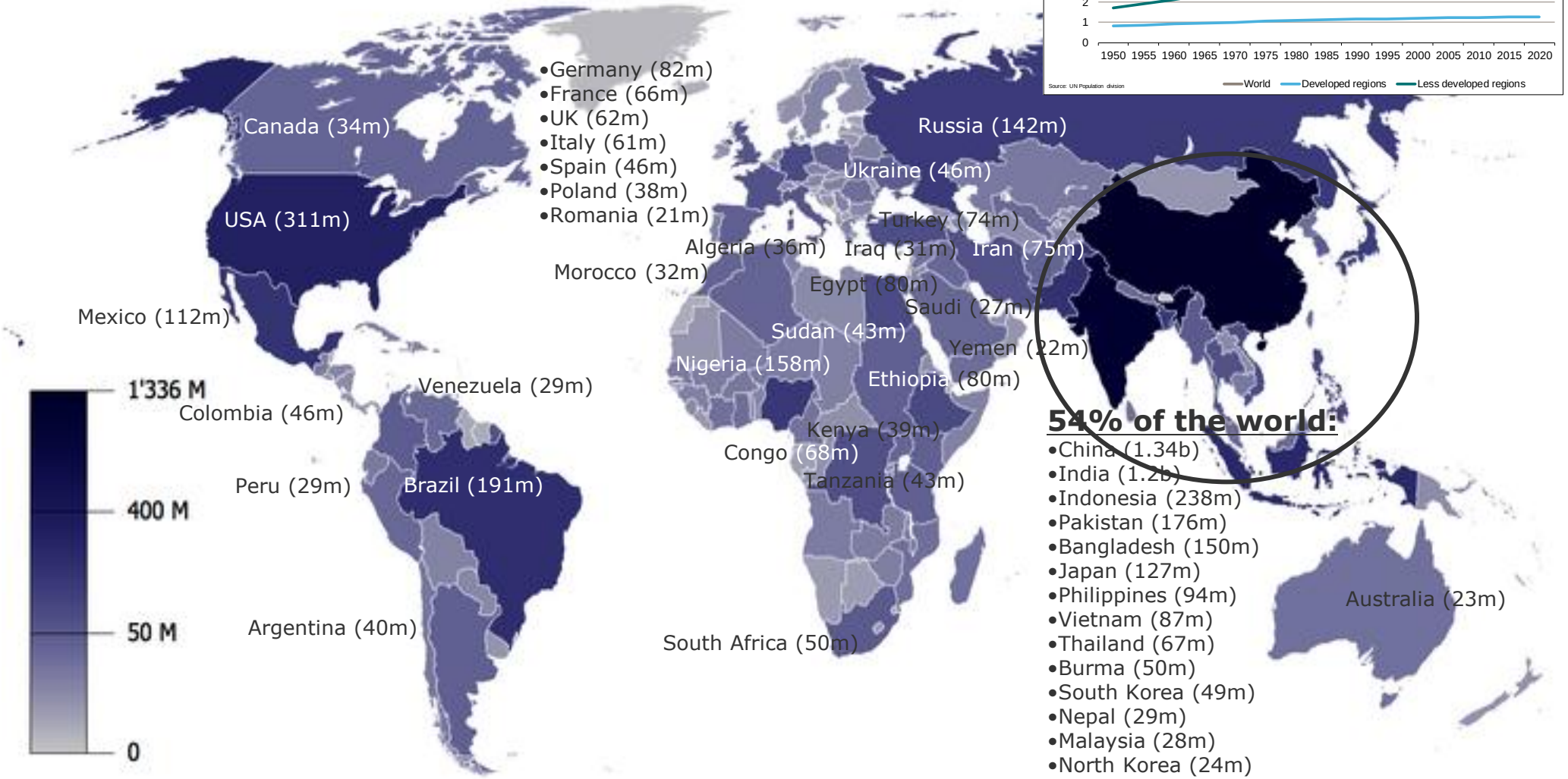
World Population By Country

(Sources 2009-2011)





54% of the world:

- China (1.34b)
- India (1.2b)
- Indonesia (238m)
- Pakistan (176m)
- Bangladesh (150m)
- Japan (127m)
- Philippines (94m)
- Vietnam (87m)
- Thailand (67m)
- Burma (50m)
- South Korea (49m)
- Nepal (29m)
- Malaysia (28m)
- North Korea (24m)
- Taiwan (23m)
- Sri Lanka (20m)
- Cambodia (13m)

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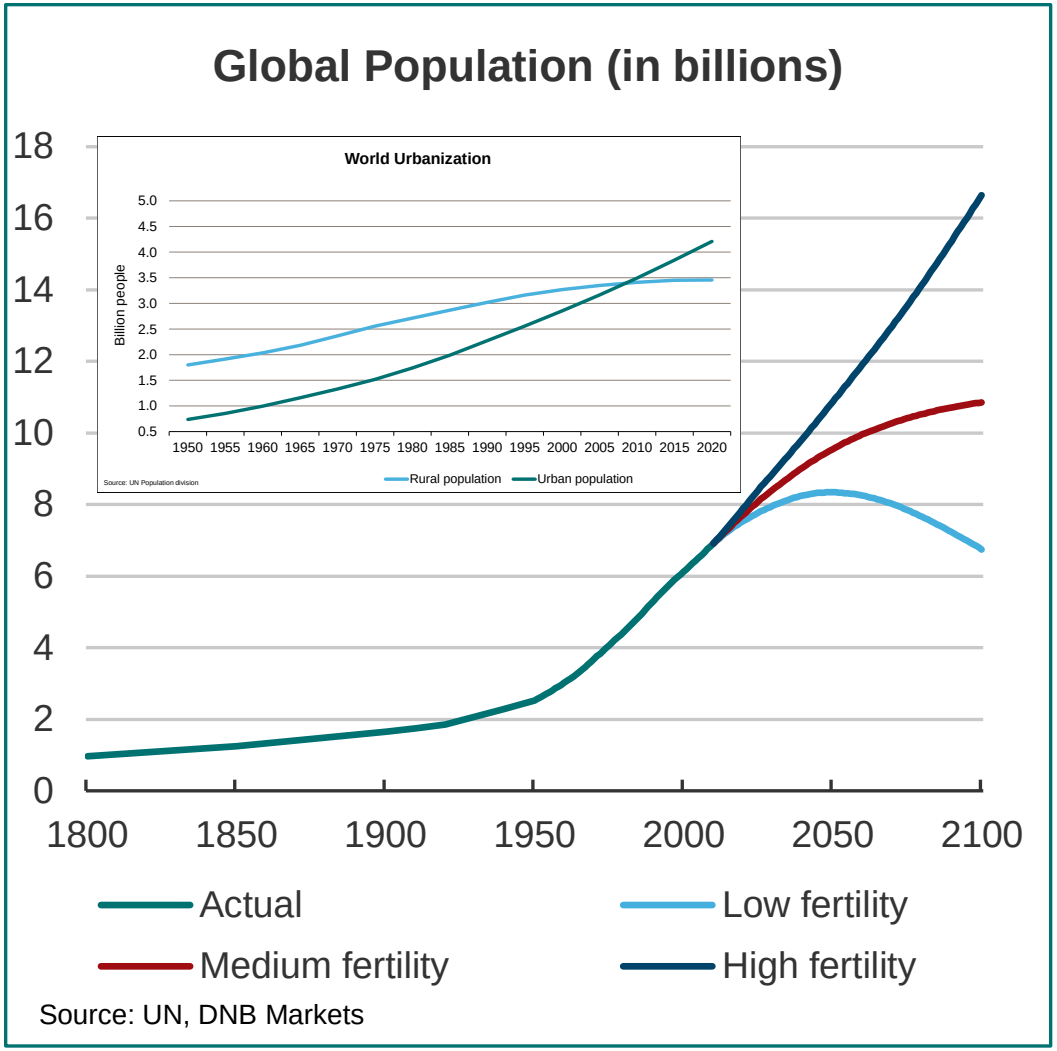
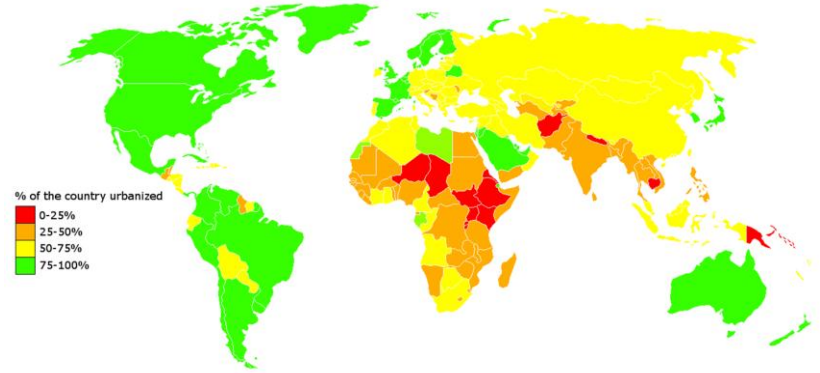
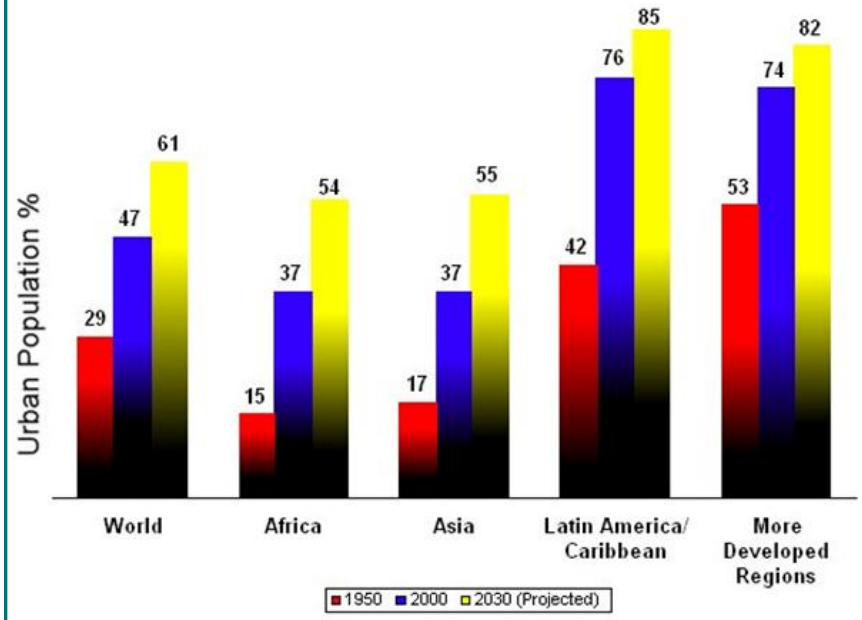
The World Population & Urbanization Continue To Grow

- Both these factors create increased energy demand







Source: United Nations, World Urbanization Prospects.

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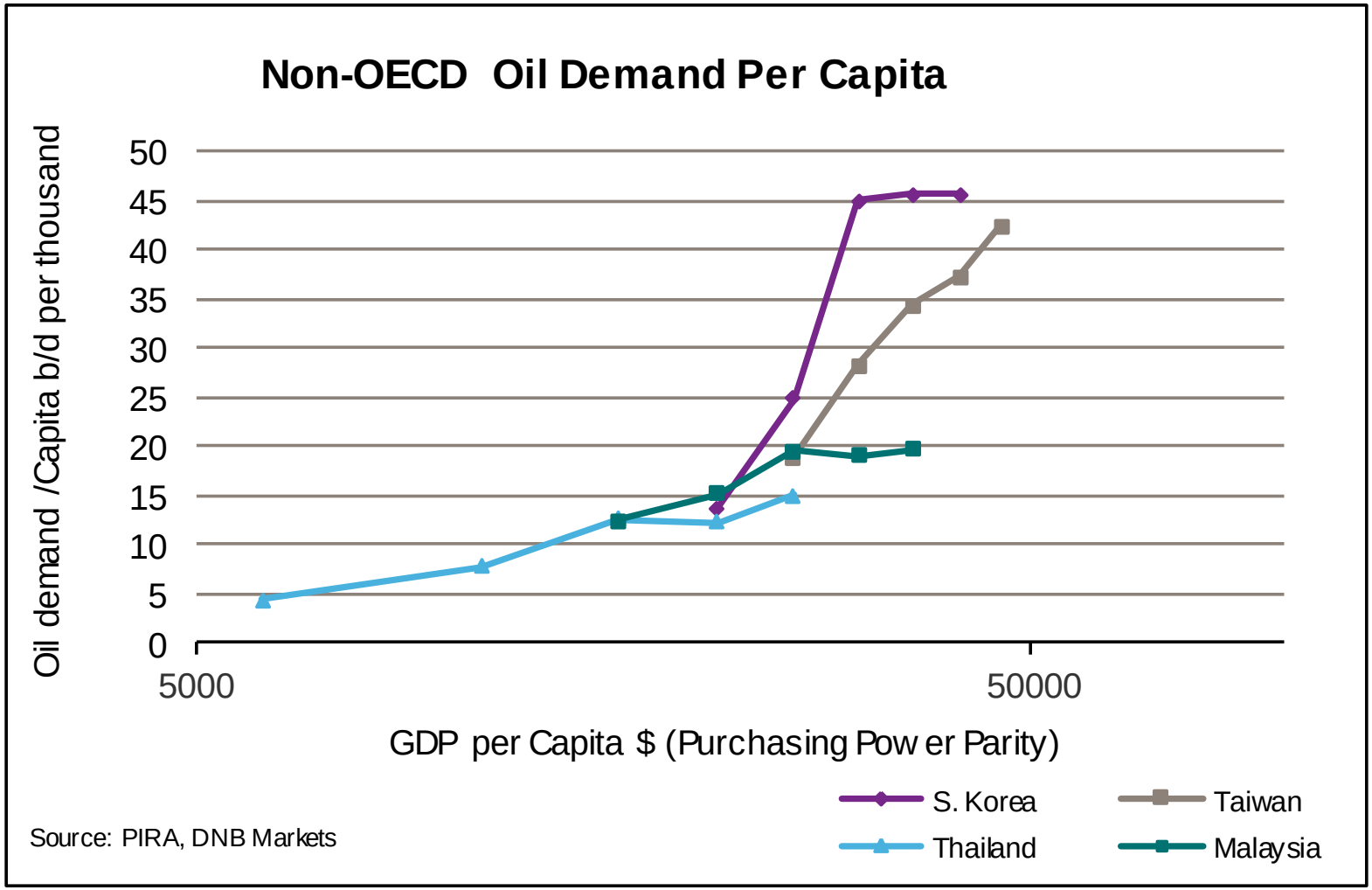
We Used To Believe In Exponential Growth In Asian Oil Demand

- If the story from other Asian nations should be repeated by China and India – oil demand should grow exponentially – why is it not happening?



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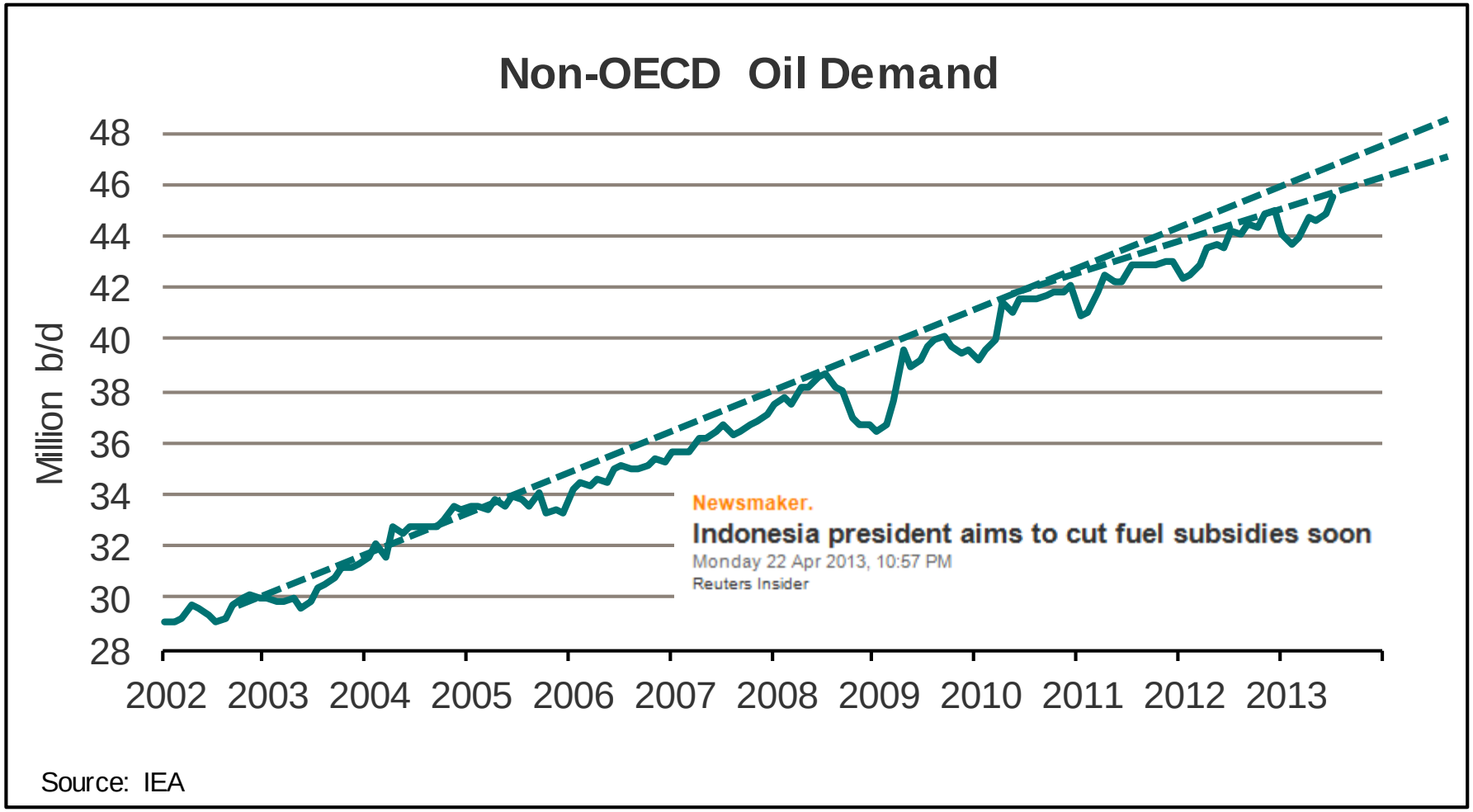
Non-OECD Oil Demand Will Continue To Grow

- We do however expect the growth rate to decrease in the current decade



Source: IEA

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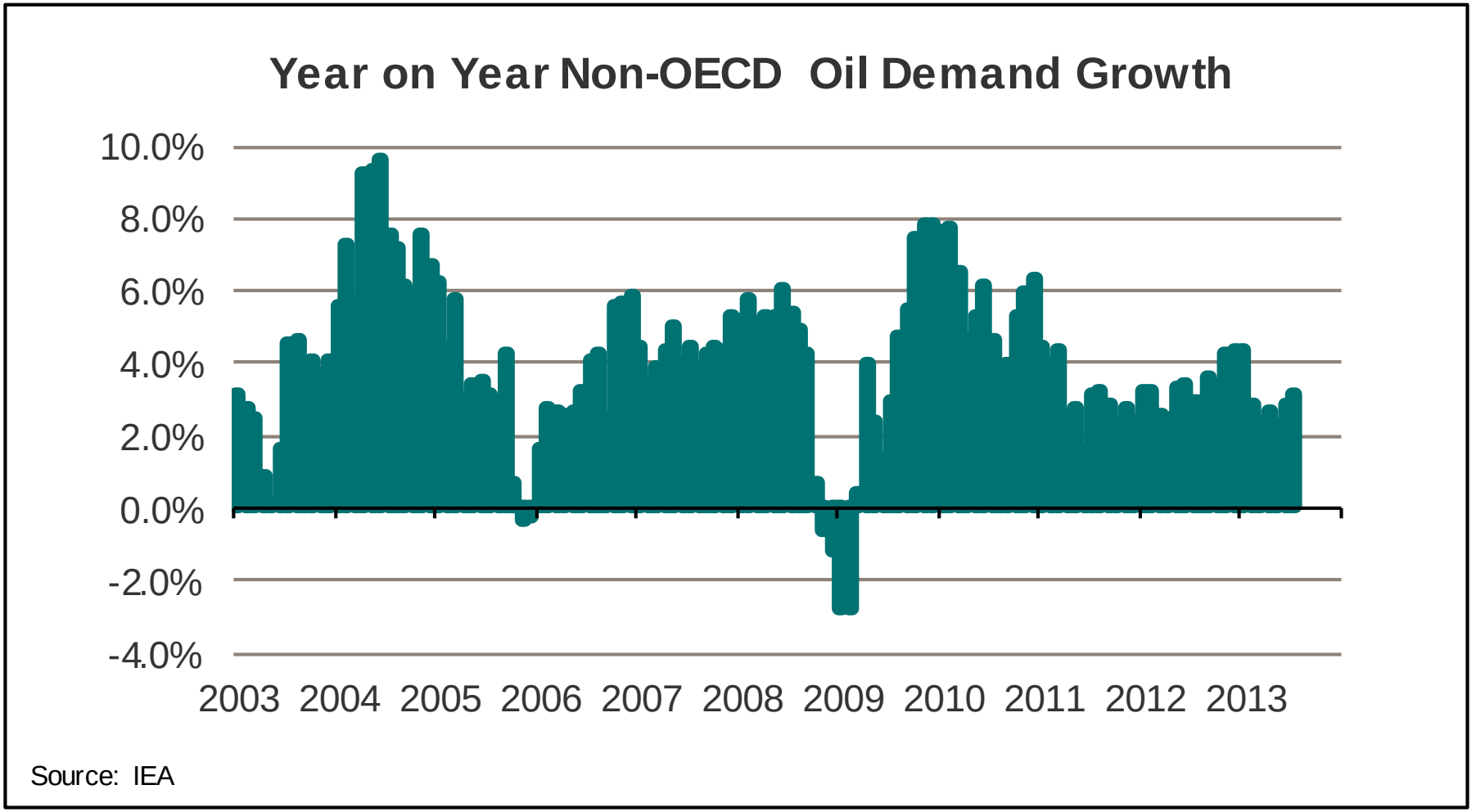
Is The Above 4% YoY Oil Demand Growth In Non-OECD History?

- We believe other energy sources will take more of the stationary demand growth going forward – on the expense of oil



Source: IEA

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Chinese Oil Demand

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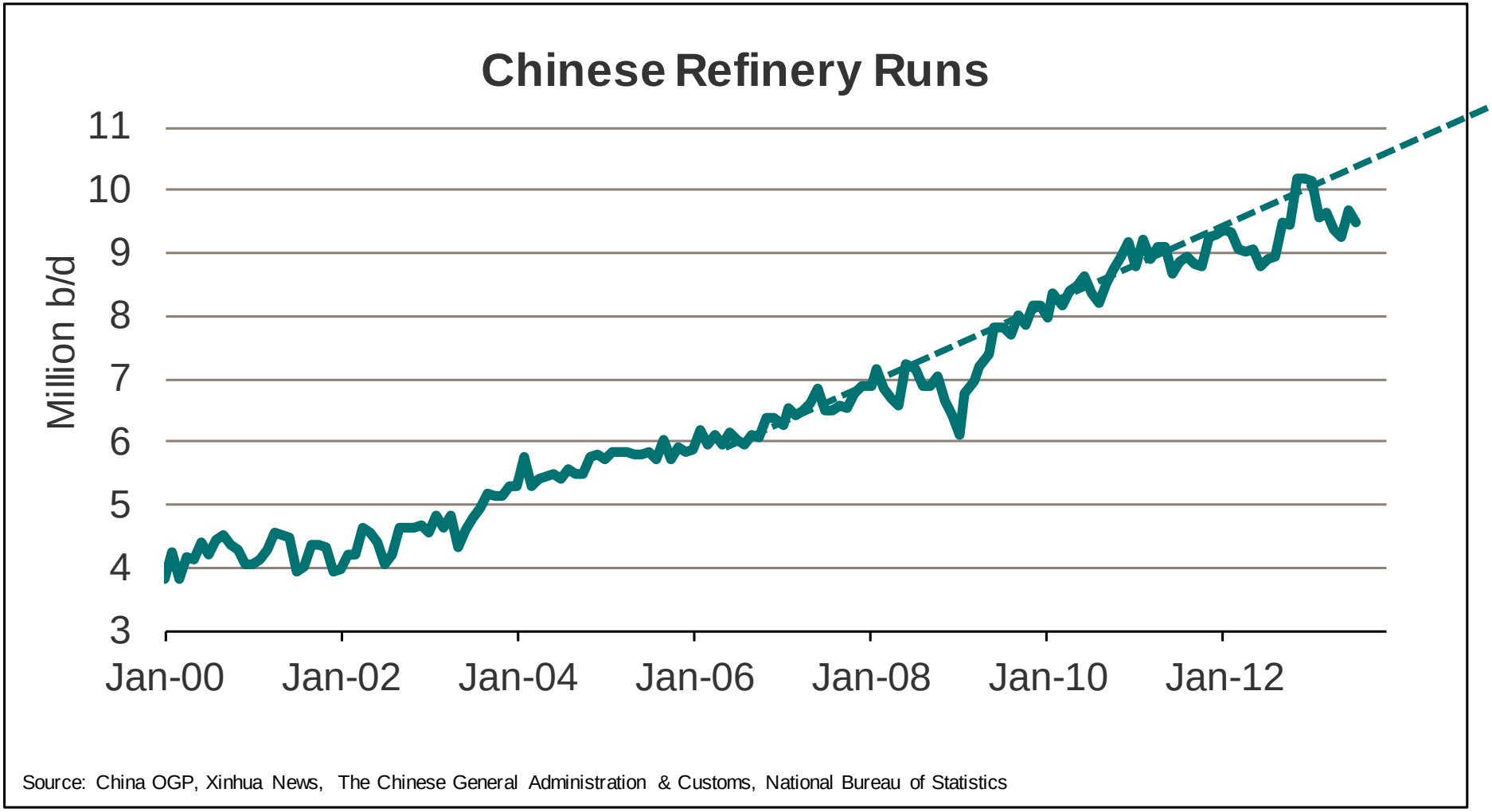
Chinese Growth In Crude Throughput Stalling??

- Where is the accelerating growth in Chinese crude oil throughput??



Source: China OGP, Xinhua News, The Chinese General Administration & Customs, National Bureau of Statistics

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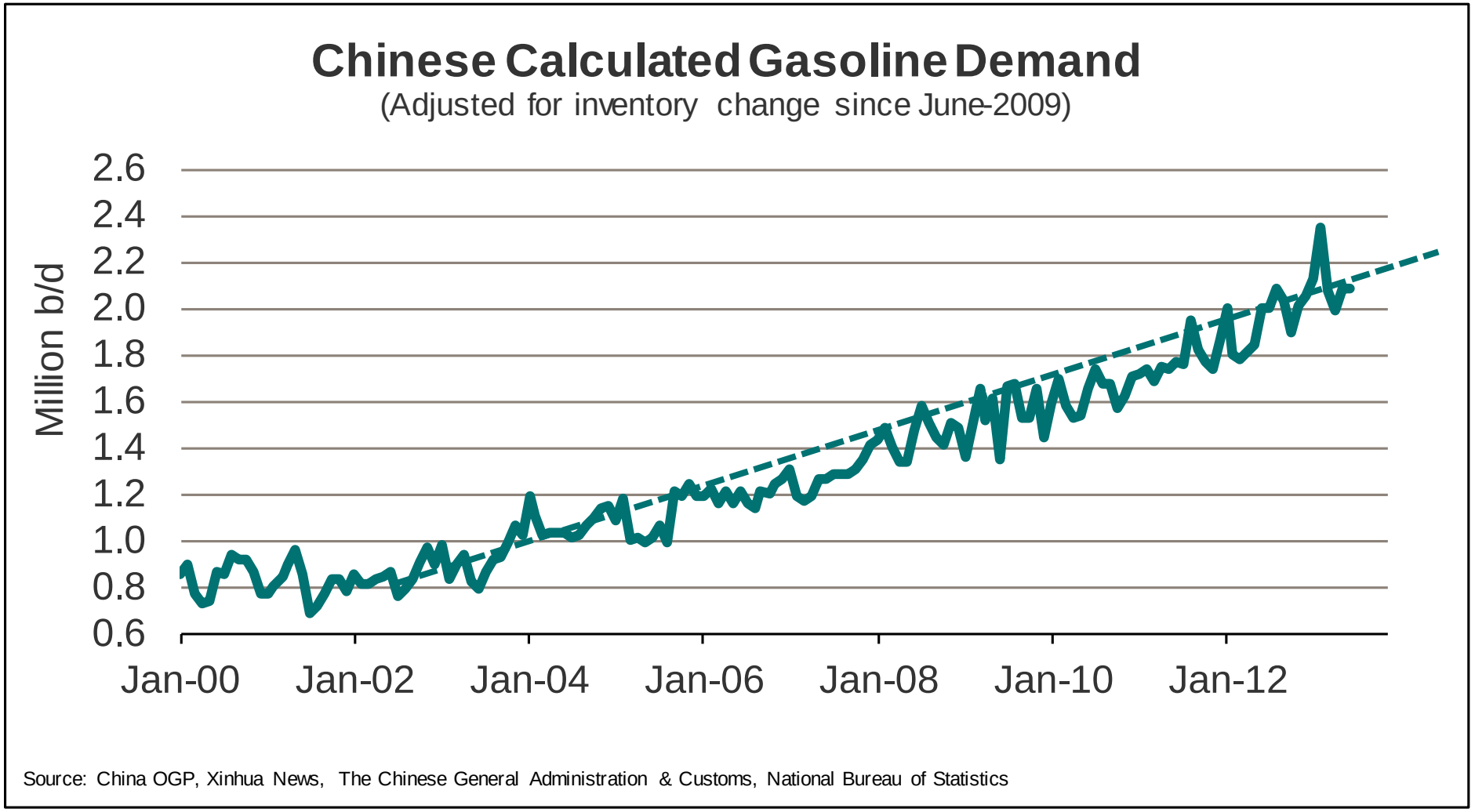
Chinese Oil Demand Growth To Favor Personal Consumption

- Oil products more tilted towards industrial production and the investment cycle may grow much slower in coming years



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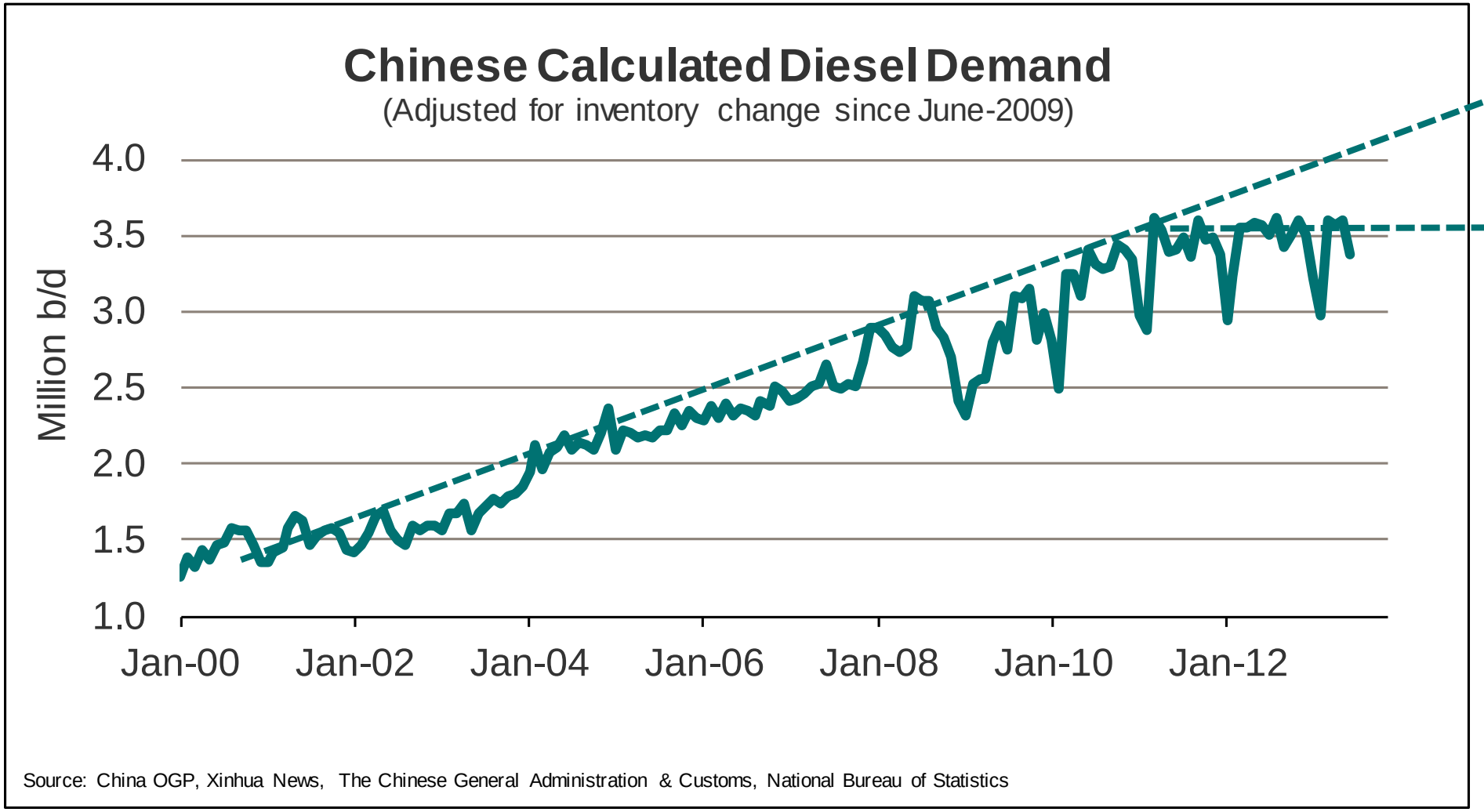

Source: China OGP, Xinhua News, The Chinese General Administration & Customs, National Bureau of Statistics

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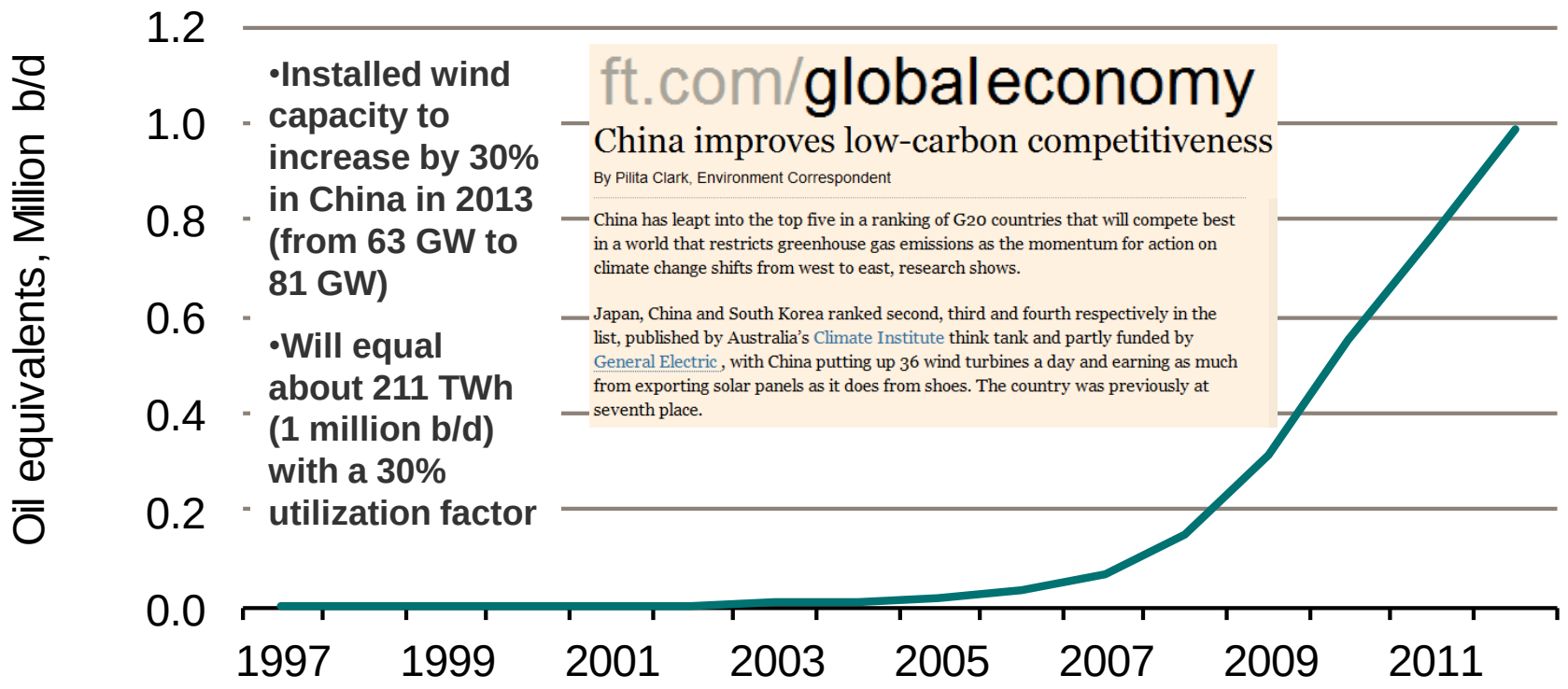
Look What The Chinese Have Done With Wind Power

- Increase from zero to 1 million b/d (211 TWh) in 5 years. Total German electricity consumption is about 600 TWh…



ft.com/globaleconomy

China improves low-carbon competitiveness

By Pilita Clark, Environment Correspondent

China has leapt into the top five in a ranking of G20 countries that will compete best in a world that restricts greenhouse gas emissions as the momentum for action on climate change shifts from west to east, research shows.

Japan, China and South Korea ranked second, third and fourth respectively in the list, published by Australia's Climate Institute think tank and partly funded by General Electric , with China putting up 36 wind turbines a day and earning as much from exporting solar panels as it does from shoes. The country was previously at seventh place.

China makes fresh promises on air pollution, pledges support for solar

SHANGHAI, June 15 (Reuters) - China's cabinet approved new measures to combat air pollution on Friday, in the latest step by China's new leadership to address the country's enormous environmental problems, with pollution a key source of rising social discontent in China.

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Natural Gas is Eating Into Oil's Market Share In China As Well

- Every NGV vehicle hitting the road represents lost diesel (or gasoline) demand

Kunlun Energy will implement 'Gas in Substitution of Oil' strategy in China

The subsidiary of PetroChina Company Limited (CNPC) will continue to focus on the promotion of the LNG business and will strive to be a pioneer in the development of "Gas in Substitution of Oil," which has been recognized as the most effective clean energy solution in China. With its technological innovation and meticulous management, Kunlun has already improved its production capacity, reduced costs, and enhanced its efficiency.

Among its initiatives, the Ansai LNG processing plant in Shaanxi is currently the largest single unit natural gas liquefaction project in China. The Taian and Huanggang LNG projects have also commenced construction and become the leading localized LNG equipment. In addition, the Wuyin line (from Wuhai, Inner Mongolia to Yinchuan, Ningxia), the world's longest hydrogen -rich coke oven gas pipeline, is in operation and has become the new benchmark in the integrated natural gas business.

Moreover, Kunlun has actively promoted the use of LNG for public transportation, heavy duty trucks and vessels. The demonstration projects for urban buses have been well-received in many cities, including Beijing and Chongqing. These initiatives are in line with the launch of relevant supportive policies by the government, which is stimulating vehicle conversions in several Chinese regions.

Last year, Kunlun increased its daily LNG production capacity by 3.15 million m3/day to a cumulative capacity of 4.53 million m3/day. The company also launched more than 28,000 LNG-powered vehicles, 15 LNG-powered vessels, 48 natural gas drillers, and 227 new natural gas fueling stations.

Source: Kunlun Energy

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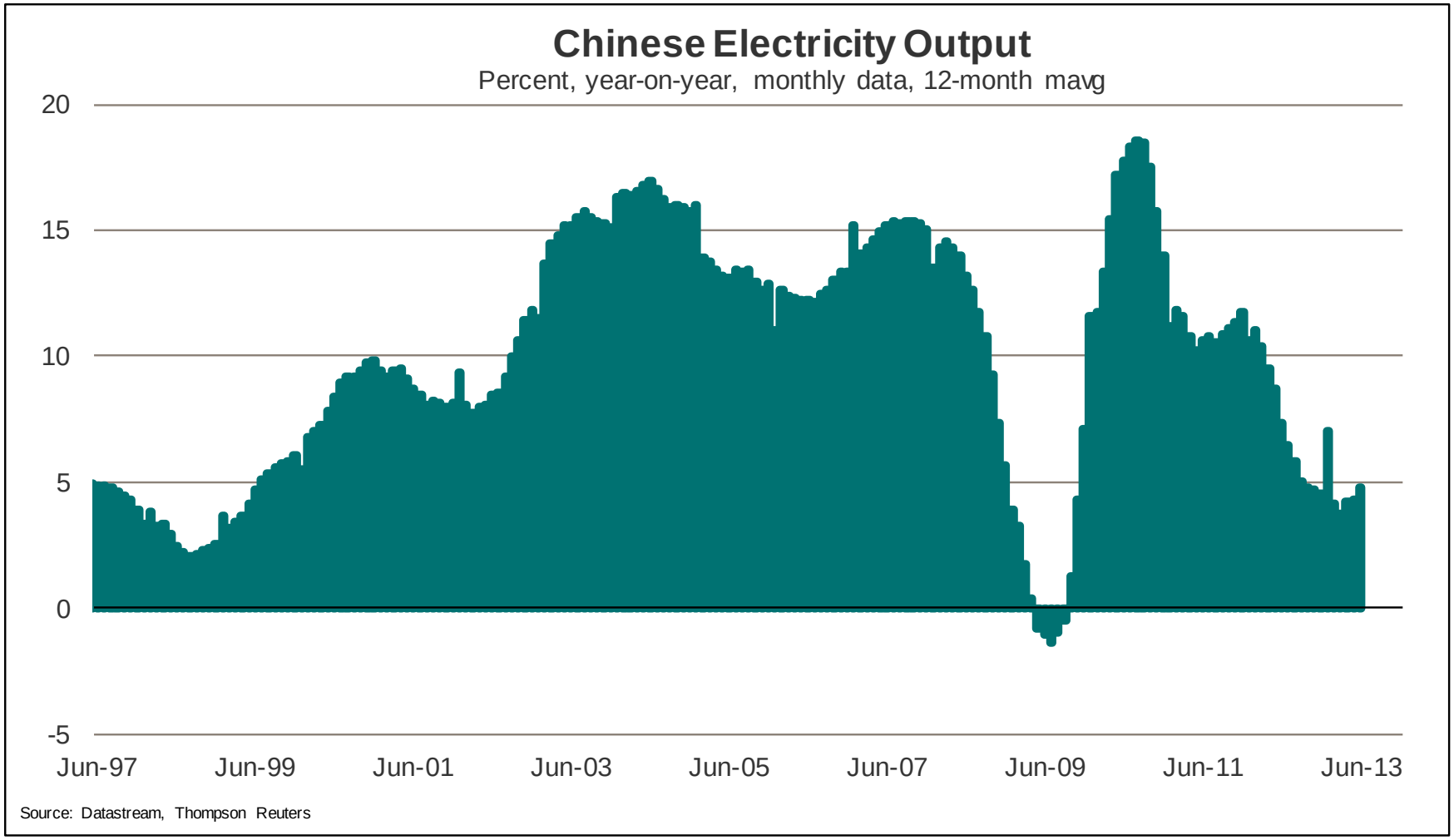
Chinese Electricity Output Suggest GDP-Growth Is Weakening

- Based on Chinese electricity output, maybe the Chinese GDP-growth is in fact weaker than the reported numbers??



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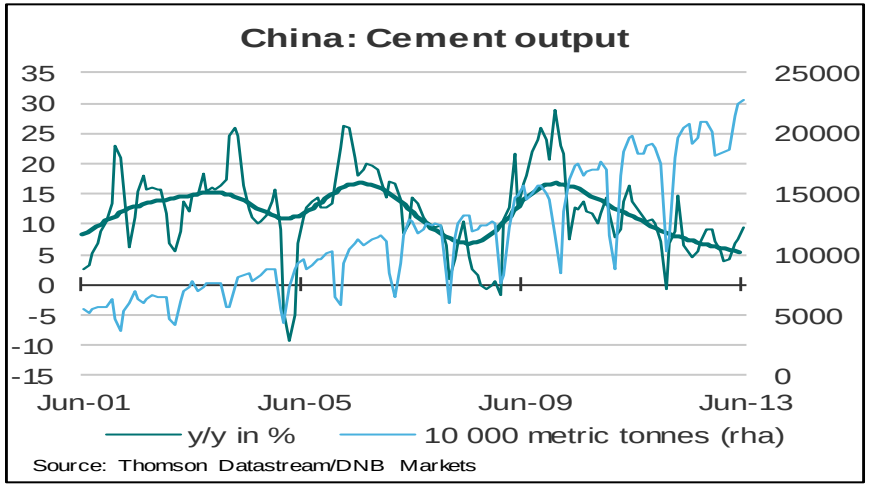
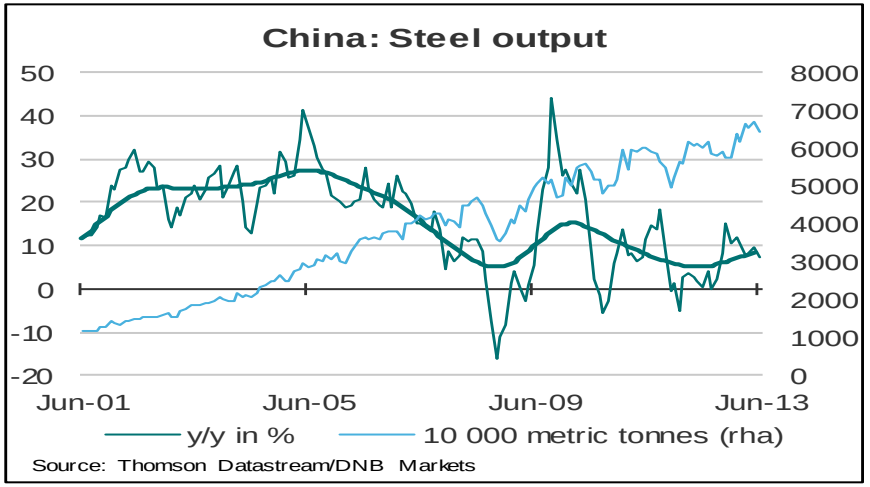
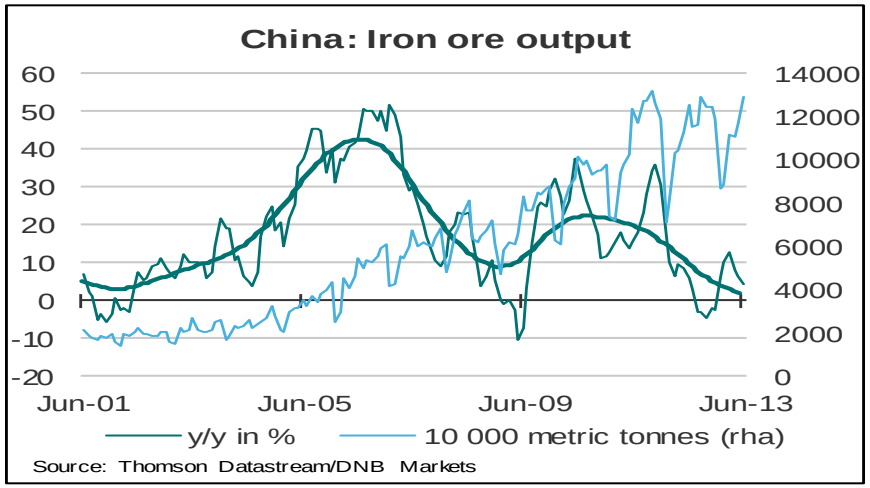
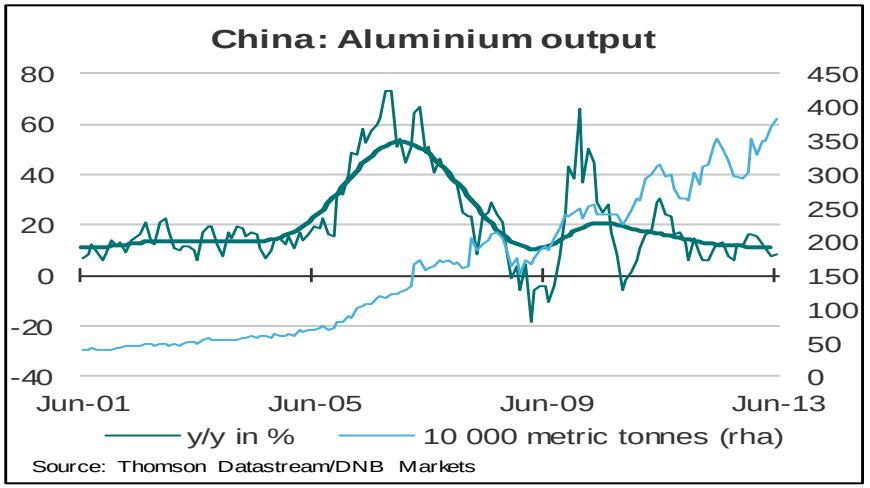
Weaker Growth Numbers In Many Chinese Industries Lately









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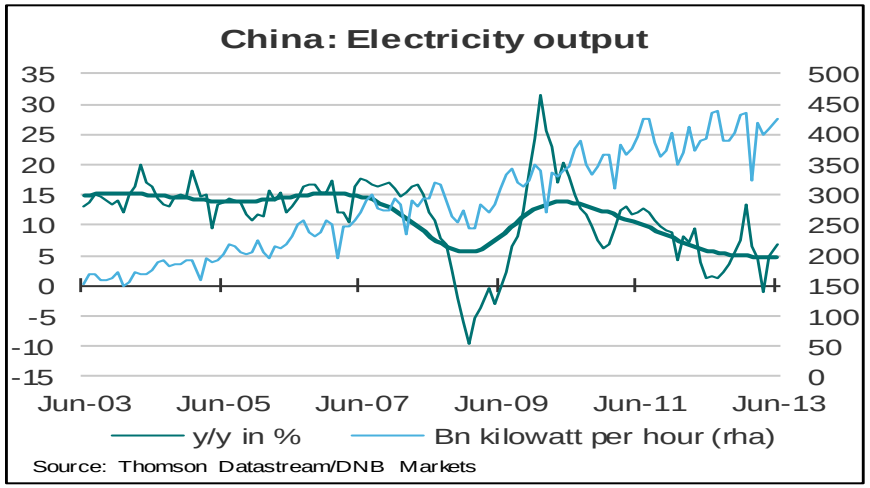
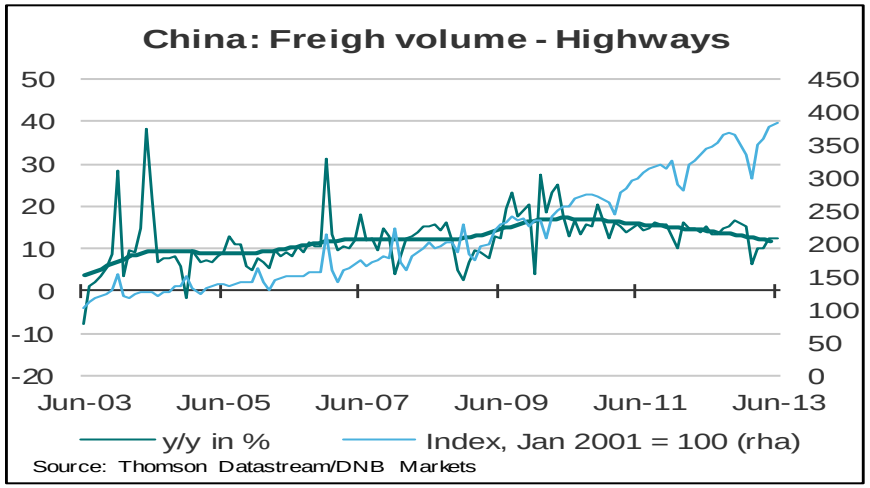
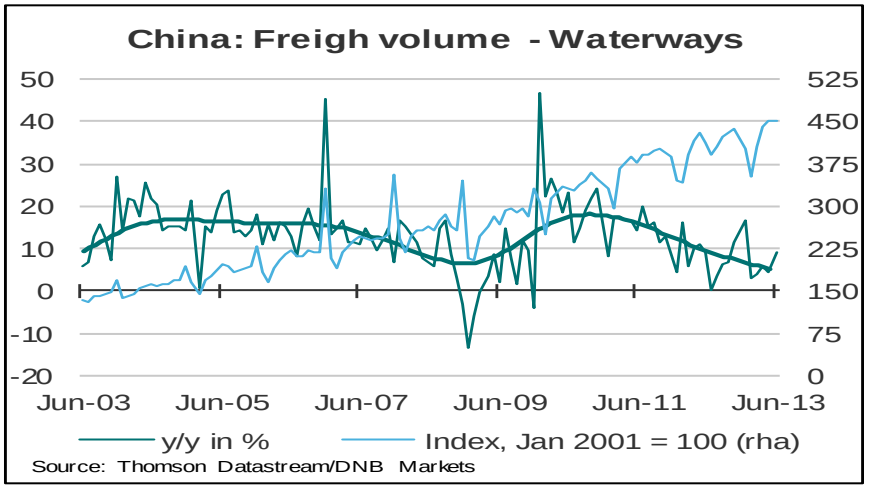
And Weaker Growth In Chinese Freight Volumes







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Chinese Industrial Output Growth Is Stalling

- After growing by 15% on average for the last decade, growth in manufacturing has slowed by more than 1 standard deviation

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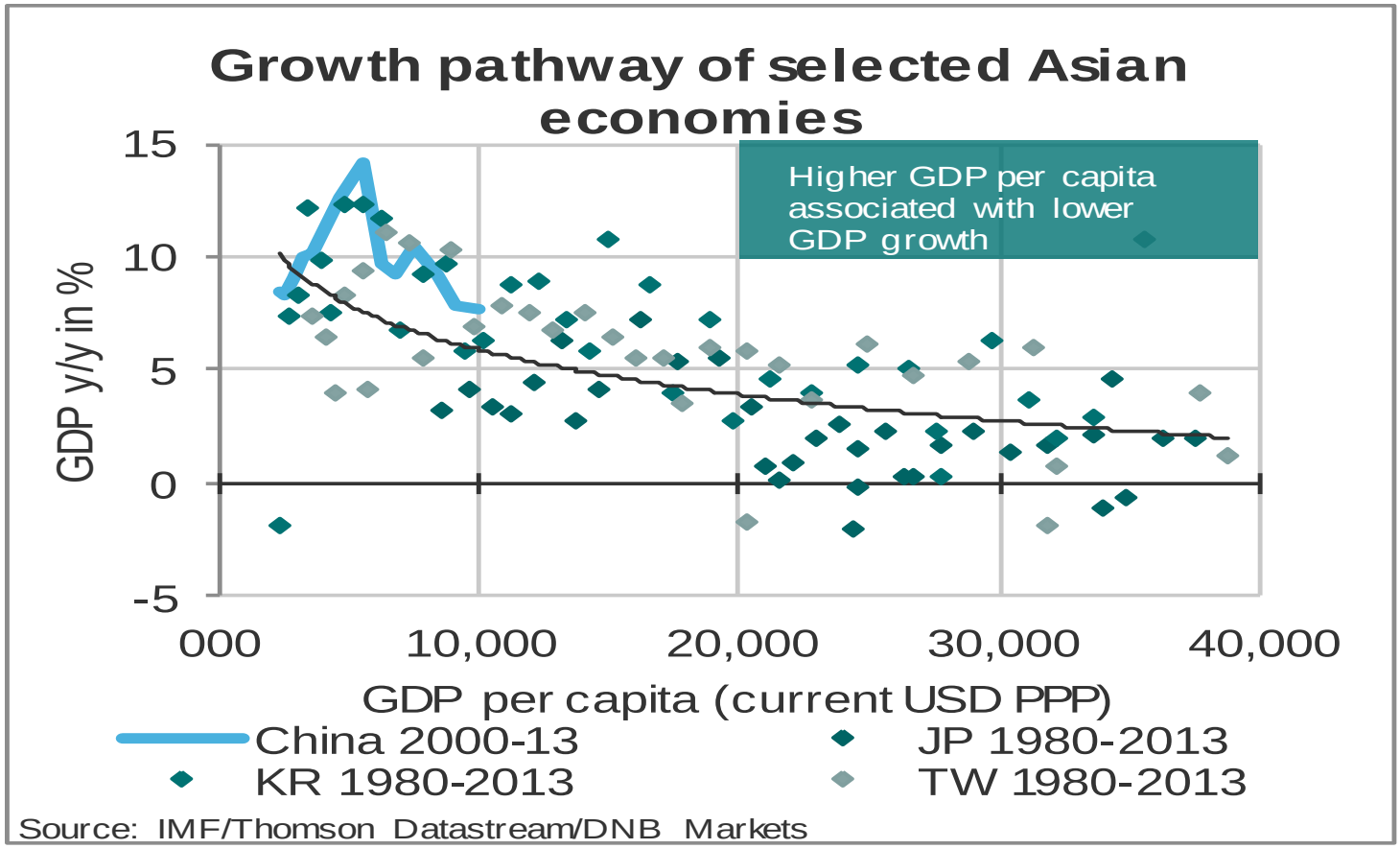
China Is No Longer A Low-Income Country

- Adjusted for difference in prices, China's GDP per capita is now 10 000 USD
- For other Asian economies, this has corresponded with somewhat lower GDP growth (in the vicinity of 5-7 percent)



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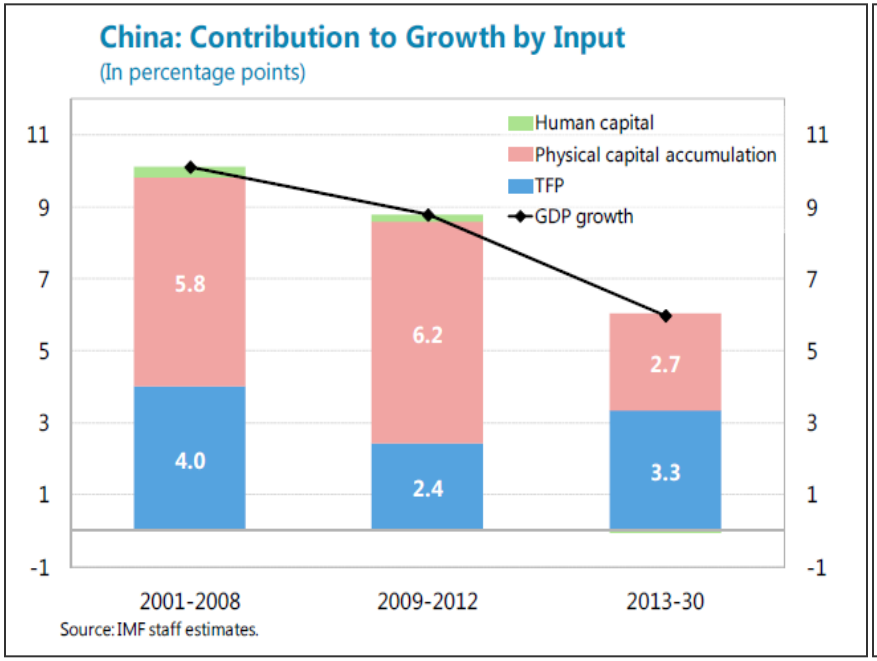
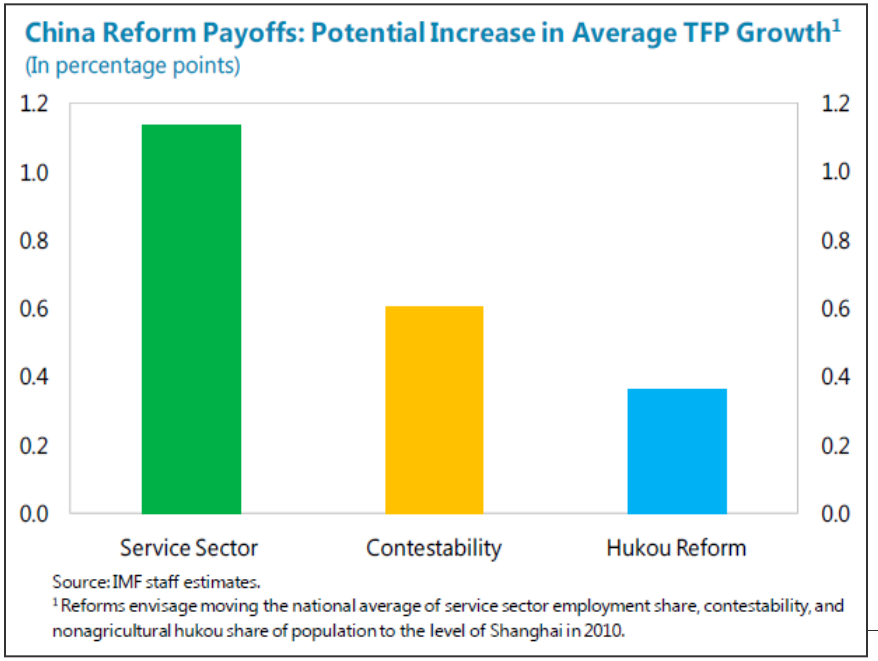
IMF: 6 % Will Be The New Trend Line Growth In China

- That is if reforms are carried through, if reforms are not carried through growth will only be 4%

- "Average productivity growth is likely to fall below its pre-crisis level, consistent with the typical slowdown in productivity growth most countries go through during their transition from middle to high income
- "This, together with a declining labor force and more moderate pace of investment, means average GDP growth could fall to around 6 percent during 2013–30
- "Accelerating the pace of structural and financial reforms would help China limit the typical productivity growth slowdown that occurs during the transition to high-income status.





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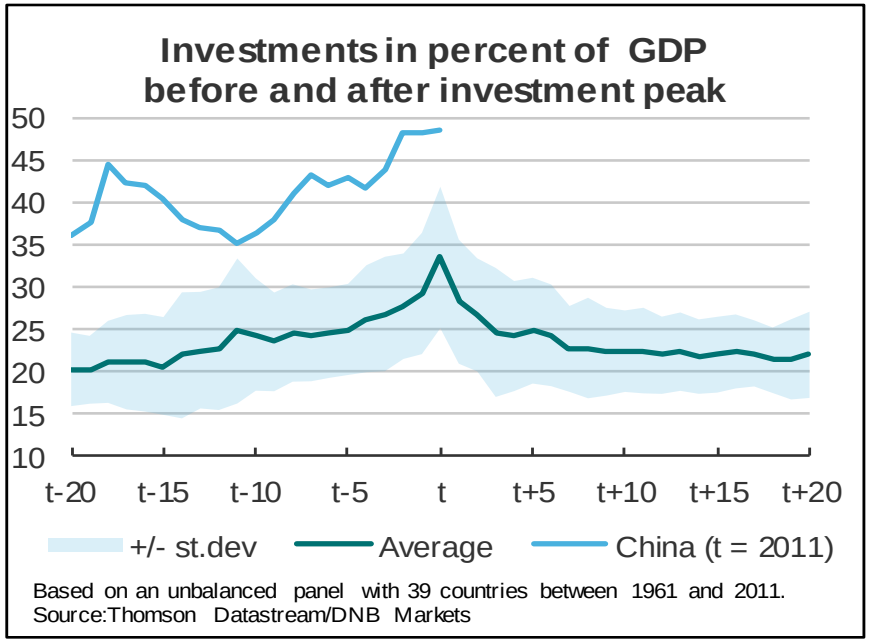
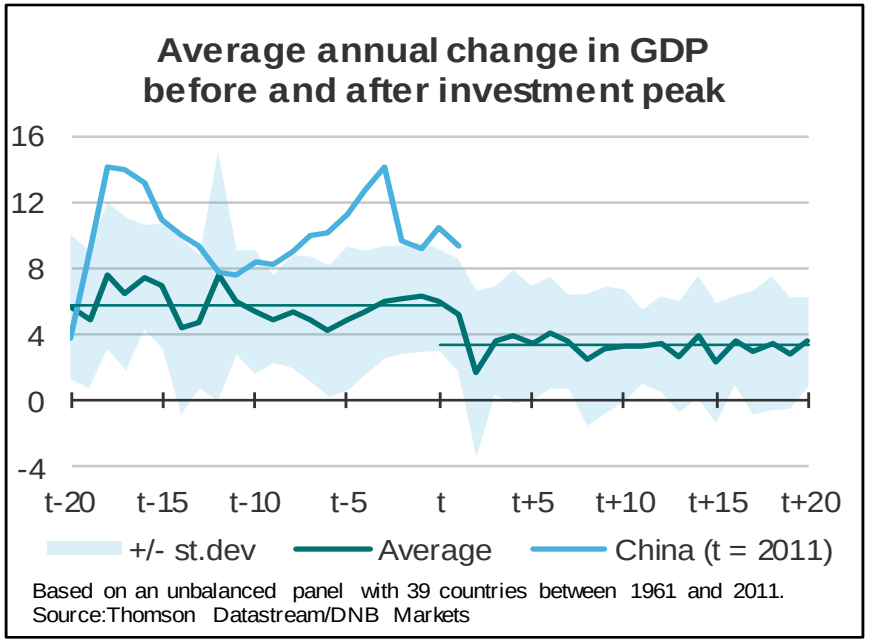
Difficult To Maintain High Growth After Investment Peak

- China's aim at increasing the consumption ratio and lowering the investment ratio should also mean lower growth in GDP
- Data for 39 economies indicate that restructuring the economy away from investments normally leads to lower growth in GDP of about 40 percent
- In Chinas case, this means that growth should decline to about 6 percent in the coming years





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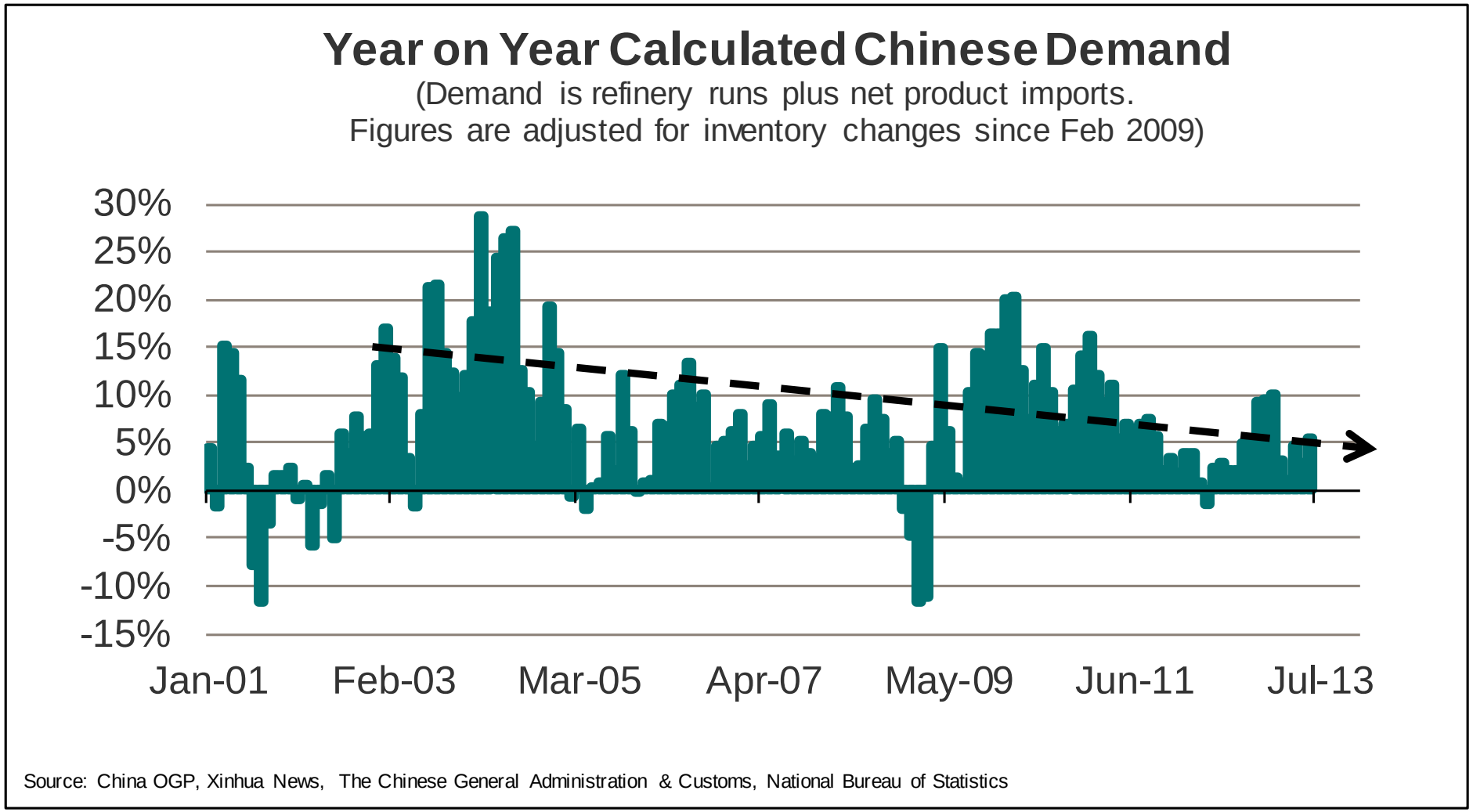
Chinese Oil Demand Growth In Percent – Trending Lower



Source: China OGP, Xinhua News, The Chinese General Administration & Customs, National Bureau of Statistics

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Global Oil Supply

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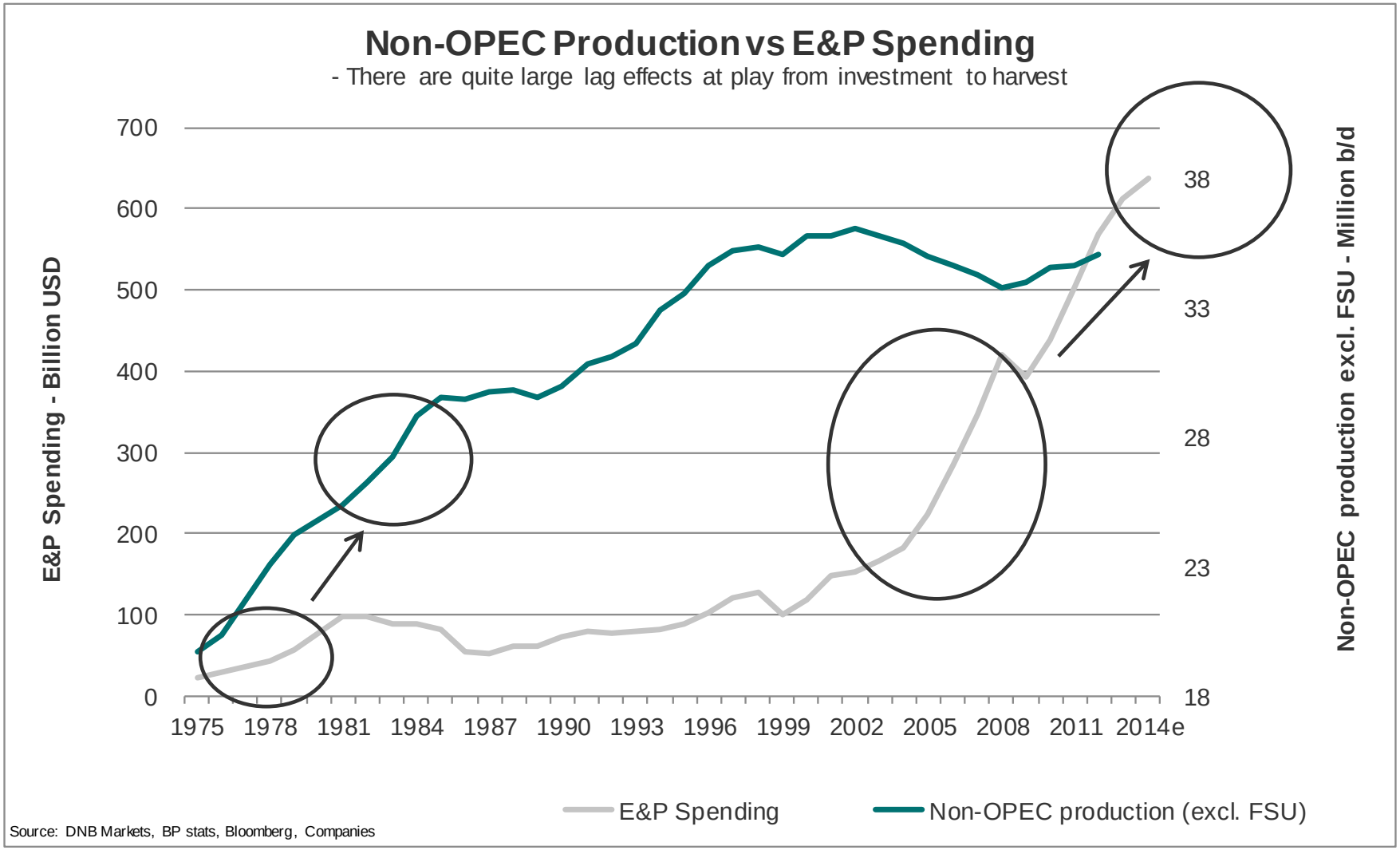
Flattish E&P CAPEX Does Not Equal No Production Growth

- The lag effects are quite large – The increased investments in the late 70s caused increased growth in output 5 years later



Source: DNB Markets, BP stats, Bloomberg, Companies

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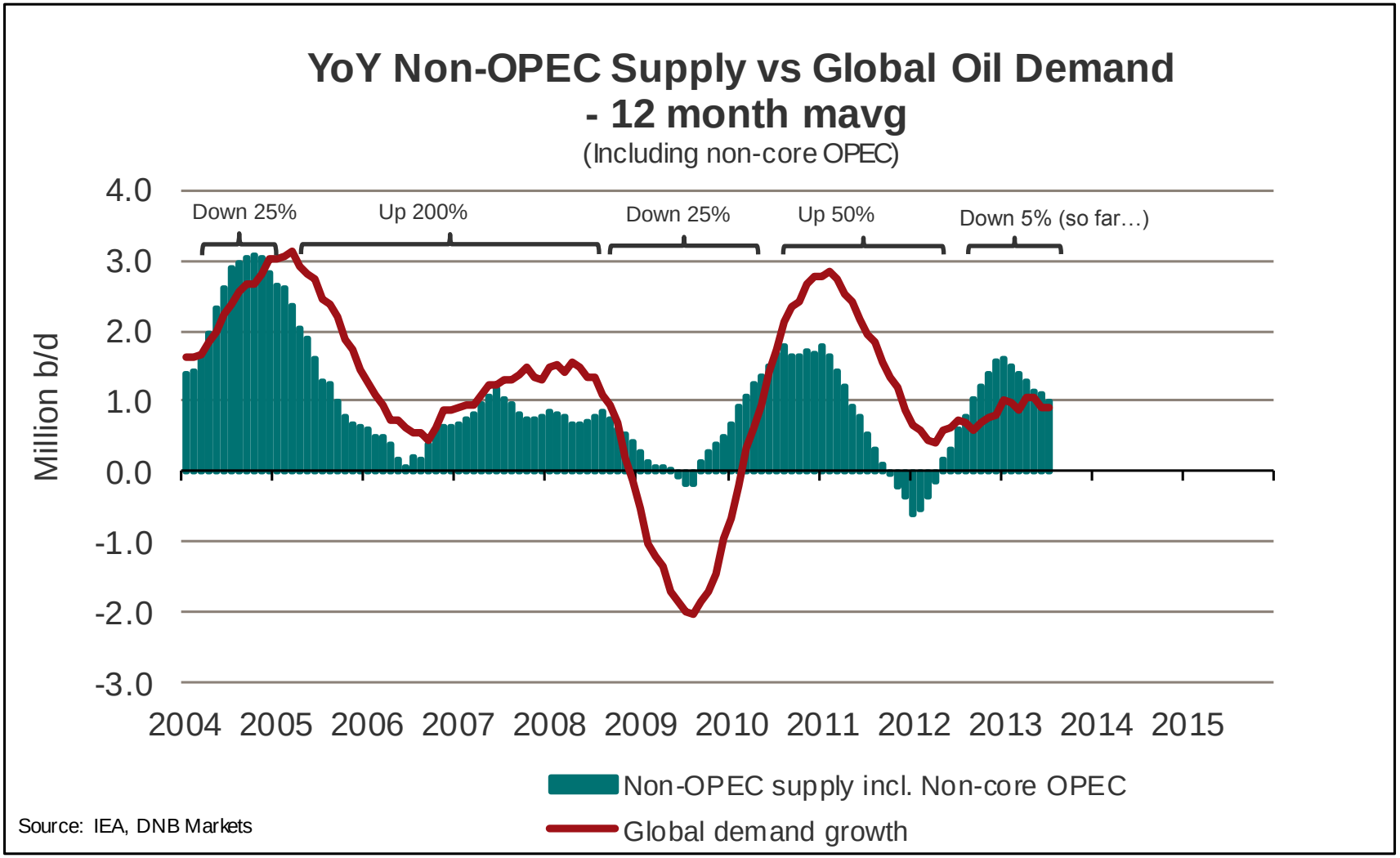
Non-OPEC Growth Outpacing Global Oil Demand Growth

- If we include the non-core OPEC countries into non-OPEC, then non-OPEC supply growth is outpacing global demand growth



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OPEC's Exports Capacity No Lower In 2015 Than In 2008?

- OPEC's domestic demand looks to grow slower than capacity additions in the 2008-2015 time frame

OPEC Crude Production Capacity		OPEC (incl. Iraq)
Max OPEC crude oil output (June-2008 output in kbd)		**32,456**
of which OPEC Middle East		22,132
of which OPEC Non-Middle East		10,324
2008-2015 field decline Middle East (IEA WEO 2008 post-peak)	2.6 %	**-3,727**
2008-2015 field decline Non-Middle East (IEA WEO 2008 post-peak)	5.2 %	**-2,191**
Startup new <u>crude</u> projects 2008-2015 (peak output):		
Algeria:		200
Angola:		1,405
Equador:		30
Iran:		995
Iraq:		1,715
Libya:		80
Kuwait:		240
Nigeria:		685
Qatar:		220
Saudi:		3,180
Venezuela:		470
UAE:		625
Added spare capacity from June 2008 (see note below)*:		1,390
Sum new projects:		**11,235**
Provision for project slippage (30%)		**3,371**
Assumed new capacity additions (2008-2015):		**7,865**
OPEC capacity 2015 (capacity summer 2008 less field decline 2008-2015 plus additions to capacity 2008-2015):		**34,403**
OPEC domestic demand in 2008		7,600
OPEC domestic demand in 2013		8,873
Yearly demand increase in %		3.2%
Assumed OPEC demand in 2015		9,440
Increase in demand 2008-2015:		1,840
Increase in capacity 2008-2015:		1,947
Capacity increase outpacing domestic OPEC demand growth 2008-2015:		**107**

** This was not real spare in 2008 due to the refining bottleneck but should now be included as the bottle neck in refining will not be repeated by 2015*

Source: Wikipedia oil megaprojects, IEA, DNB Markets

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The Shale Oil Revolution

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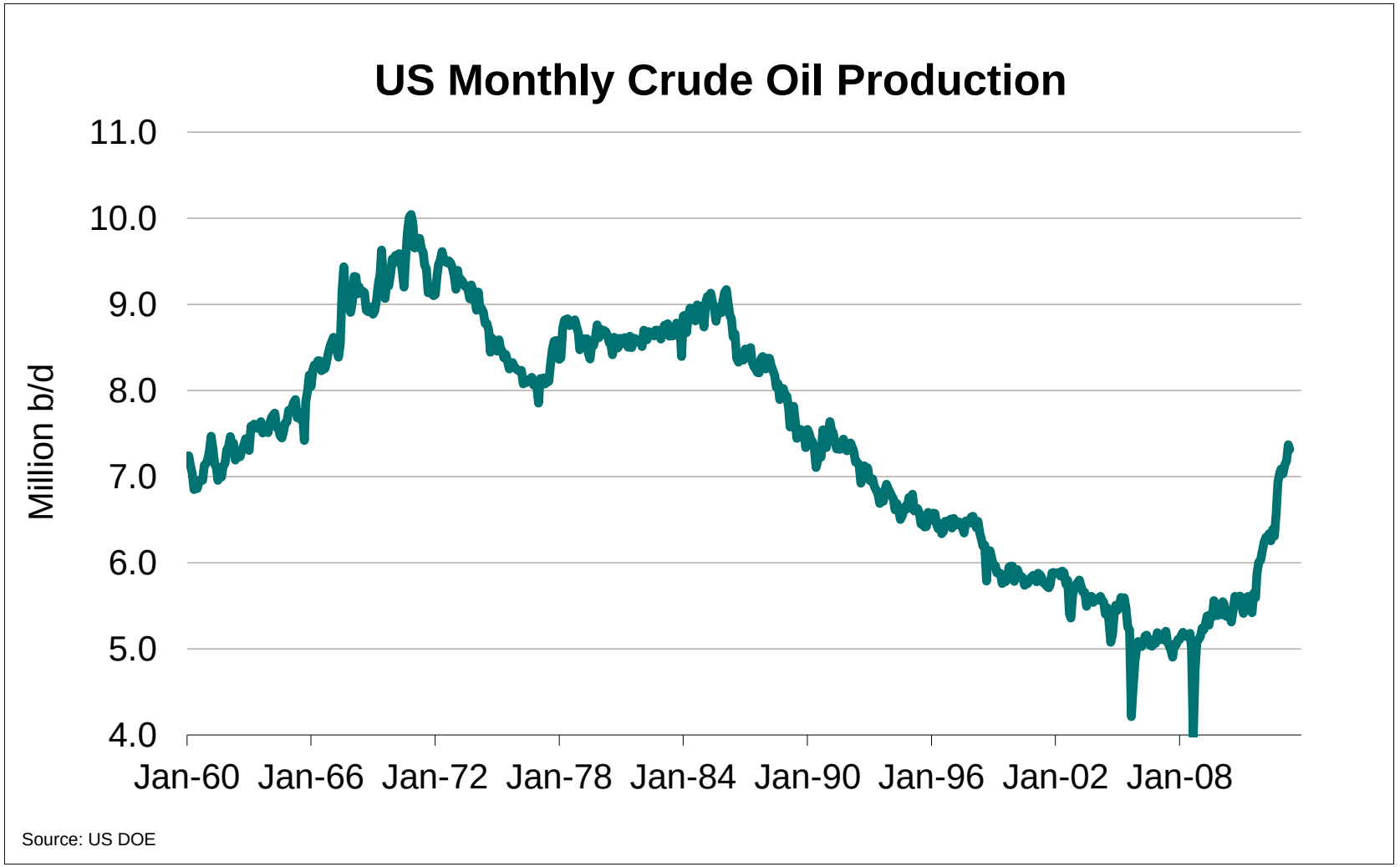
US Crude Production Back On The Rise – The Shale Revolution

- After more than 20 years of steep production decline, US production is rising again



Source: US DOE

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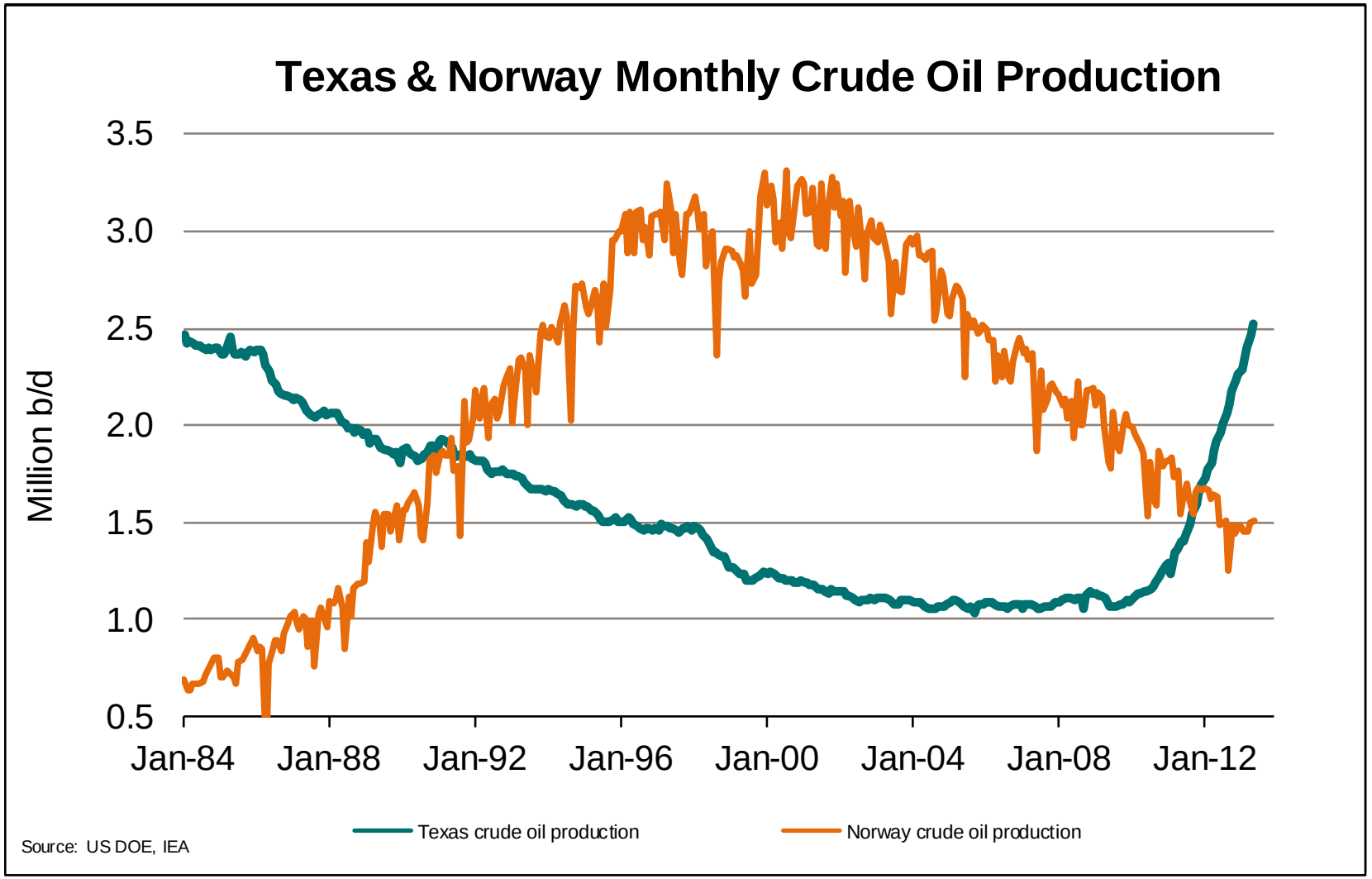
How Large Is This Change In US Crude Output Really?

- Last year Texas was still below Norwegian crude oil production – Not anymore…



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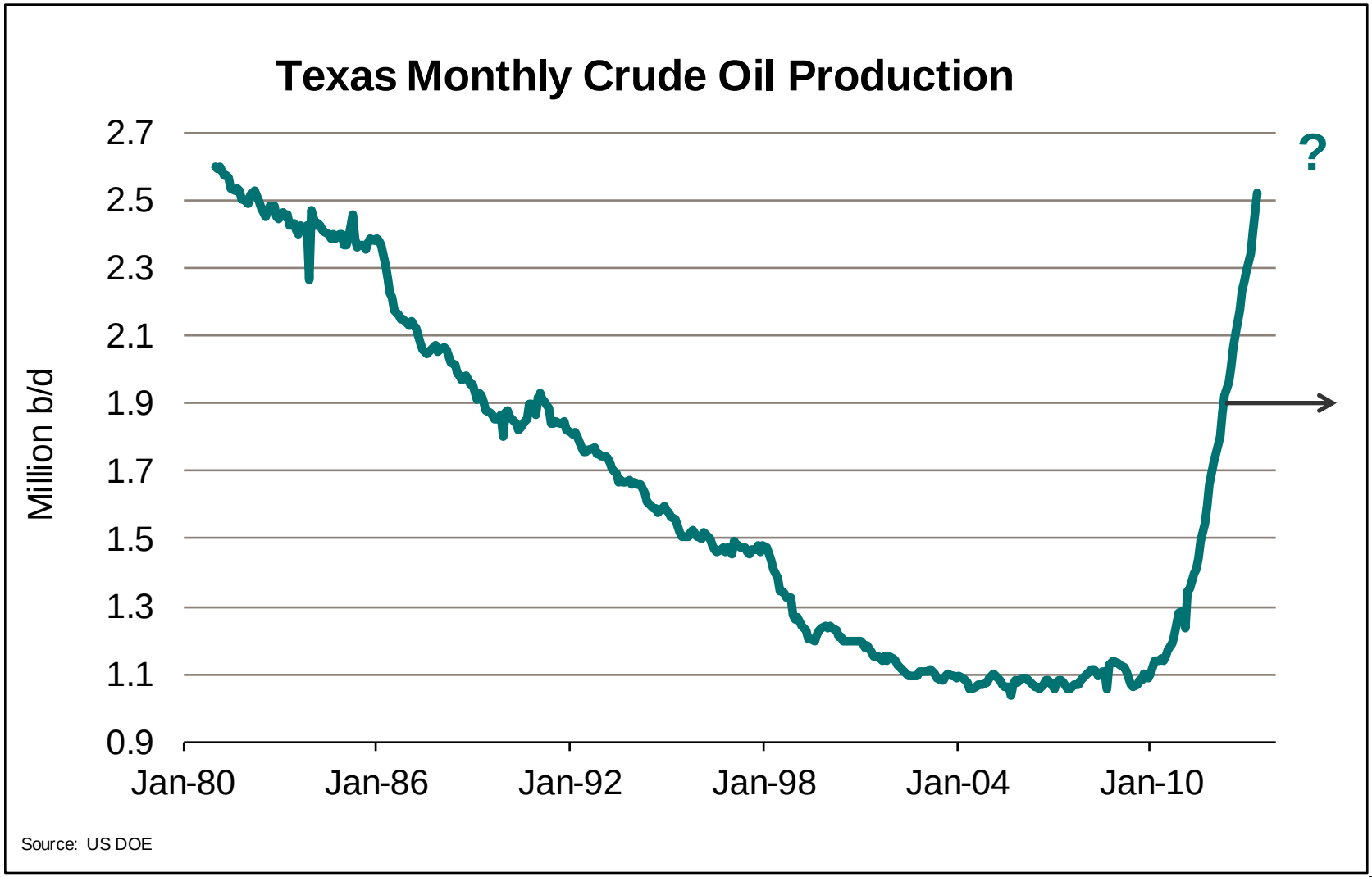
The Texas Crude Output Graph Is Almost Bending Backwards…

- One year ago Texas production had reached 1.9 mbd and we asked ourselves; is it plausible to believe that crude output would suddenly stop at that level an flatten out? Our conclusion was; no it's not… Now the latest reported level is 2.5 million b/d



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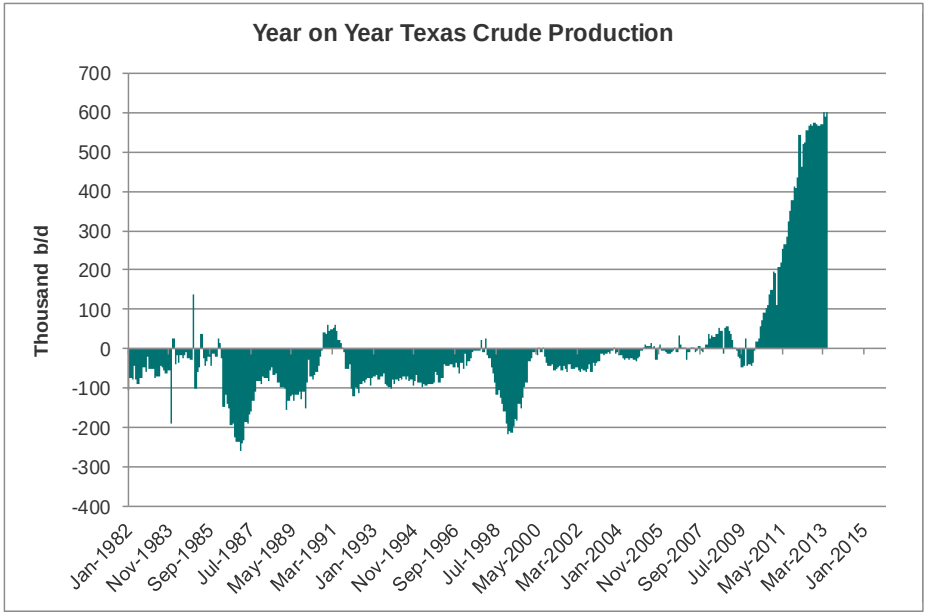
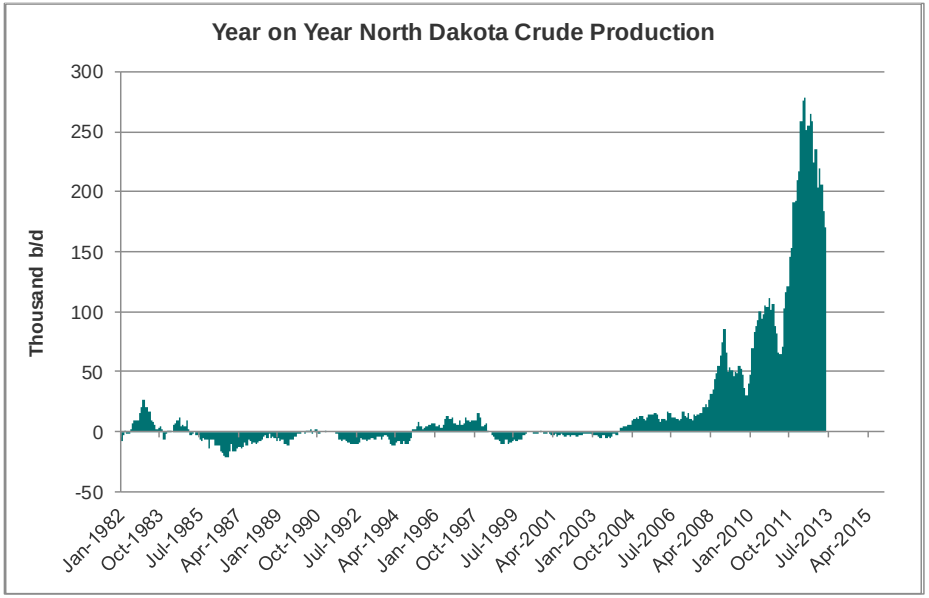
Texas & North Dakota Is Where It Has Mainly Happened So Far

- Growth in North Dakota started in 2008 while Texas was two years later in the cycle





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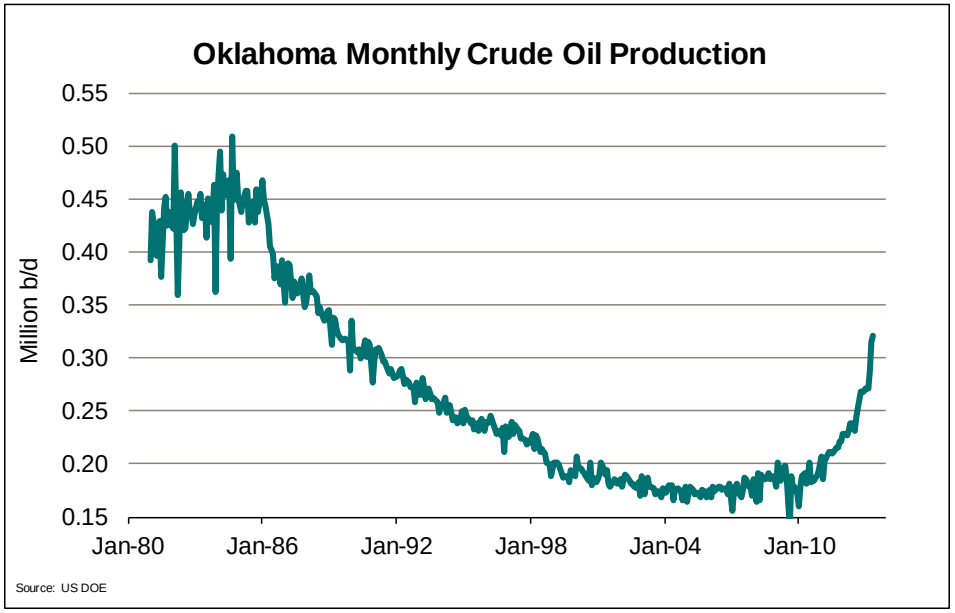
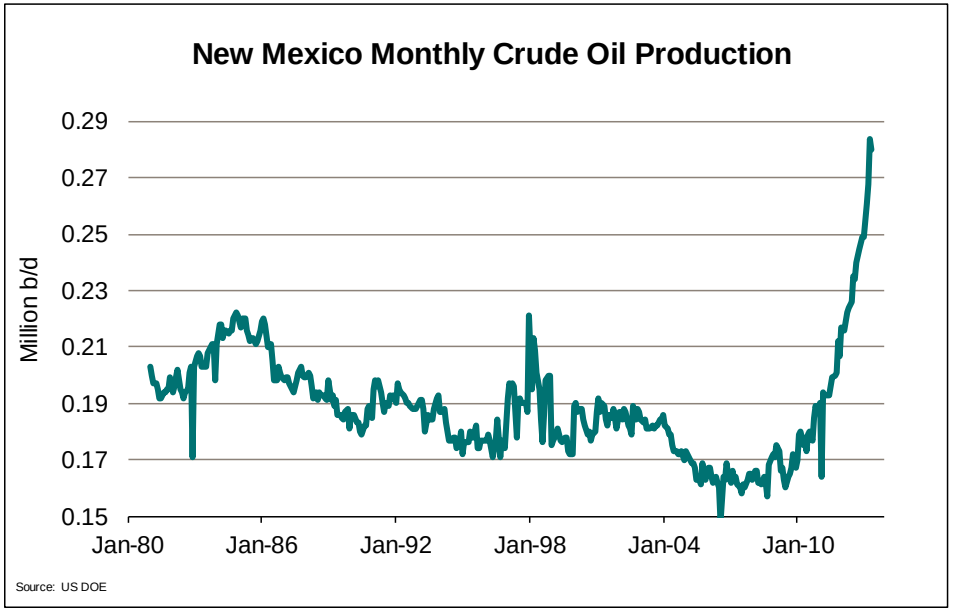
Crude Production Now On The Rise In Other States As Well

- Growth is starting to become visible also in Oklahoma and New Mexico





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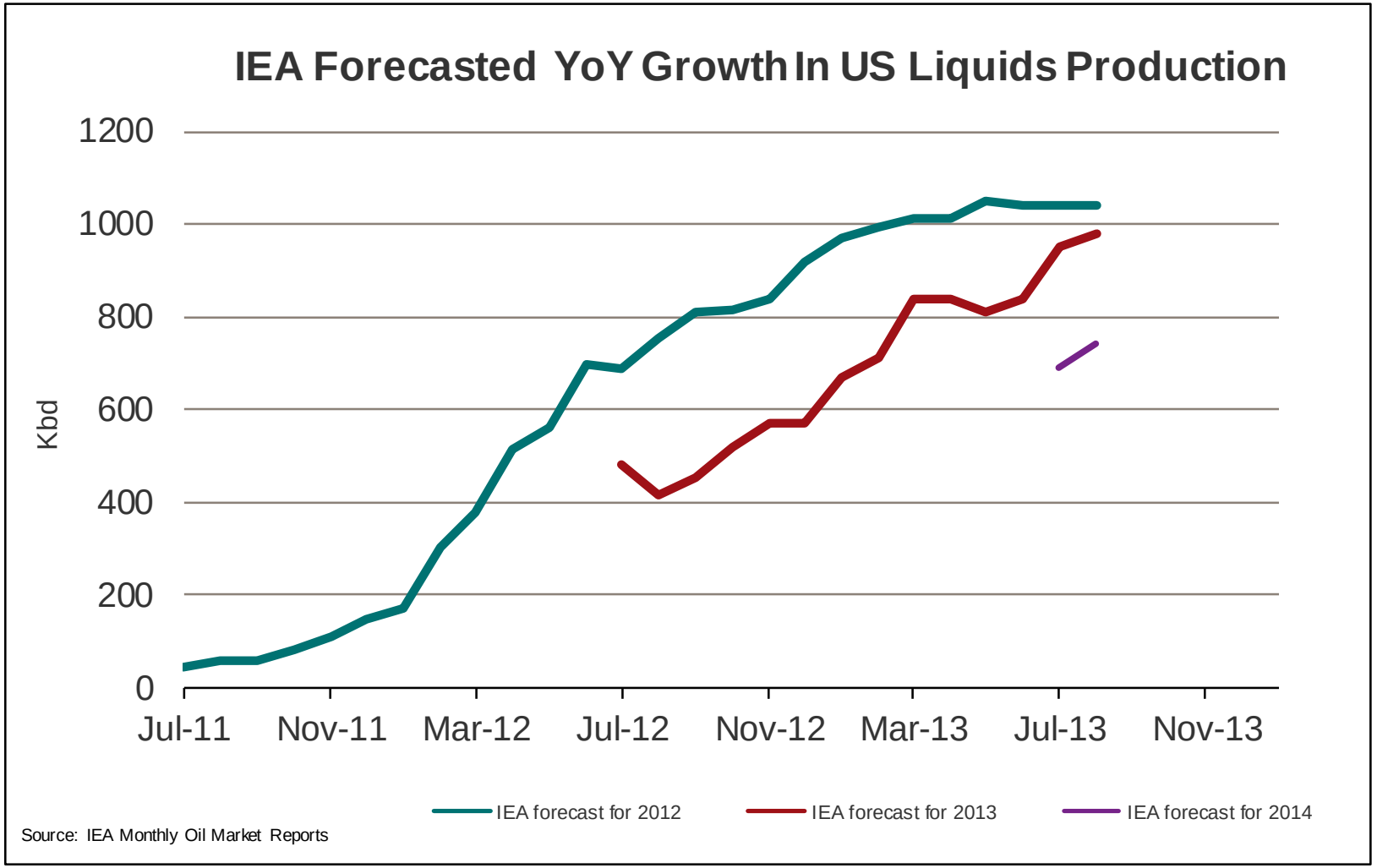
IEA's Forecasts For US Production Growth Were Far Too Low

- IEA's first take on 2012 US production growth was at 45 kbd - now 2012 growth is estimated to have been 1.04 million b/d



Source: IEA Monthly Oil Market Reports

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IEA's Assessment Of Shale From WEO 2008

- Shale oil/oil shale not expected to make a significant contribution to world supply before 2030

•What did the IEA say about shale oil and oil shales in WEO 2008 under the discussion of unconventional resources?

•Page 217: *Oil shales are rocks that contain a large portion of solid organic compunds (kerogen) and are found at shallow depths, from surface outcrops to 1000 metres below ground. The United States has the largest resources* (note the IEA is here talking about kerogen), *followed by Brazil, Jordan, Morocco and Russia.* ***Oil shales are not projected to make a significant contribution to world oil supply before 2030****…Production costs currently range from 50-120 $/b.* (The above is all about Kerogen and not shale oil/light tight oil)

•Then a little bit about shale oil/light tight oil: *Deeper resources require the use of techniques to enhance the productivity of the formation (such as hydraulic fracturing).* ***The main US resource is the Green River Formation (Wyoming, Colorado and Utah)*** *with four basins. Early experiments in the 1980's were halted due to the unfavorable economics and poor operational performance.*

•Note: Texas and North Dakota was not discussed at all under the chapter "Non-conventional oil resources" starting at page 215. The key focus was on Extra-heavy oil and oil sands. Since 2008 we have now seen US crude output increase (mainly from shale crude) by 2.2 million b/d (one would think that should classify as significant…)

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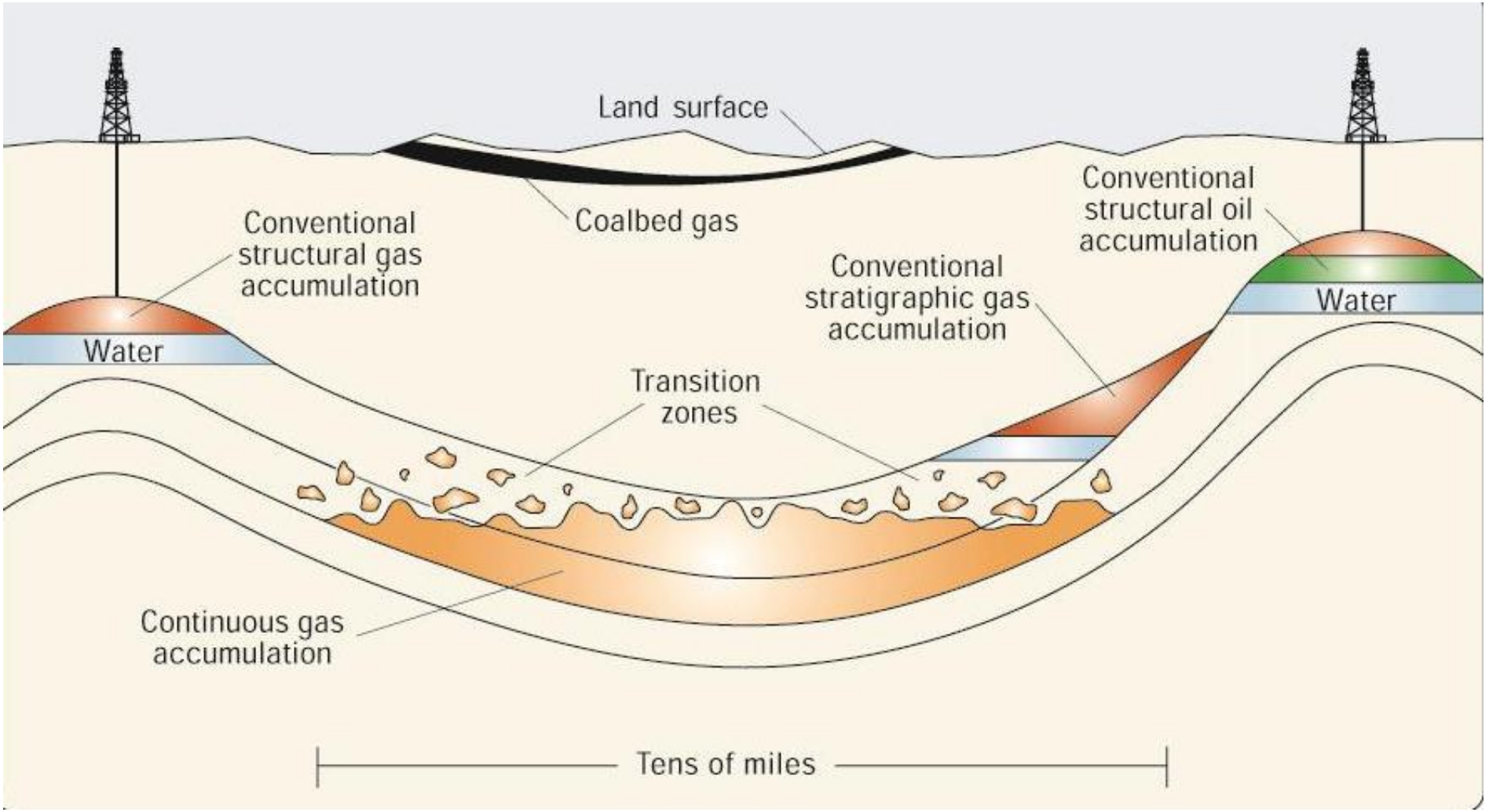
Conventional vs Unconventional

- Moving to the “kitchen” instead of the “living room” (Source: USGS)



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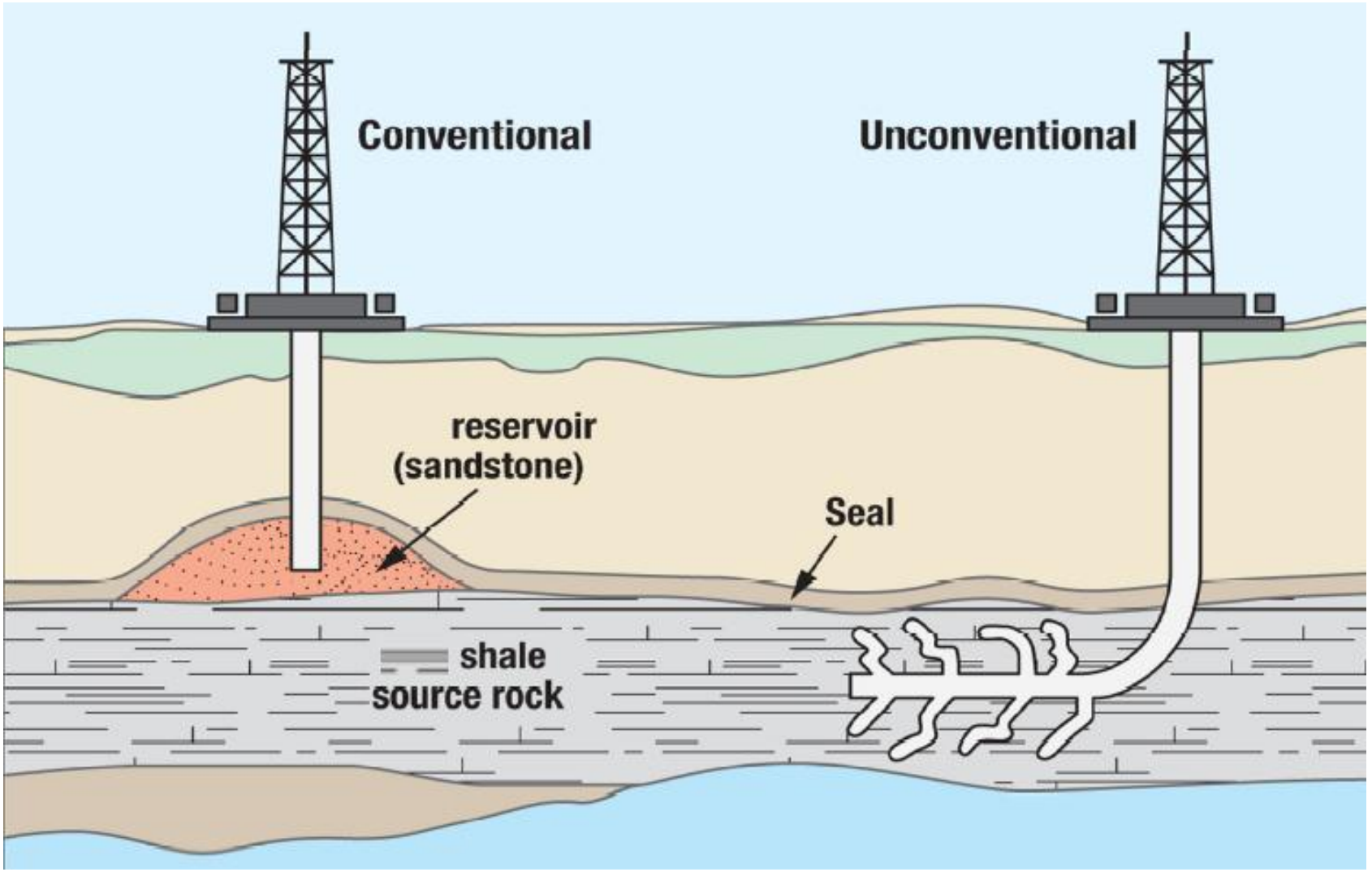
Technology Has Unlocked Gas & Oil In Shale Source Rock



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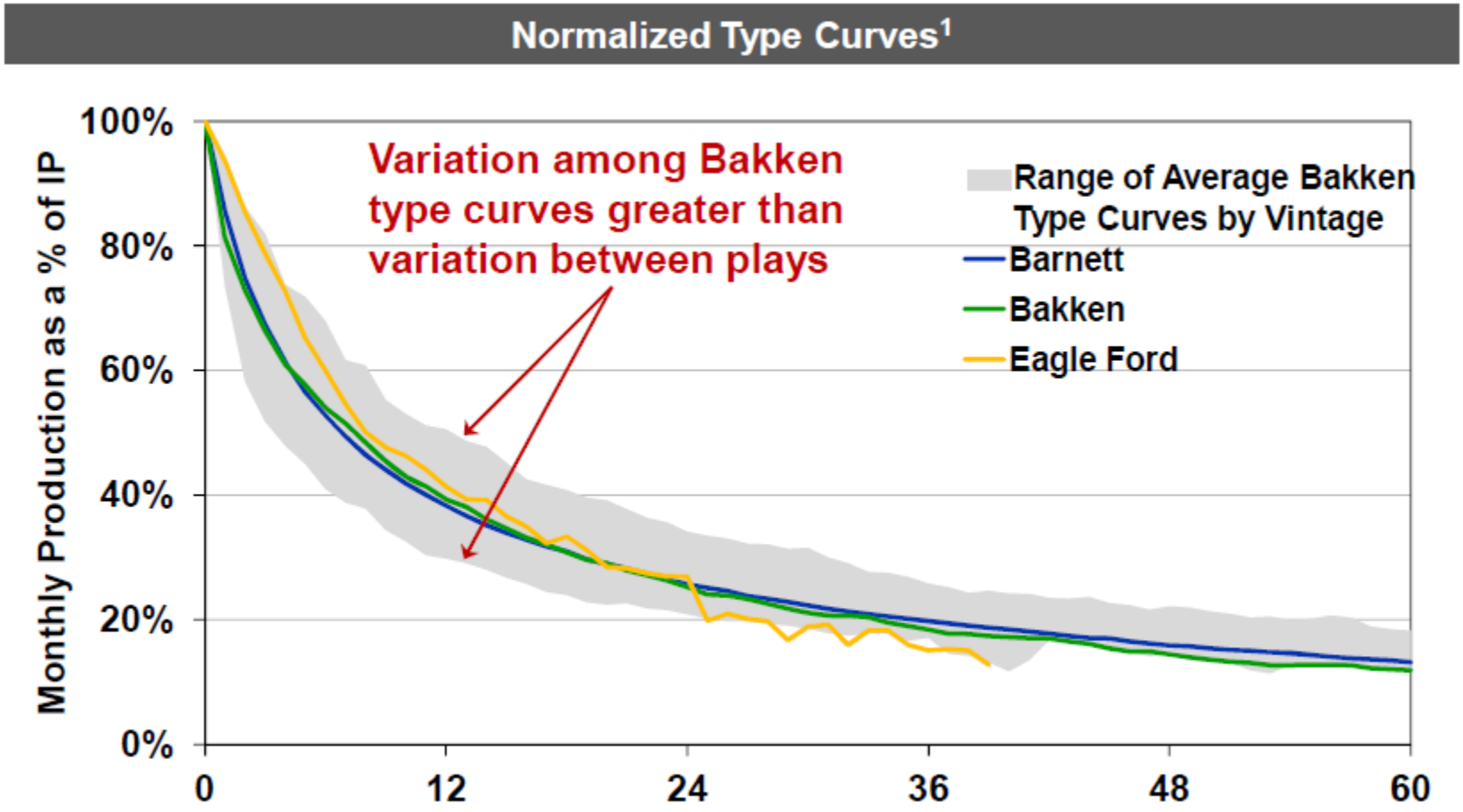
Type Curve Have Similar Shapes Across Plays

- Source: PIRA Study – Road to US energy independence



[1]*Monthly type curve data is normalized such that the first (peak) month is 100.*

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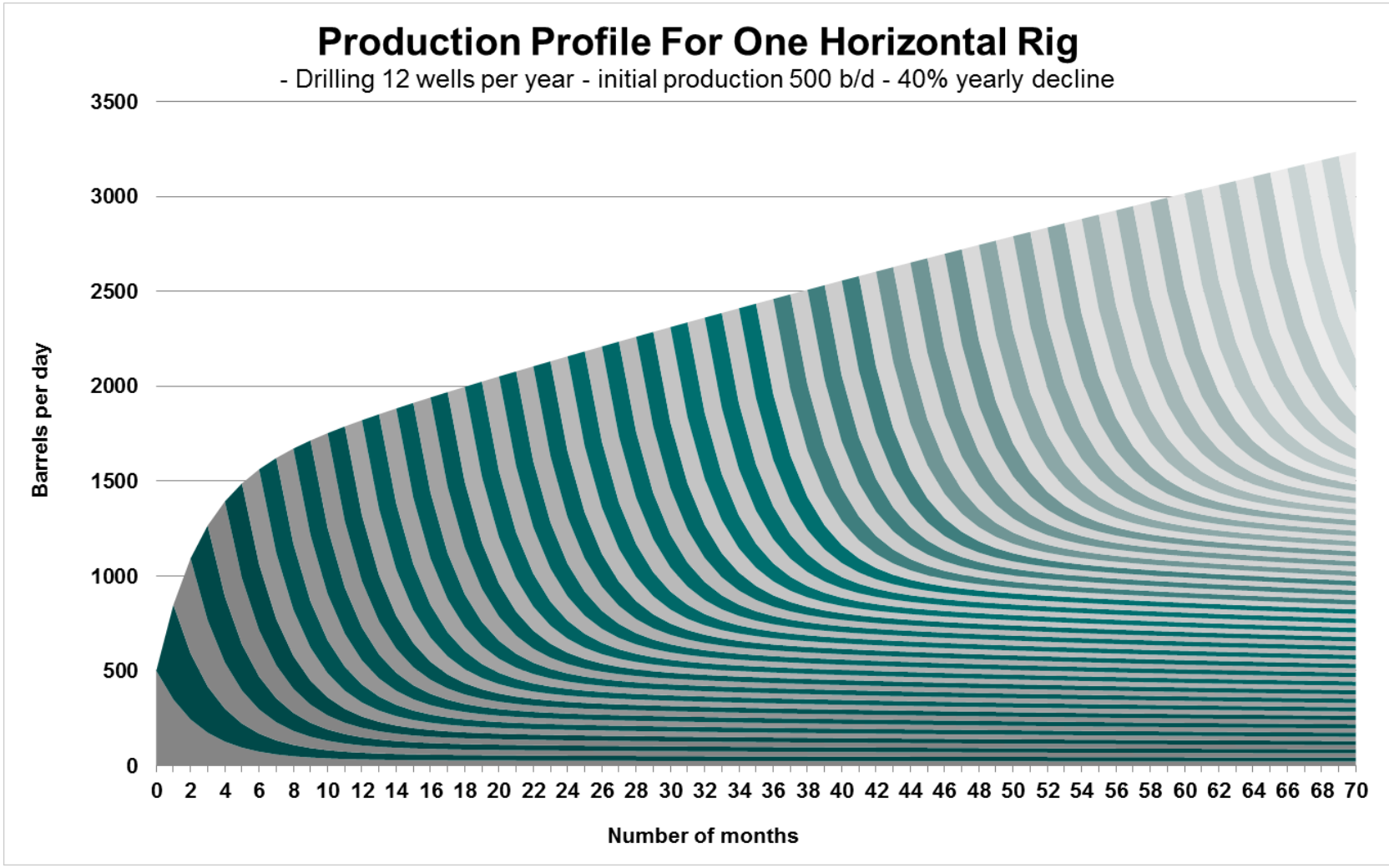
But Decline Rates Per Well Not Interesting In This Industry

- One horizontal rig will increase its contribution even if decline rates per rig is very high – this is like traditional process industry



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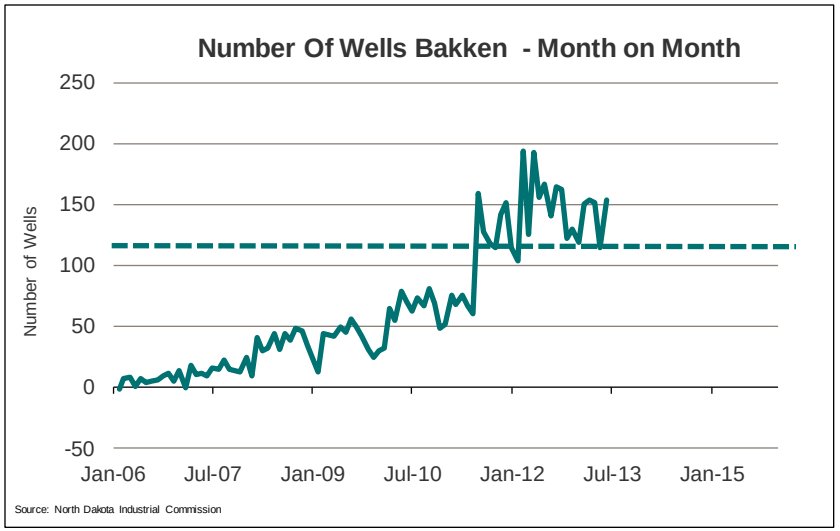
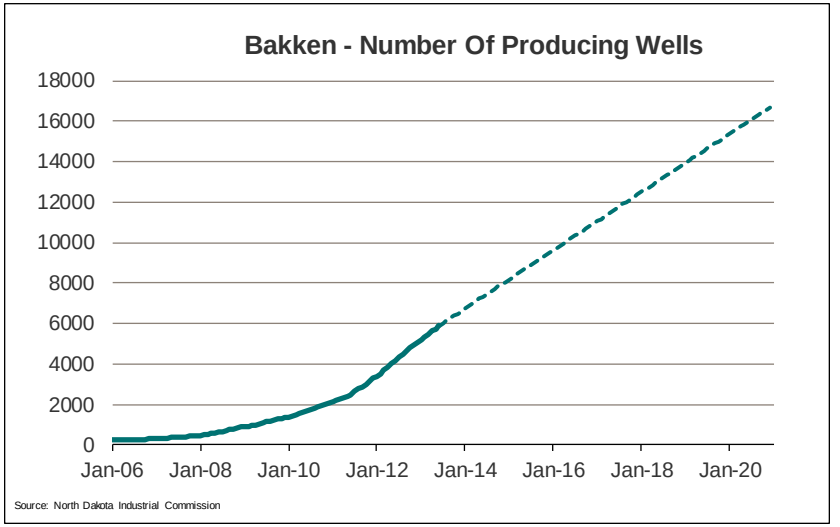
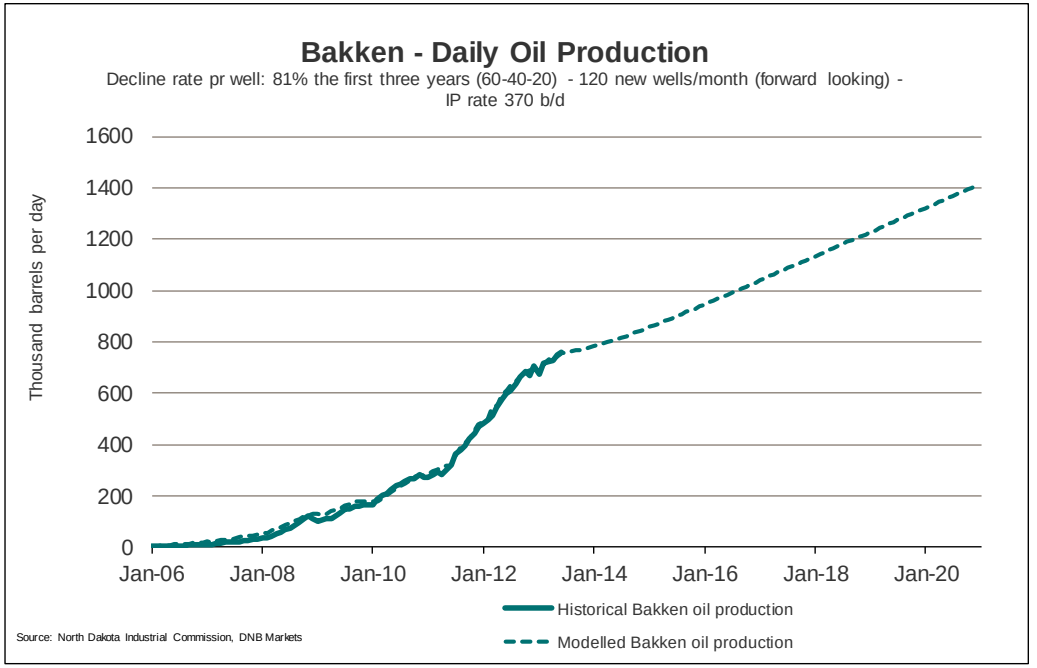
Easy To Calculate A Further 600 kbd Growth In Bakken By 2020

- Even a 20% reduction in in growth of wells (from the 2012-average) will bring on another 600 kbd in Bakken by 2020







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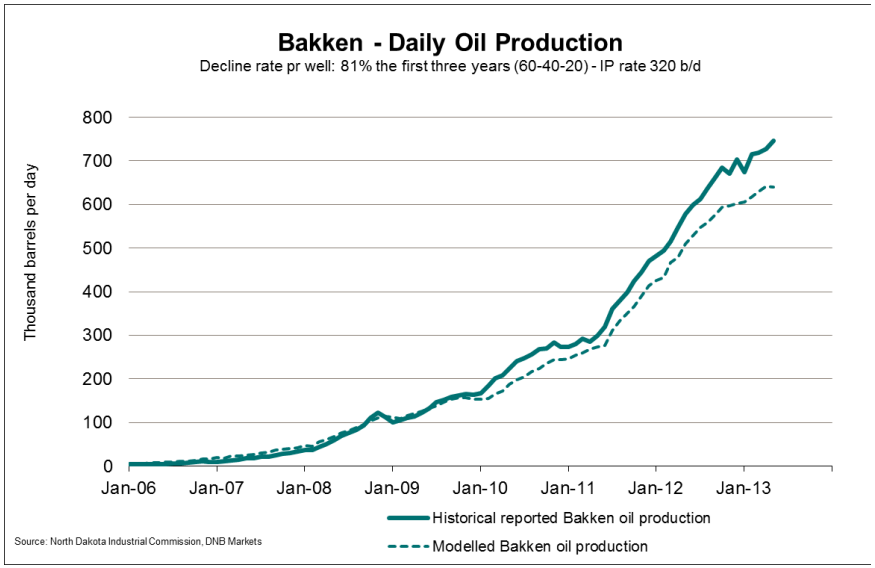
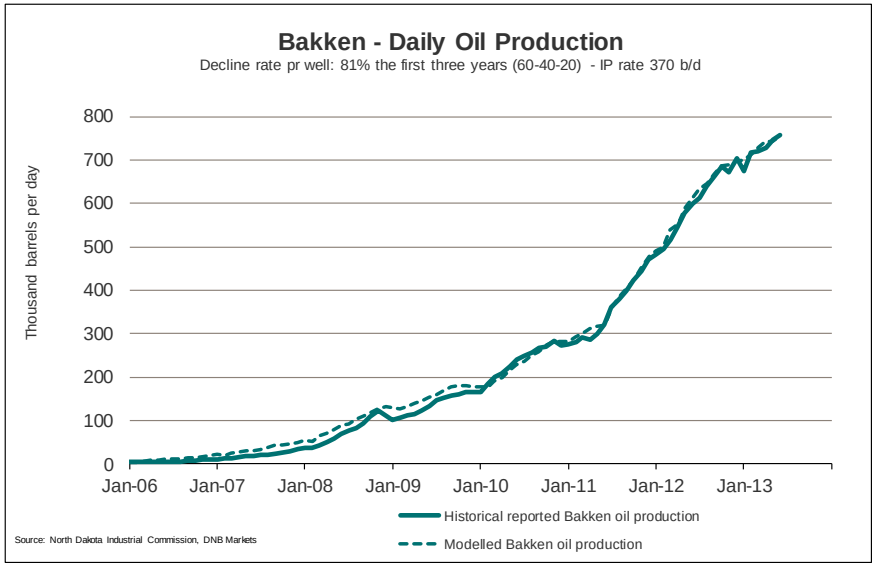
Learning Curve Is Progressing – IP Rates In Bakken Improving

- IP rates are improving so if geology is deteriorating, then technology and process improvements are more than offsetting this





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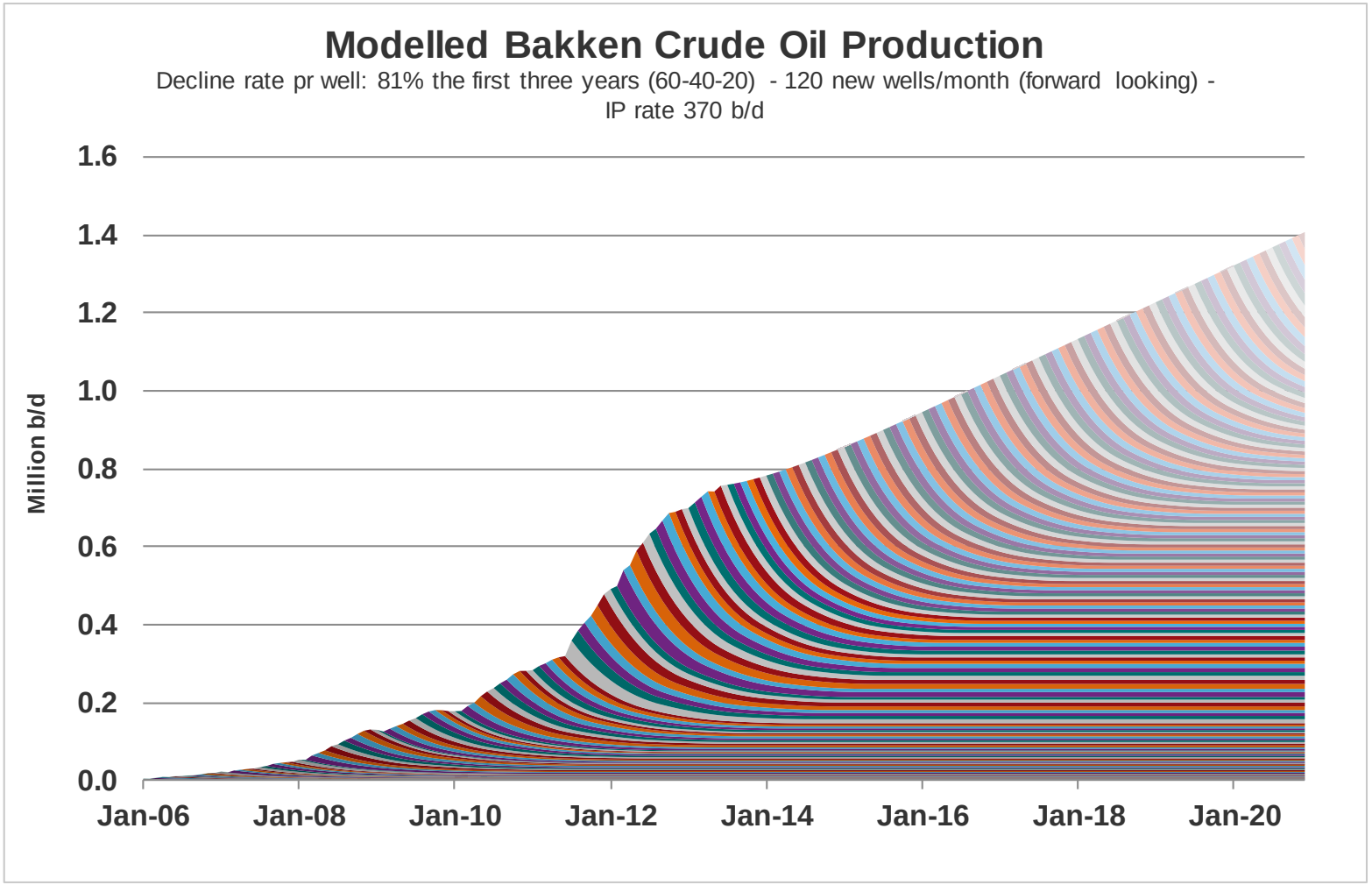
Lower Growth in 2013 Than In 2012, But Still Extremely Strong

- As long as the growth rate in the number of wells can be maintained above 120, production in the Bakken will double by 2020



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Accumulated production start up	27,834	85,924	242,064	413,744	684,584	1,132,654	1,788,294	2,365,494	2,898,294	3,431,094	3,963,894	4,496,694	5,029,494	5,562,294	6,095,094
Net production end of year	9,063	48,196	131,127	178,173	281,574	478,364	696,575	778,015	849,709	937,917	1,031,494	1,125,628	1,219,761	1,313,894	1,408,027
Accumulated decline	18,771	37,728	110,937	235,572	403,010	654,290	1,091,719	1,587,480	2,048,586	2,493,177	2,932,400	3,371,067	3,809,734	4,248,401	4,687,068
Yearly start up	27,834	58,090	156,140	171,680	270,840	448,070	655,640	577,200	532,800	532,800	532,800	532,800	532,800	532,800	532,800
Total yearly production decline	18,771	18,957	73,209	124,634	167,438	251,280	437,429	495,761	461,106	444,591	439,223	438,667	438,667	438,667	438,667
Decline vs new start up	67%	33%	47%	73%	62%	56%	67%	86%	87%	83%	82%	82%	82%	82%	82%
Yearly net production increase		39,133	82,931	47,046	103,402	196,790	218,211	81,439	71,694	88,209	93,577	94,133	94,133	94,133	94,133

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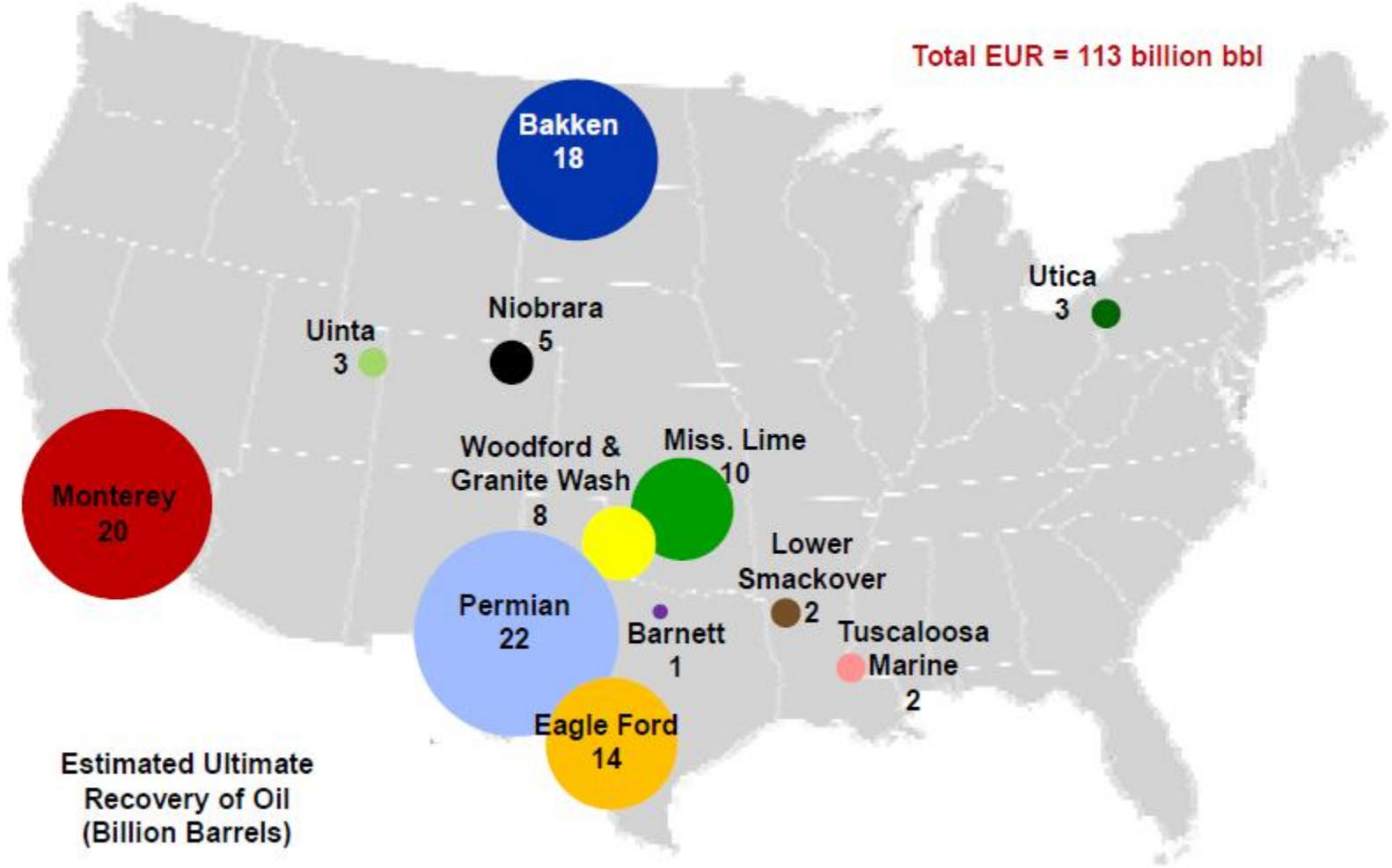
US Recoverable Shale Oil Reserves - 113 billion barrels

- Source: PIRA Study – Road to US energy independence (Since Sept the estimate is increased to about 170 billion barrels…)



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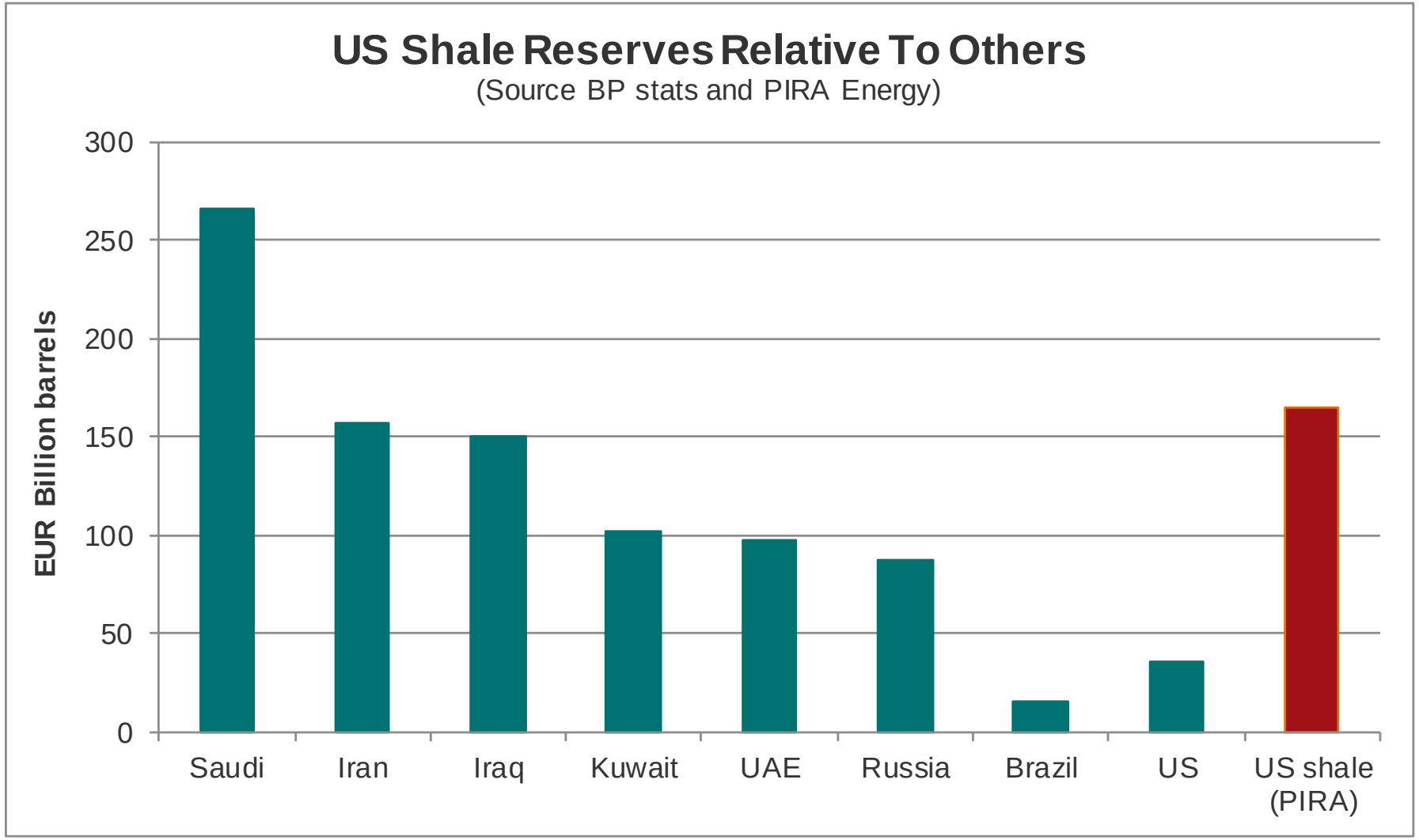
US Shale Resources vs Other Resources

- US shale resources larger than conventional reserves in Iran/Iraq/Kuwait/UAE/Russia according to PIRA Energy



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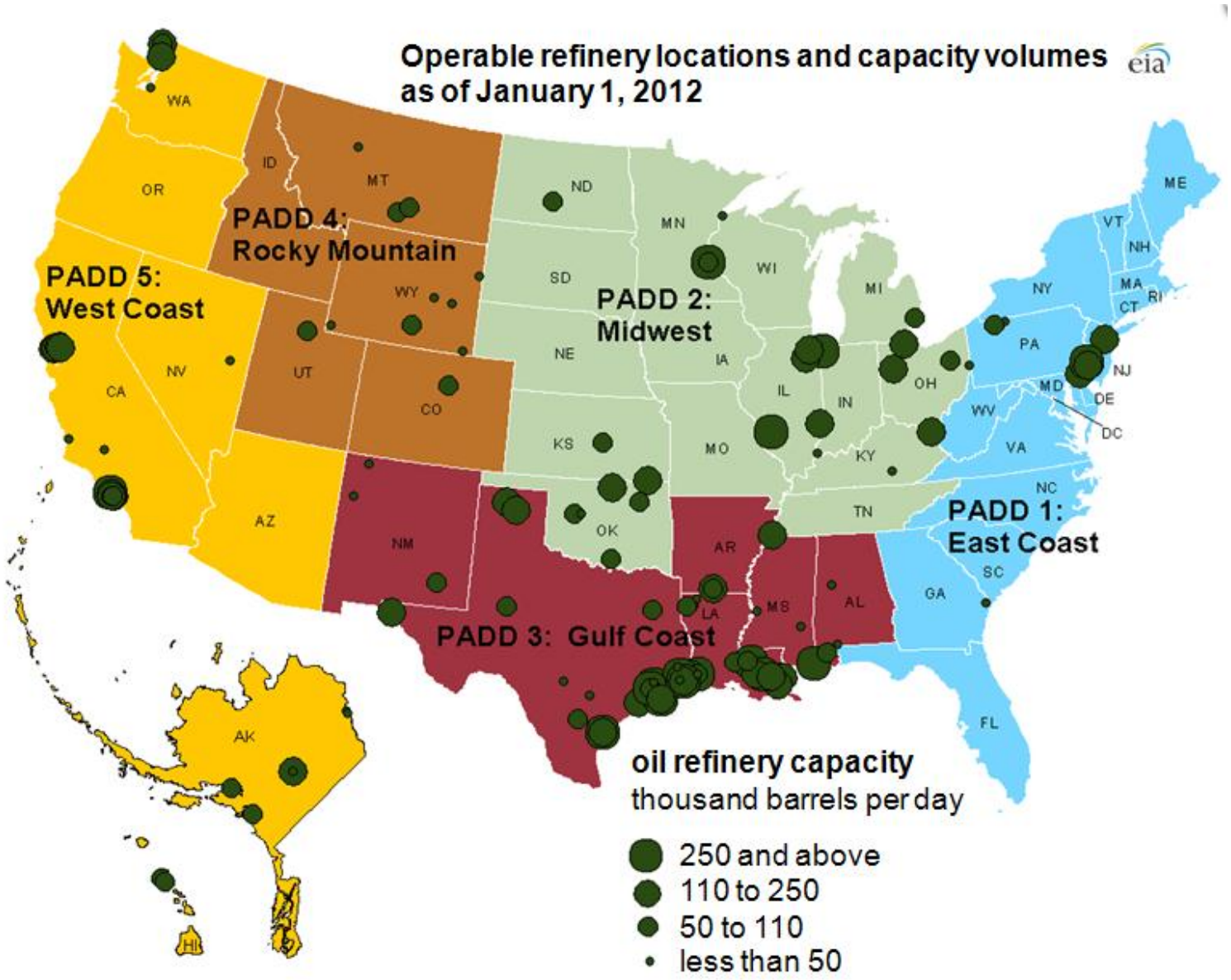
US Oil Refineries – Centered On The Gulf Coast



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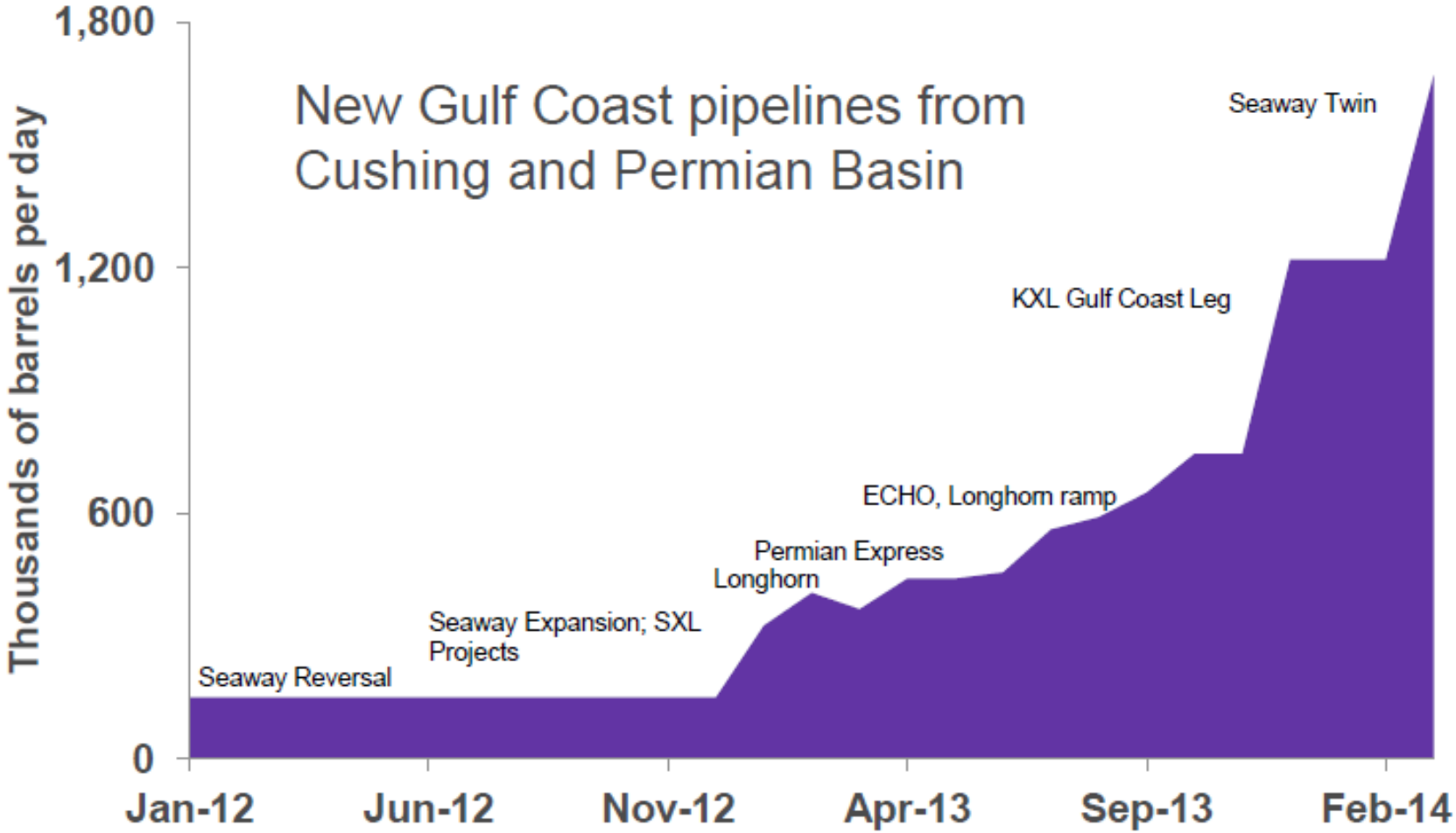
Pipeline Capacity Expanding Rapidly

- This makes cheaper and more crude oil available to US GOM refiners – Then they need less crude imports



Source: Thomson Reuters

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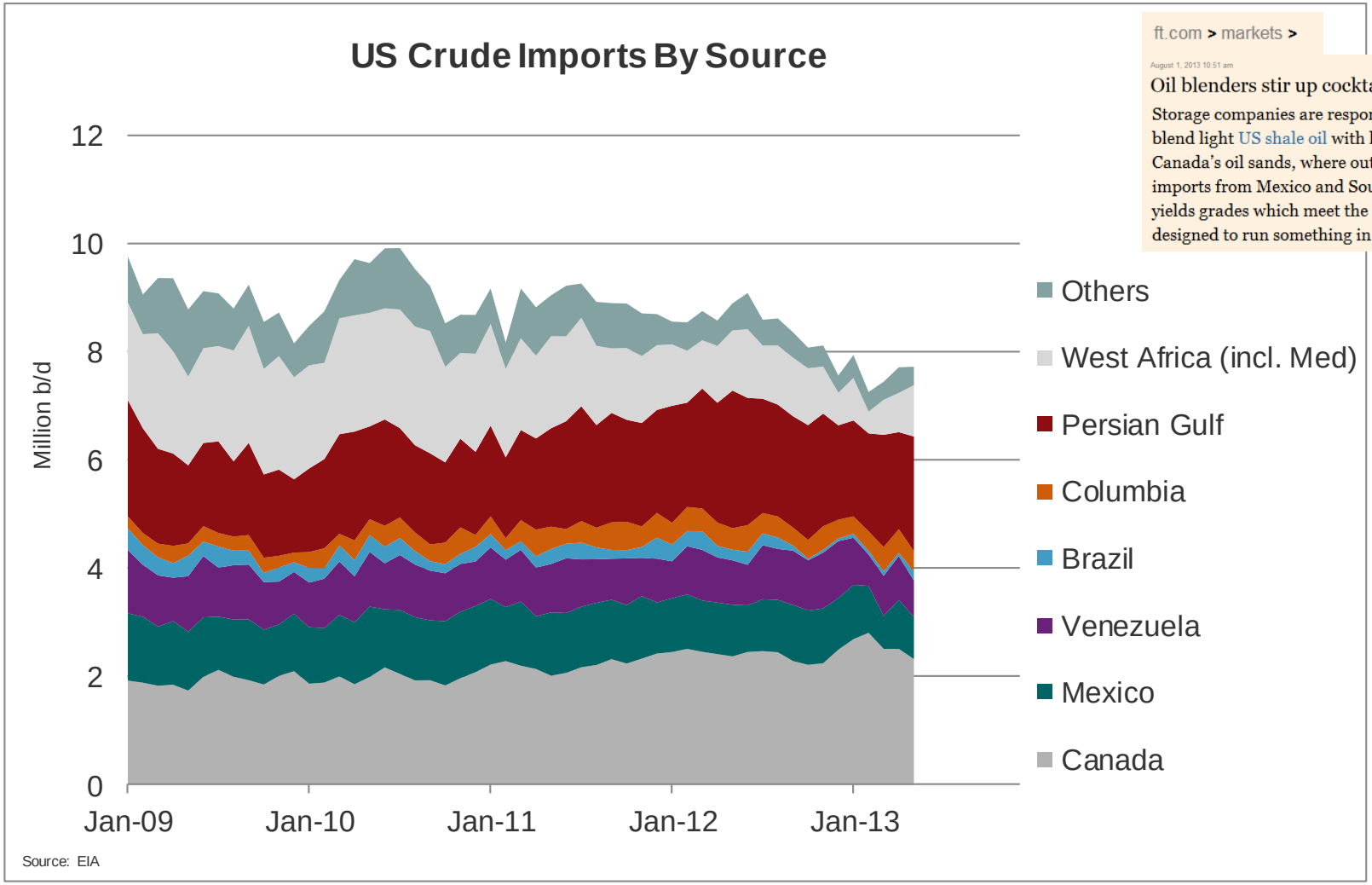
US Will Push Away Imports From PG & West Africa

- The top half of the sources below will disappear first from US crude imports. Canada set to continue to grow, others to drop.



ft.com > markets >

August 1, 2013 10:51 am

Oil blenders stir up cocktail to meet US demand

Storage companies are responding with tanks that can blend light US shale oil with heavier crude from Canada's oil sands, where output is also rising, and imports from Mexico and South America. The process yields grades which meet the needs of refineries designed to run something in between.

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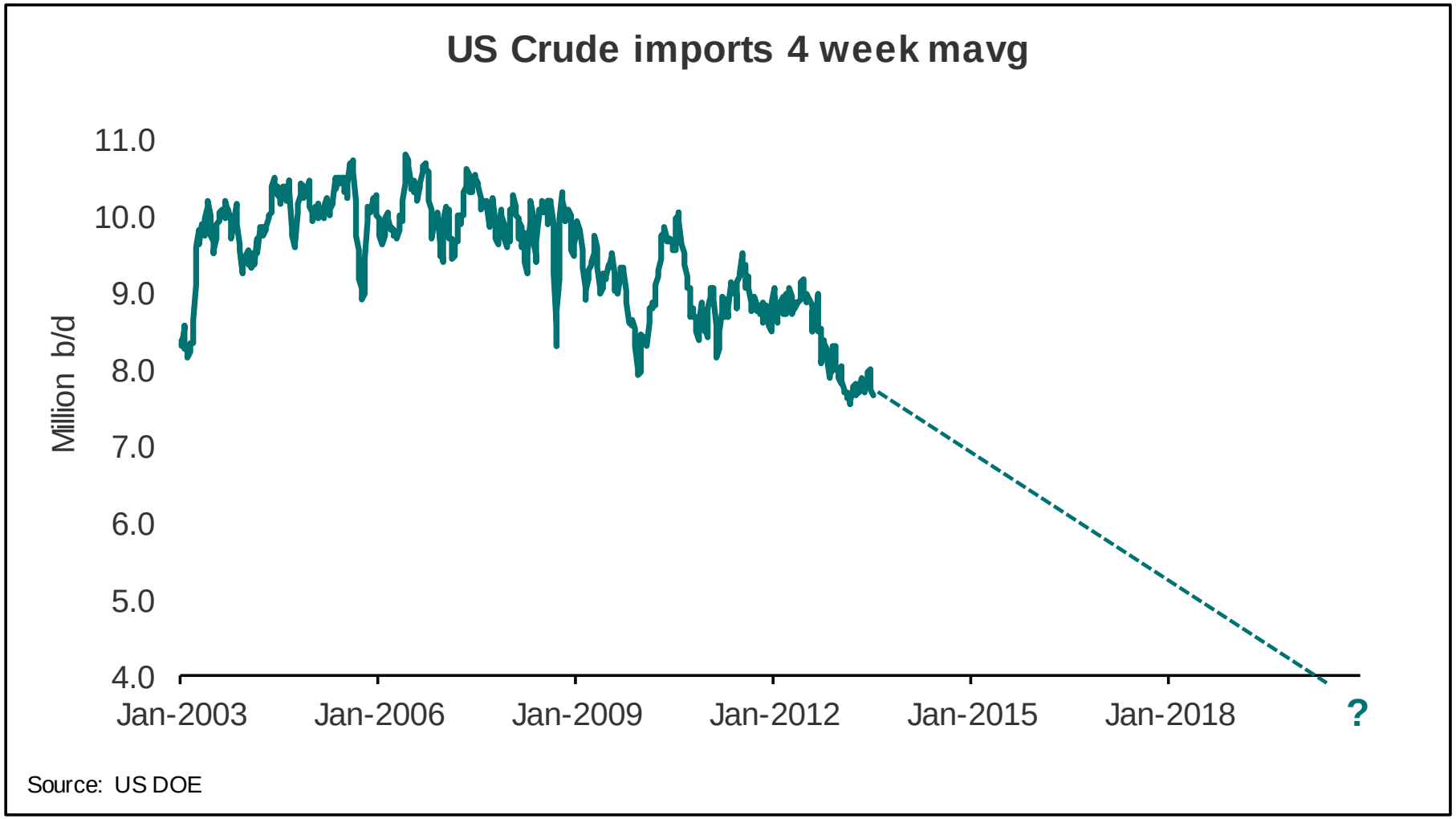
We Are Starting To See The Effect On US Crude Imports Now

- US crude imports has started to drop but this is just the beginning



Source: US DOE

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Cheaper Oil But Not Cheap

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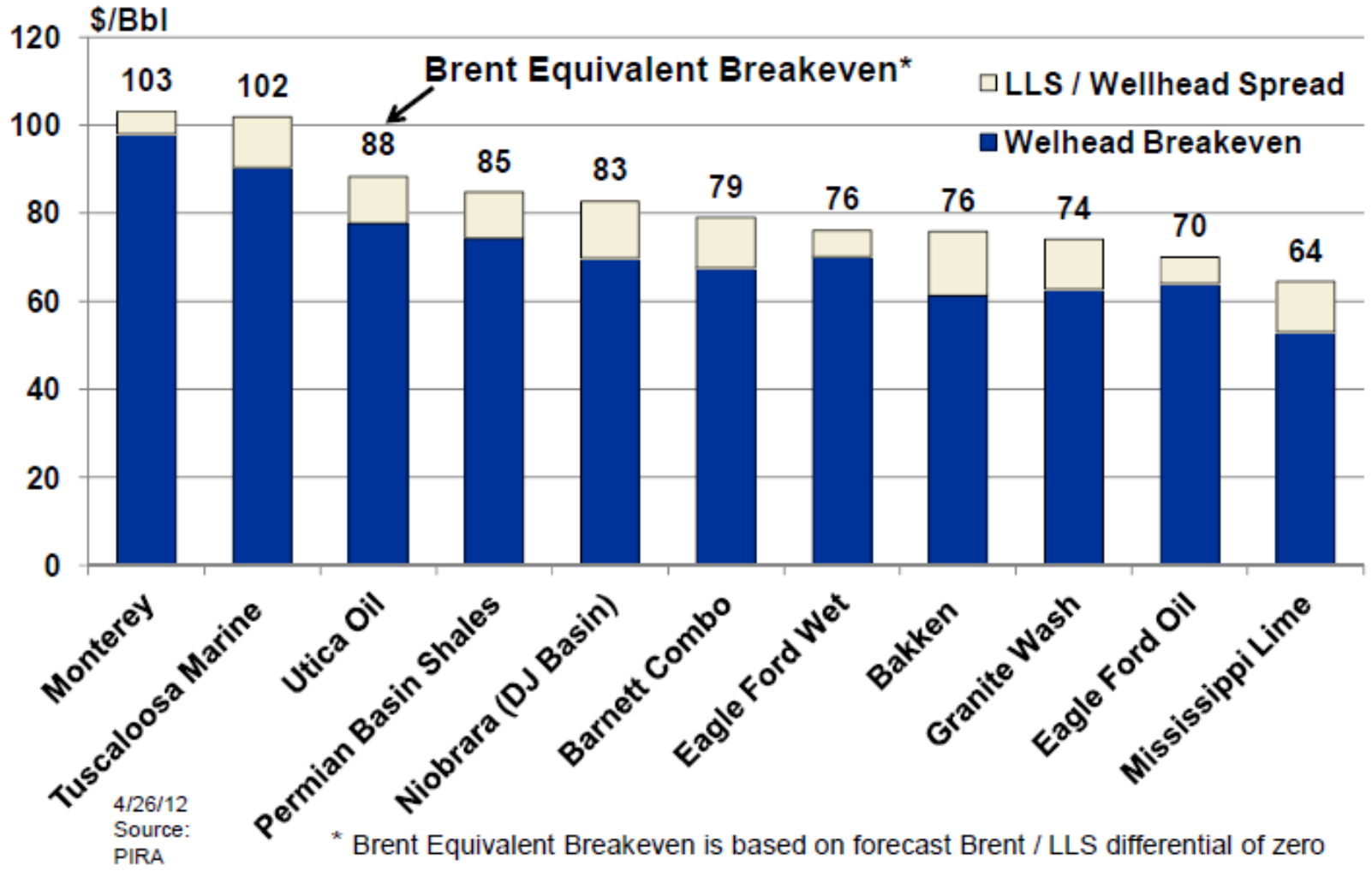
The New Shale Resources Are Not Particularly Cheap

- Brent needs to stay in the 75-90 $/b range or higher to make the broad shale industry economical



Source: PIRA Energy

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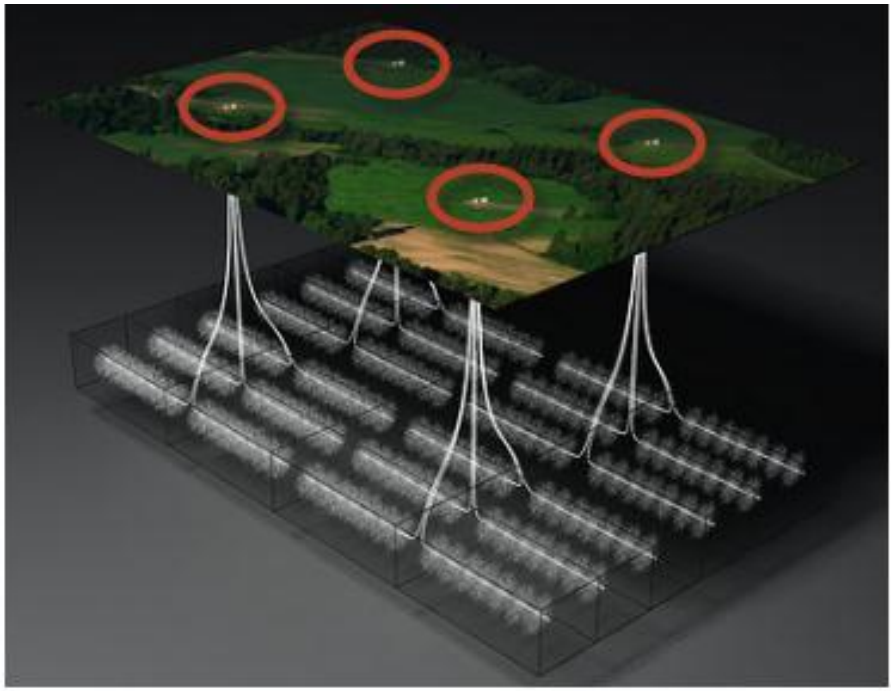
Example Of Better Efficiency – Pad Drilling

- 5 to 10 wells drilled per pad – Drills moved with “hydraulic walking”
- Eagle Ford average to drill one well down to 19 days in 2012 vs 23 days in 2011
- New procedure is pad-to-pad moves (reduces the cost of rigging up and down)



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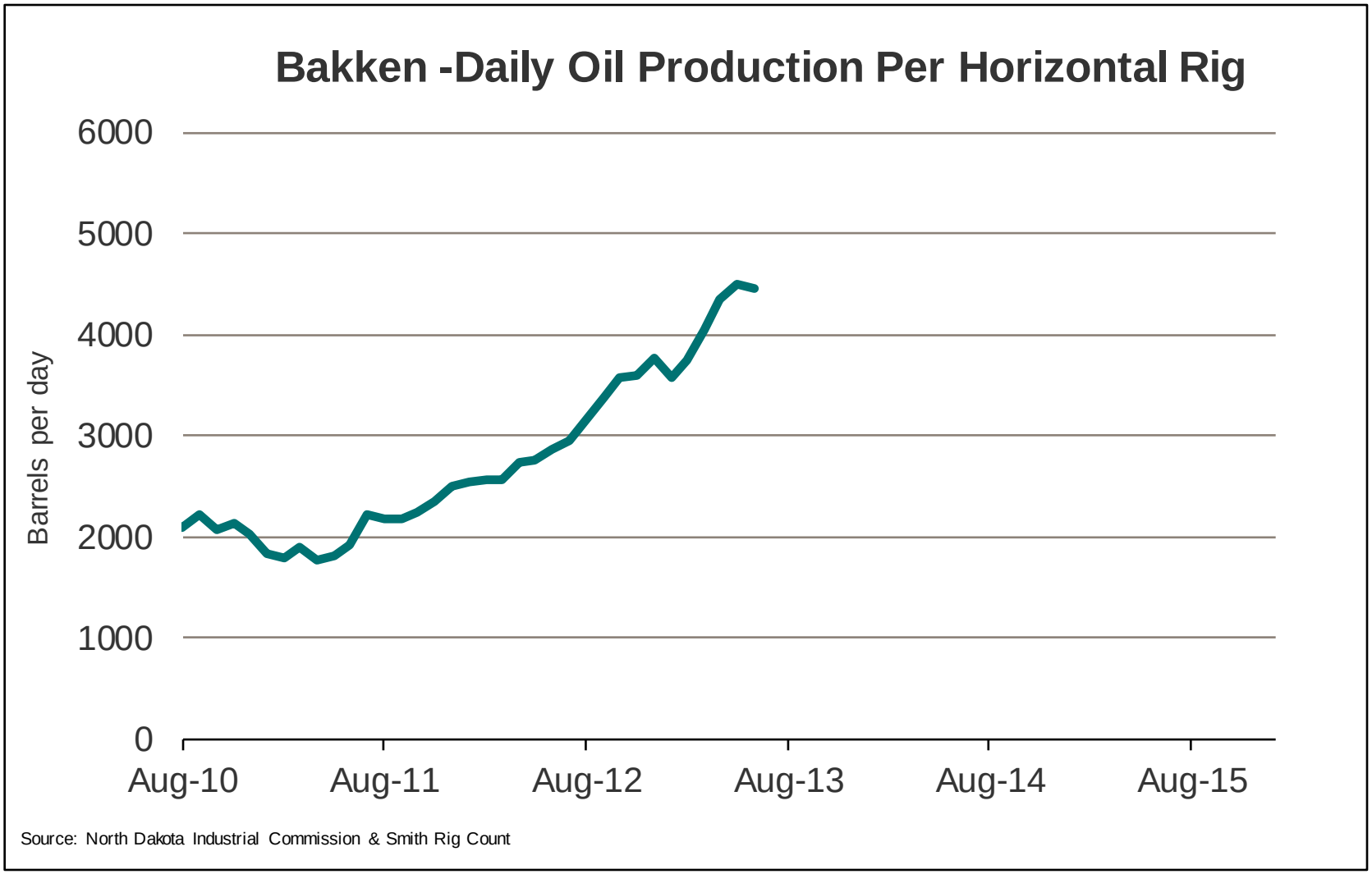
Learning Curve Still Ongoing In The Shale Plays

- Production **per rig** is exploding to the upside



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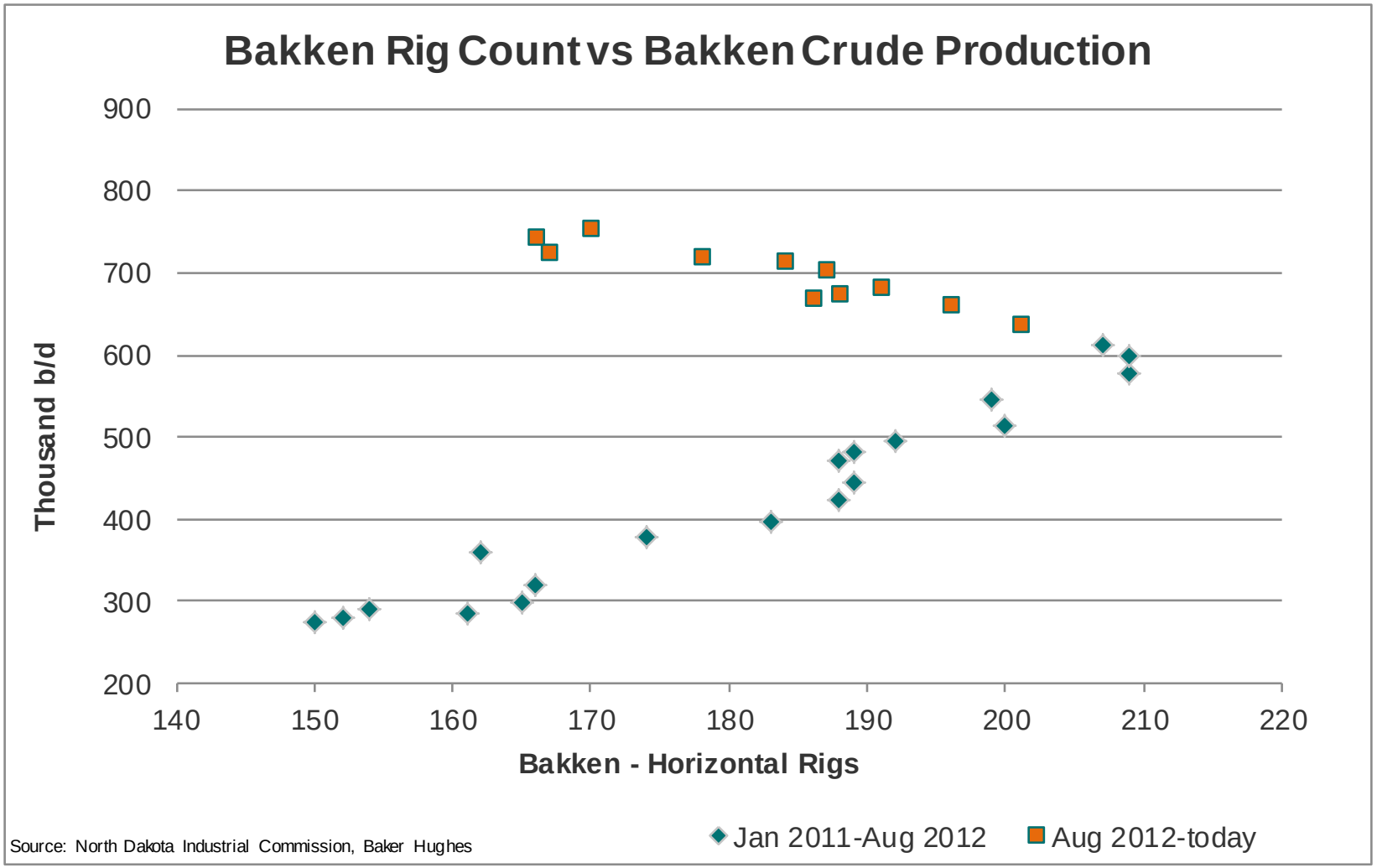
No Predictability For Oil Production In Counting Rigs Anymore

- The lower the rig count; the higher production is what we are currently seeing…



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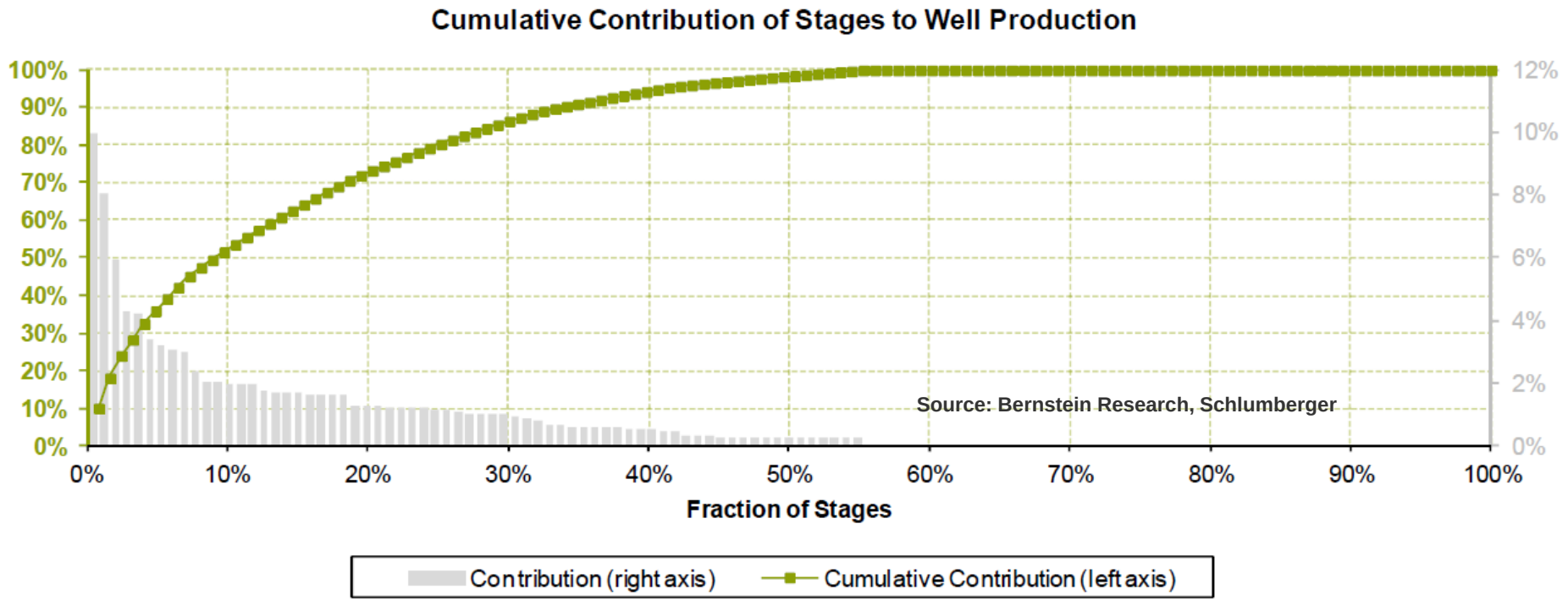
80% Of Production Comes From 20% Of The Fracking Stages

- This suggest large room for improvements. Both geology and completion to blame. Huge prize for companies in identifying the good quality reservoirs prior to Hydraulic fracturing but also in improving the quality of completions. Graph below is from Bernstein Research *"A chart that Could Scare the Oil Bulls".*



Bloomberg News June 25, 2013

Frack Music Attracts Halliburton to Submarine Spy Tool

A gossamer-thin glass line threaded two miles underground is allowing oilfield engineers to listen to a new kind of music: the sounds of fracking.

Halliburton Co. (HAL) and competing providers of drilling gear are adapting acoustic spy technology used by U.S. submarines to record sounds made deep in the earth that can guide engineers in finishing a well and predicting how much oil will flow.

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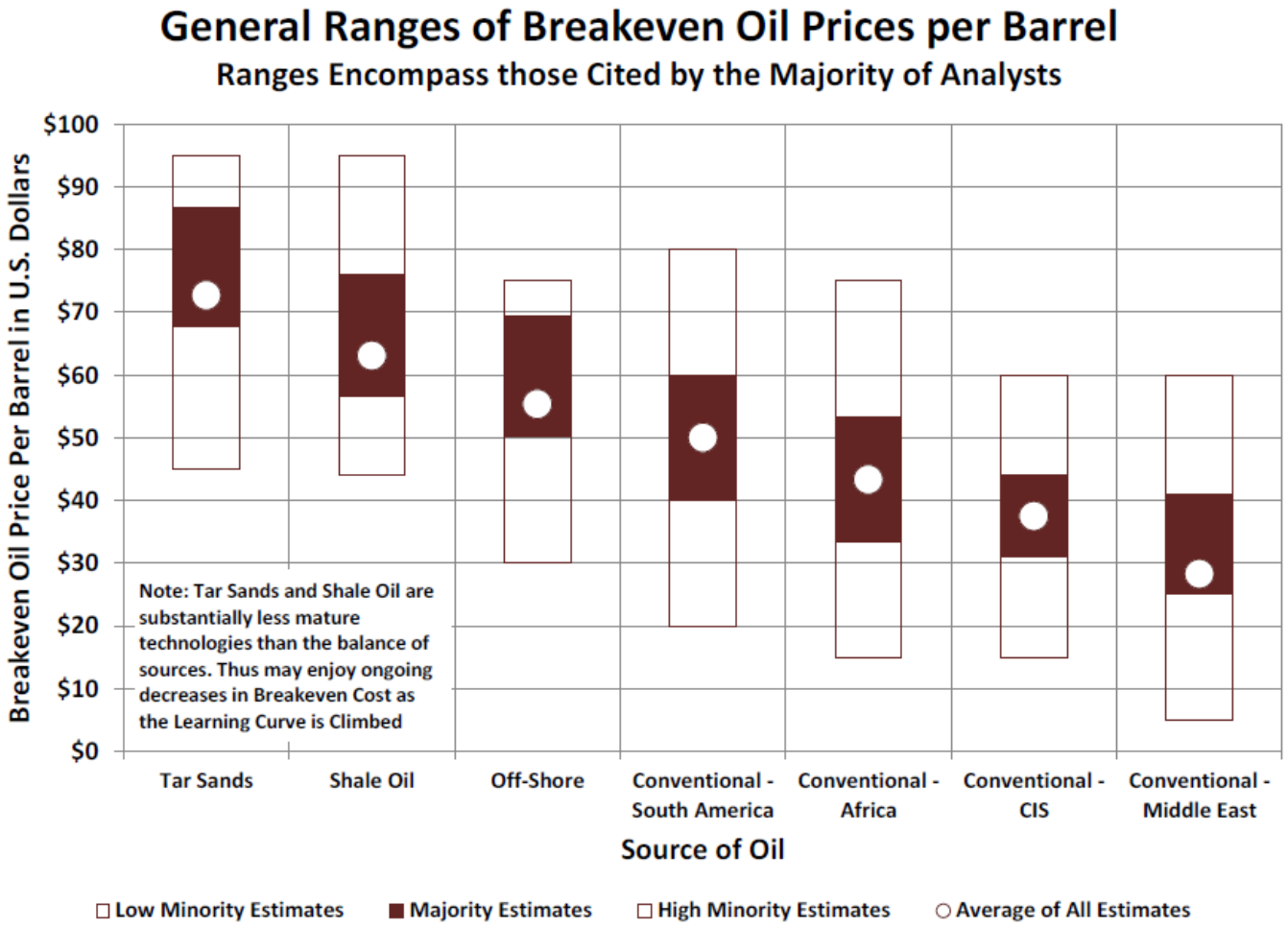
General World Break Even Prices By Source (Source: J.T. Gabrielsen Consulting)

- Same spread in shale oil as oil sand, but average and majority of estimates are significantly lower
- Both in *Off-shore* and *Conventional South-America* some projects will require higher oil prices than the cheapest *Shale oil*



Sources: Jon T. Gabrielsen Consulting analysis of data from: "Factbox-Oil production cost estimates by country" July 28, 2009 referencing IEA, Kazakh-British Chamber of Commerce, Reuters, and the Industry Body Oil & Gas UK, 20th World Petroleum Congress "Brazil's deepwater: A financial as well as technical challenge" citing Petrobras CEO Jose Sergio Gabrielli, Article "The Cost of New Oil Supply" citing Chris Skrebowski April 18,2012 http://pictorial-guide-to-energy.blogspot.com/2012/04/production-costs-of-unconventional-oil.html, bakkendispatch.com "More on Occidental Petroleum and Rising Production Costs" June 13, 2012, Business Insider: "Analyst Makes Bombshell Prediction of $50 Oil, And More Production Than We Could Possibly Know What to Do With" December 1, 2012, Daily Finance: "3 Risks for Canadian Oil Investors" October 29, 2012, Den Norske Bank - Torbjørn Kjus "Oil Market Outlook" 22 August 2012 citing PIRA, EagleFordShale.com May 5, 2013 "What is the Breakeven Oil Price in the Eagle Ford?" citing Baker Hughes, Energy Maritime Associates "Oil Price Unevenly Affects Floating Production Projects" February 2009 Oil and Gas Journal, Forbes January 8, 2013, "What Would Happen To The Current Fracking Activity And Subsequent Booms Generated If Oil $/bbl Were to Drop?", Forbes January 8, 2013, "What Would Happen To The Current Fracking Activity And Subsequent Booms Generated If Oil $/bbl Were to Drop?", Forbes: "Oil Price Differentials: Caught Between the Sands and the Pipelines" June 21, 2012, IEA Oil Market Report citing Rystad Energy, Oil and Gas Investor "Oil-Sands Lessons" April 2010, Oilprice.com article citing Wood Mackenzie reports, "Have Canadian Tar Sands had their Day?", outrunchange.com "We Need to Learn quickly....." May 19, 2012, petroleumnewsbakken.com quoting Kay Cashman of Statoil at June 20, 2012 Investor Conference, Reuters "Insight: Peak, Pause, or Plummet? Shale Oil Costs at Crossroads" May 17, 2012, The Oil Depletion Analysis Center: Newsletter September 16, 2011 citing Chris Skrebowski and a table from Merrill Lynch/Bank of America, The Oil Drum: "Is Shale Production from Bakken Headed for a Run with "The Red Queen", TheStreet.com "Oil Giants Pour Billions into Bakken Shales", and Thompson Reuters: "Repsol-led group makes big oil find off Brazil" May 24, 2012,

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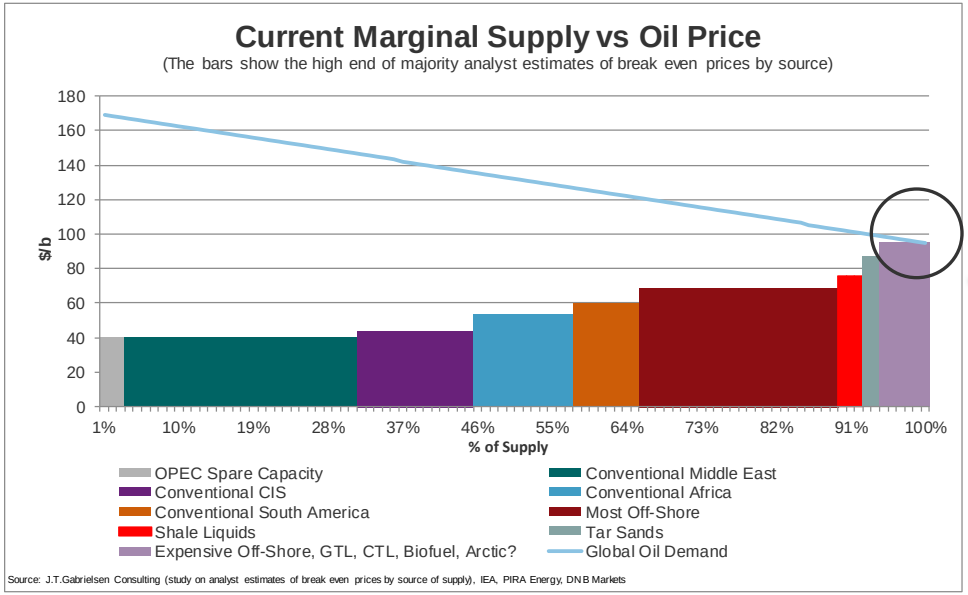
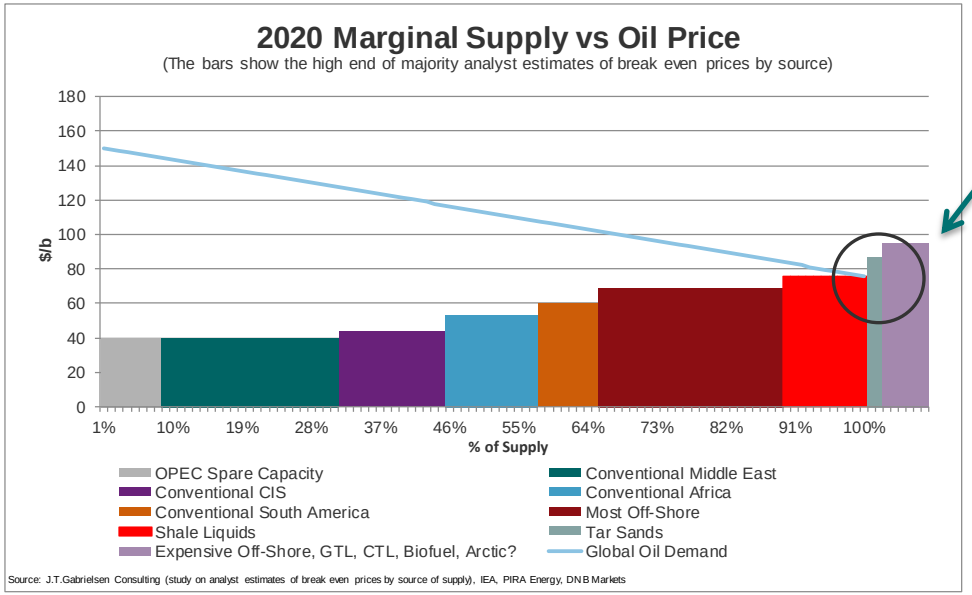
The Most Expensive Barrels Risk Being Pushed Out By Shale Oil

- Which projects are most at risk? Oil Sands, Ultra Deepwater, Biofuel, Arctic, Barents Sea??





The most expensive barrels risk being pushed out of the market as OPEC spare capacity increase, mainly as an effect of growing shale production.

The best example of this in real life is Shtokman in the Barents sea.

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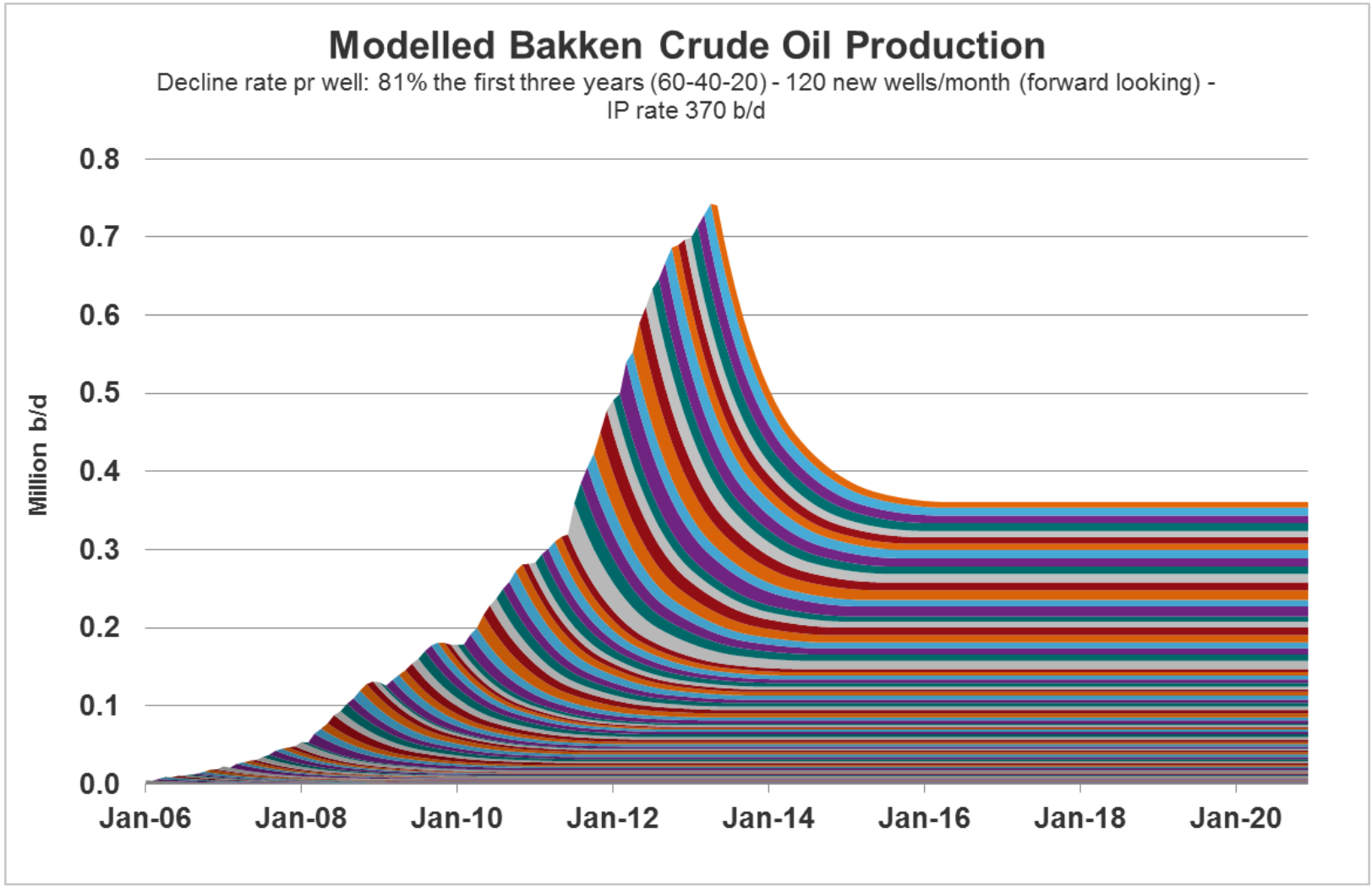
Drilling Must However Continue To See Further Growth

- If drilling stops the decline rates will take hold; Bakken production would be cut in half within two years



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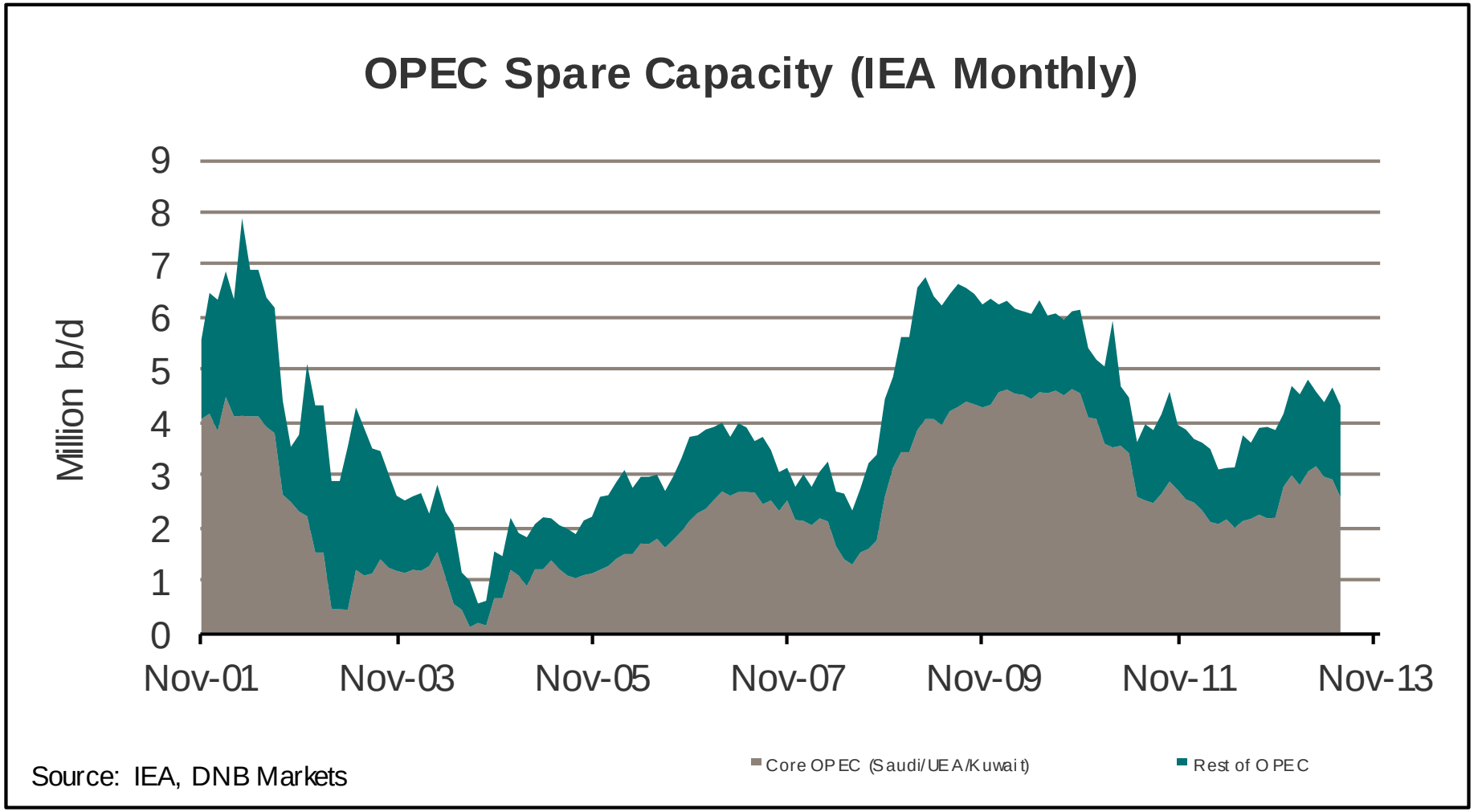
OPEC Spare Capacity



Source: IEA Monthly Oil Market Reports

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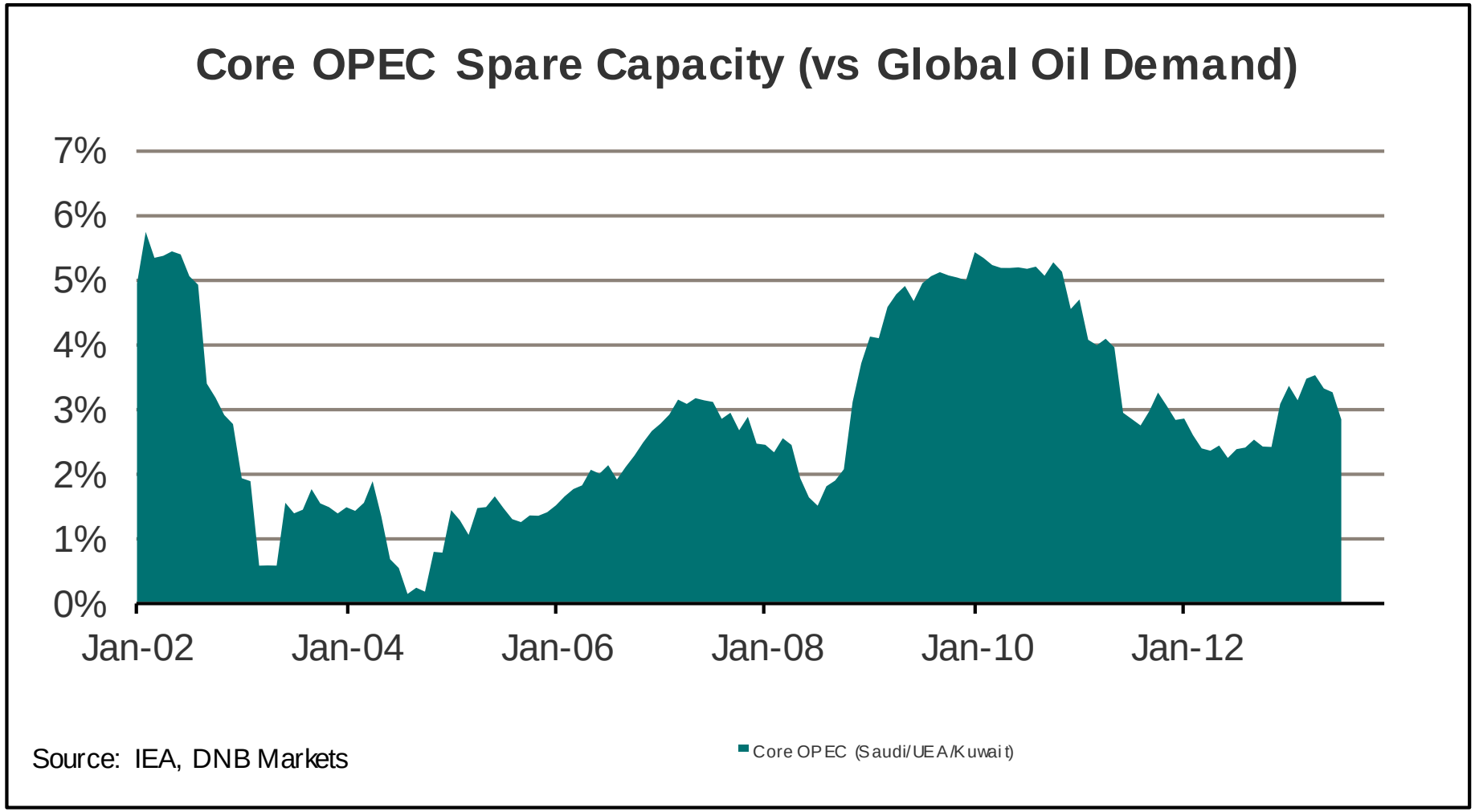
Core OPEC Spare Capacity In Percentage Of Global Demand



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Geopolitical Pressure Points

- Lots of opportunities for oil production outages in the MENA

Domestic

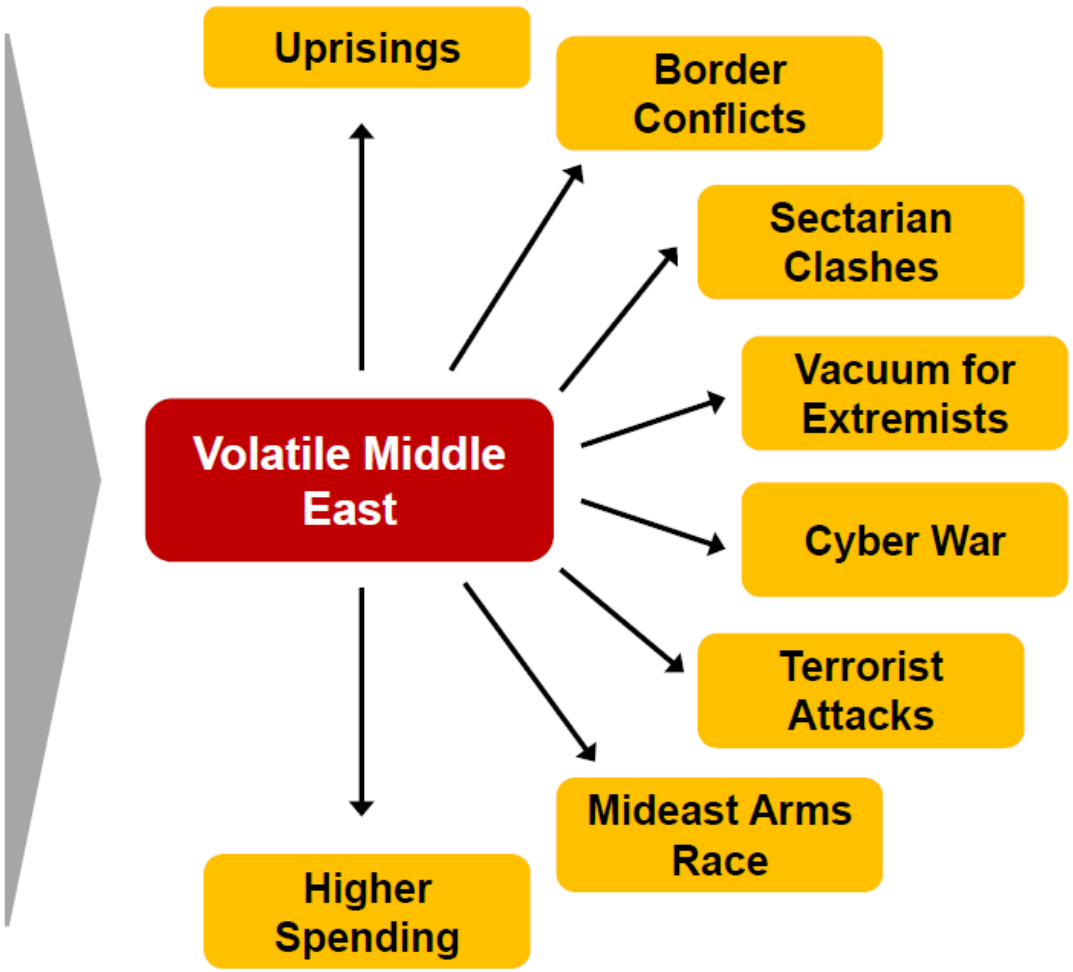
- Aging Autocrats
- Unemployment
- Youth Bulge
- Minority Rule

External

- Sanctions
- US Withdrawal

Regional

- Syrian Spillover
- Sunni-Shia
- Iran-Saudi
- Nuclear
- Kurds
- Israel-Palestine



Source: PIRA Energy

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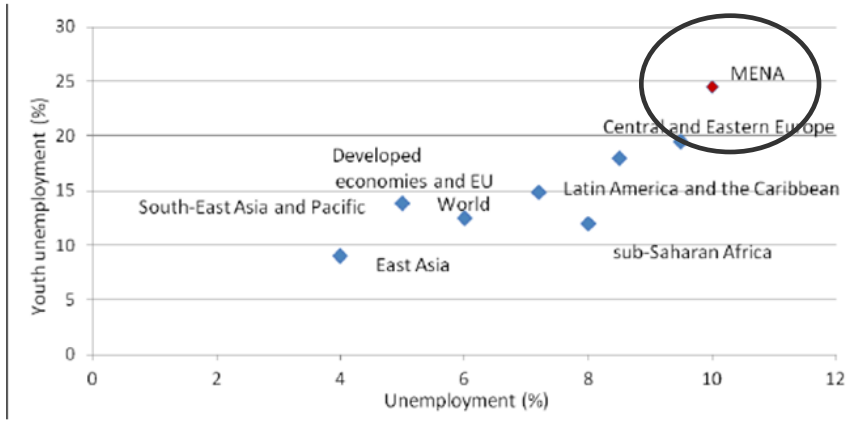
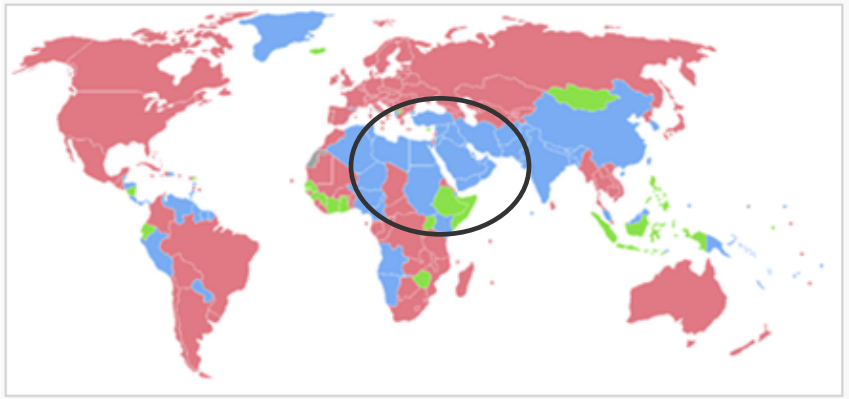
MENA Demographics: Young - Unemployed - Males

- A recipe for social unrest

Figure 1: Total and Youth Unemployment by Regions (2010)

Source: ILO and IMF data.



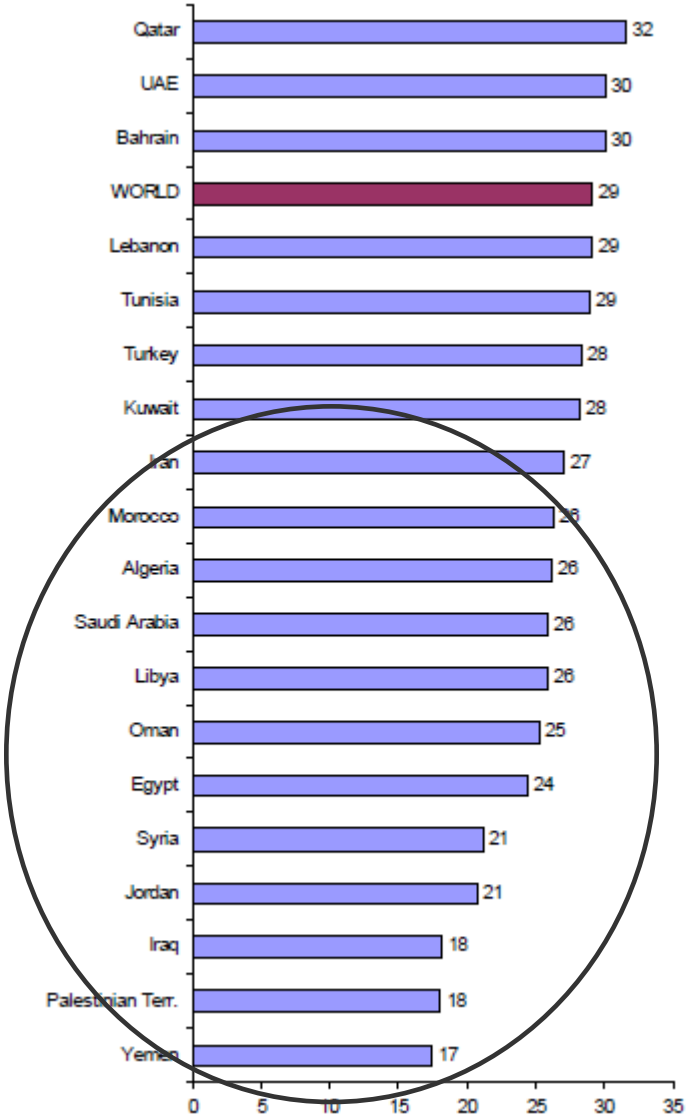


Map indicating the human sex ratio by country.[1]

Countries with more **females** than males.

Countries with the **same** number of males and females (accounting that the ratio has 3 significant figures, i.e., 1.00 males to 1.00 females).

Countries with more **males** than females.



Sources: IMF, UN Population Division, CIA World Factbook

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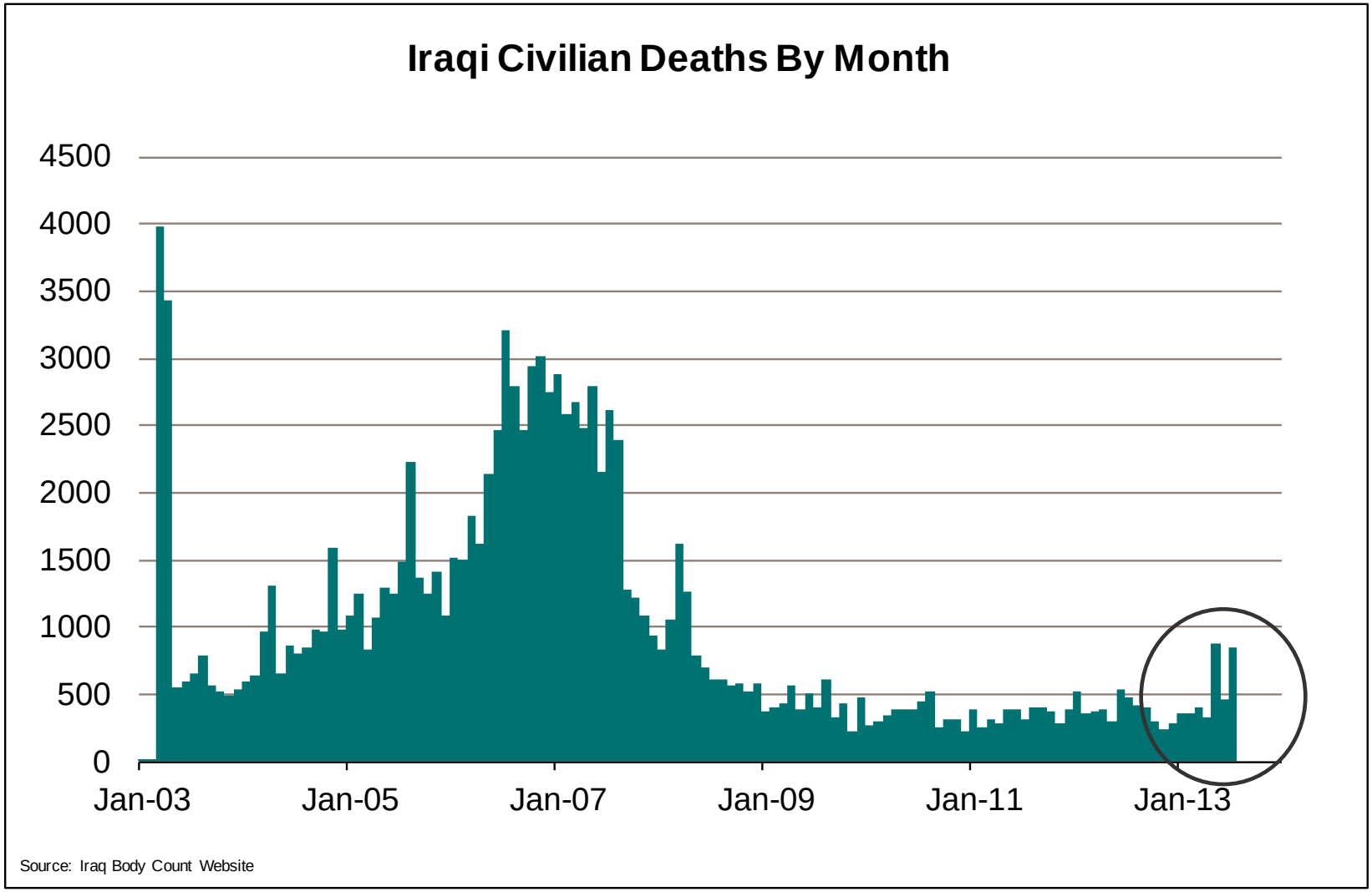
Rising Violence In Iraq - Iraq Body Count Web Site



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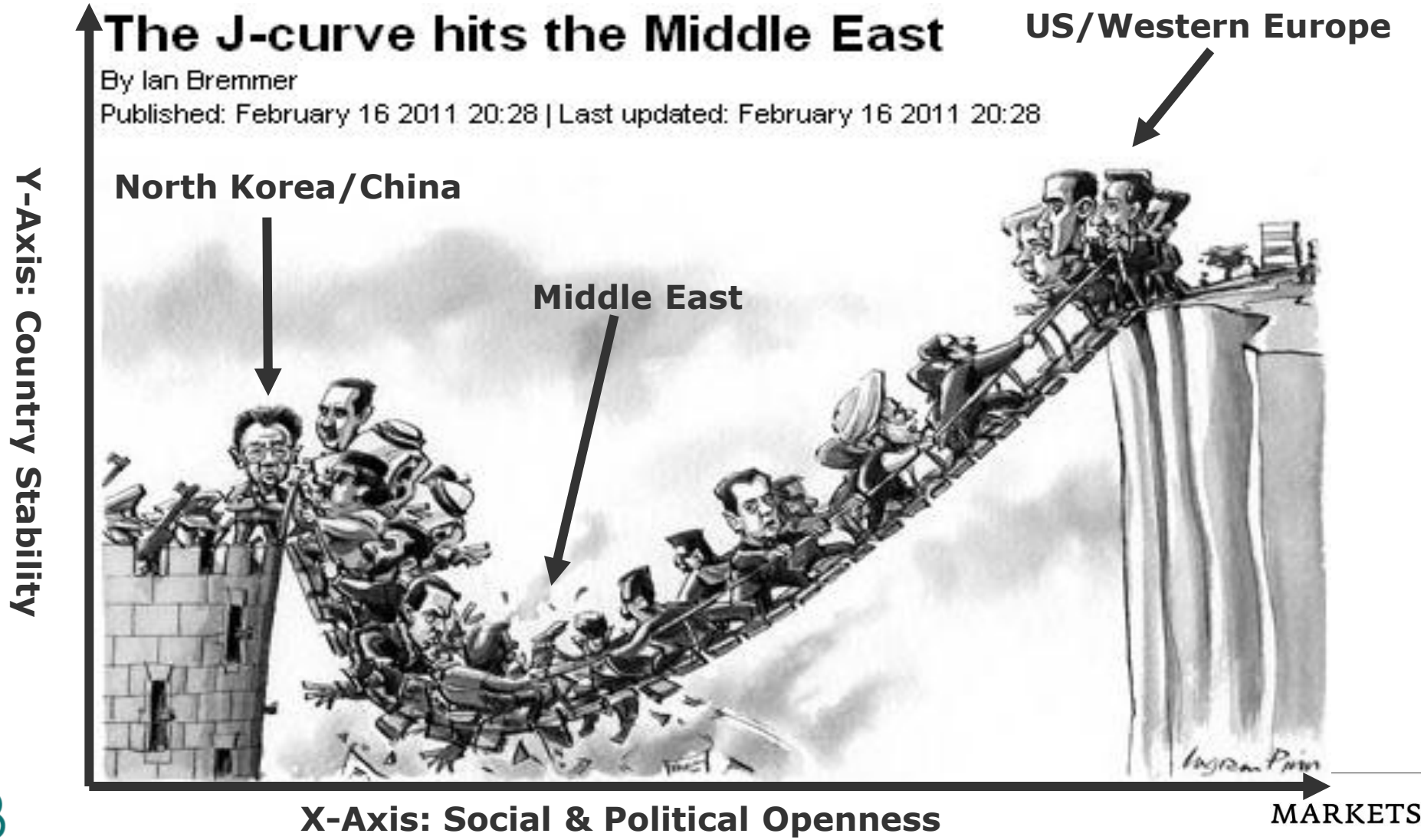
Geopolitical Risk Increase As A Society Opens Up

- Internet - Satellite-TV - Cell-phones



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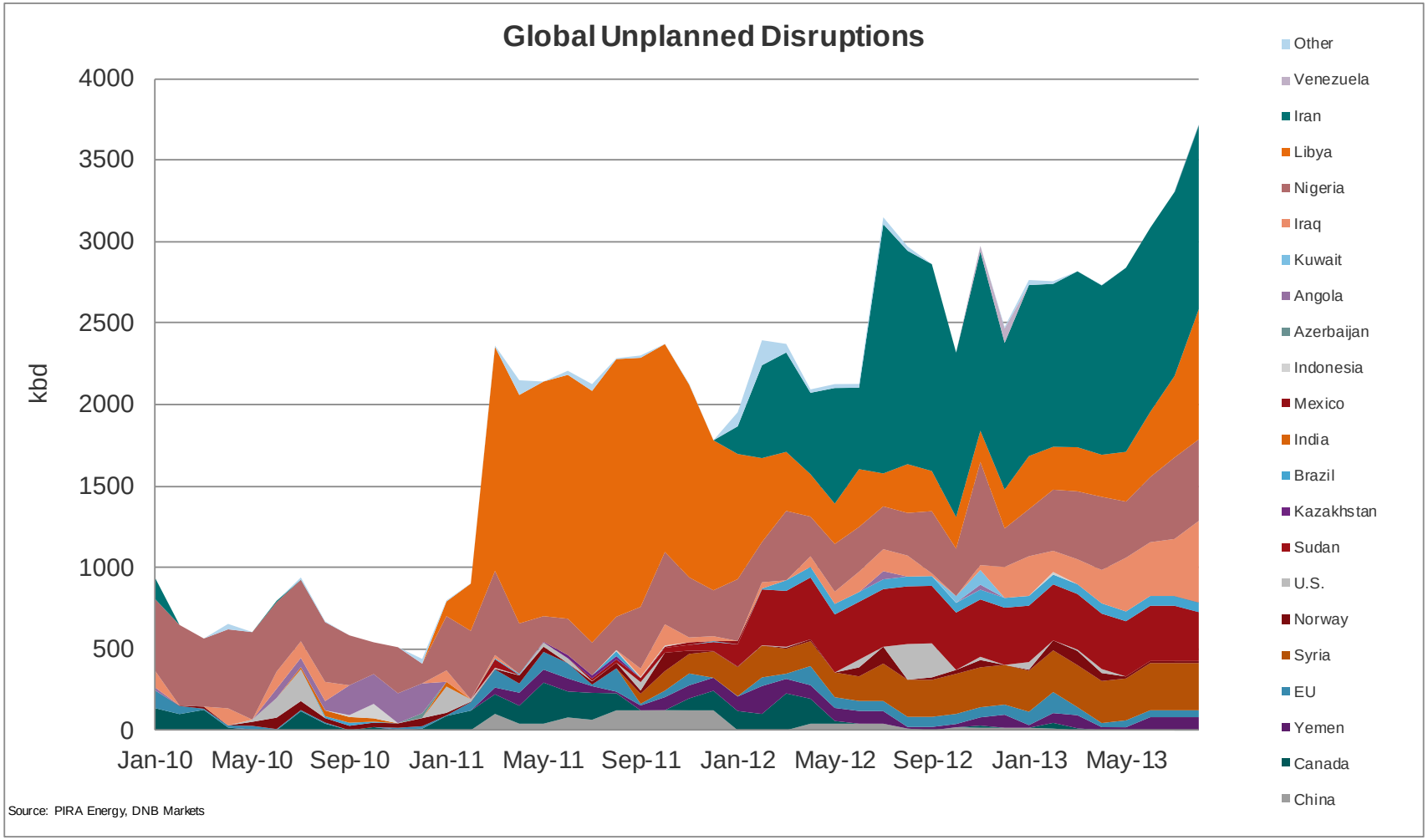
Global Supply Disruptions Have Been Growing Last Two Years

- Will unplanned outages continue at the current high level for the coming 5-years?? What happens if these barrels return?



Source: PIRA Energy

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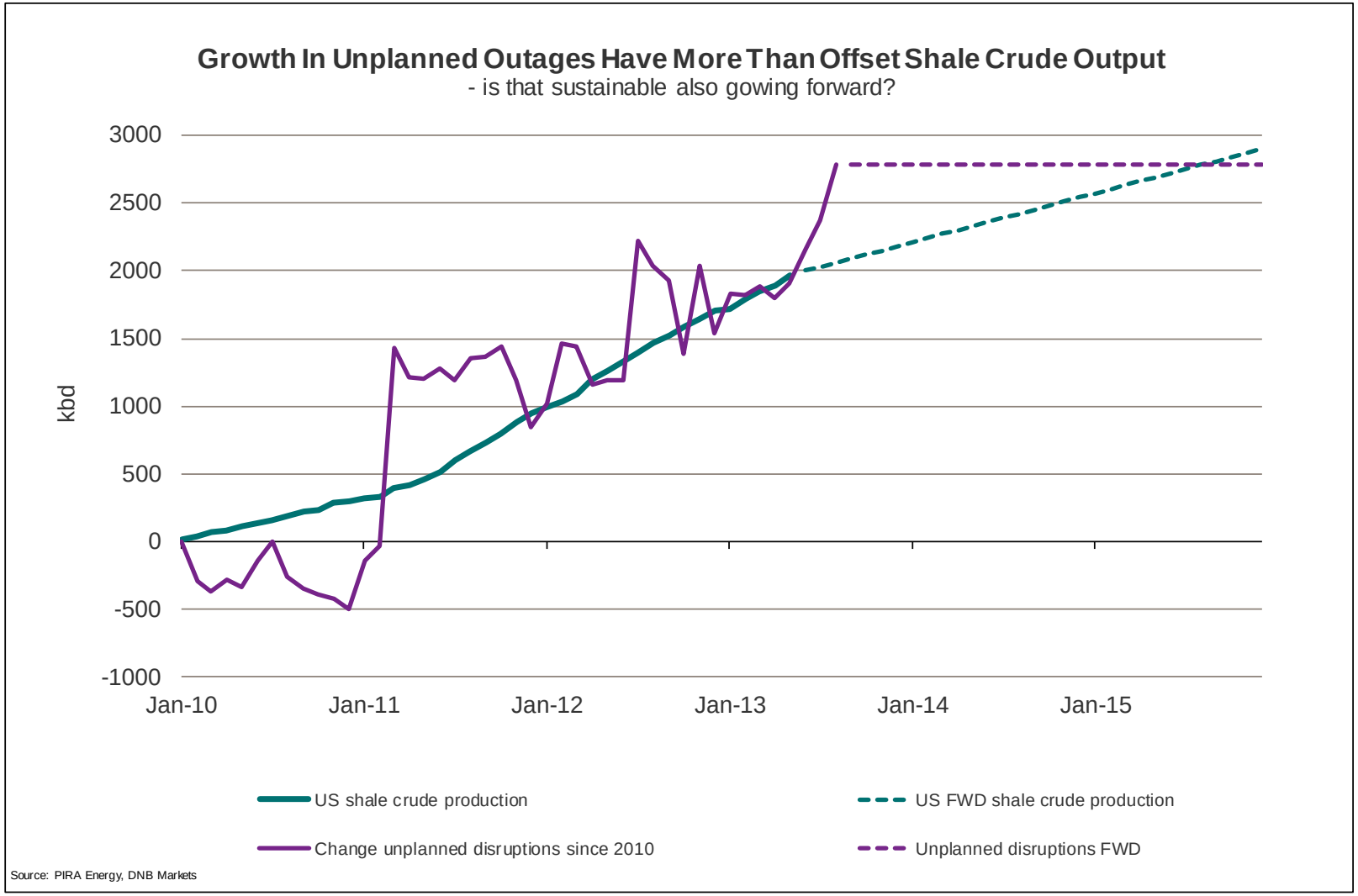
Shale Crude Output Growth Has Been Offset By Outages

- Shale crude production growth is starting to catch up – What happens next three years with unplanned outages??



Source: PIRA Energy

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The Saudi Royal Family

Abdul Aziz (Ibn Saud)
- King: 1902-1953
- Founded Saudi Arabia in 1932
- 22 wives (4 at a time)
- 45 sons of which 5 have been kings

King Saud
- King: 1953-1964
- Forced out

King Faisal
- King: 1964-1975
- Killed

King Khalid
- King: 1975-1982
- Heart Attack

King Fahad
- King: 1982-2005
- Stroke

King Abdullah (88)
- King: 2005-
- Regent since 1995
- Unifying and popular
- 6 sons

Crown Price Sultan (80)
- Died 23.10.2011

Crown Price Naif (79)
- Ultra conservative
- Died 16.06.2012

New Crown Price Salman (76)
- 25th son of Ibn Saud
- Defence Minister
- Well regarded
- Trusted mediator
- Had a stroke in 2010

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Saudi Requires Higher Oil Prices To Balance The Budget

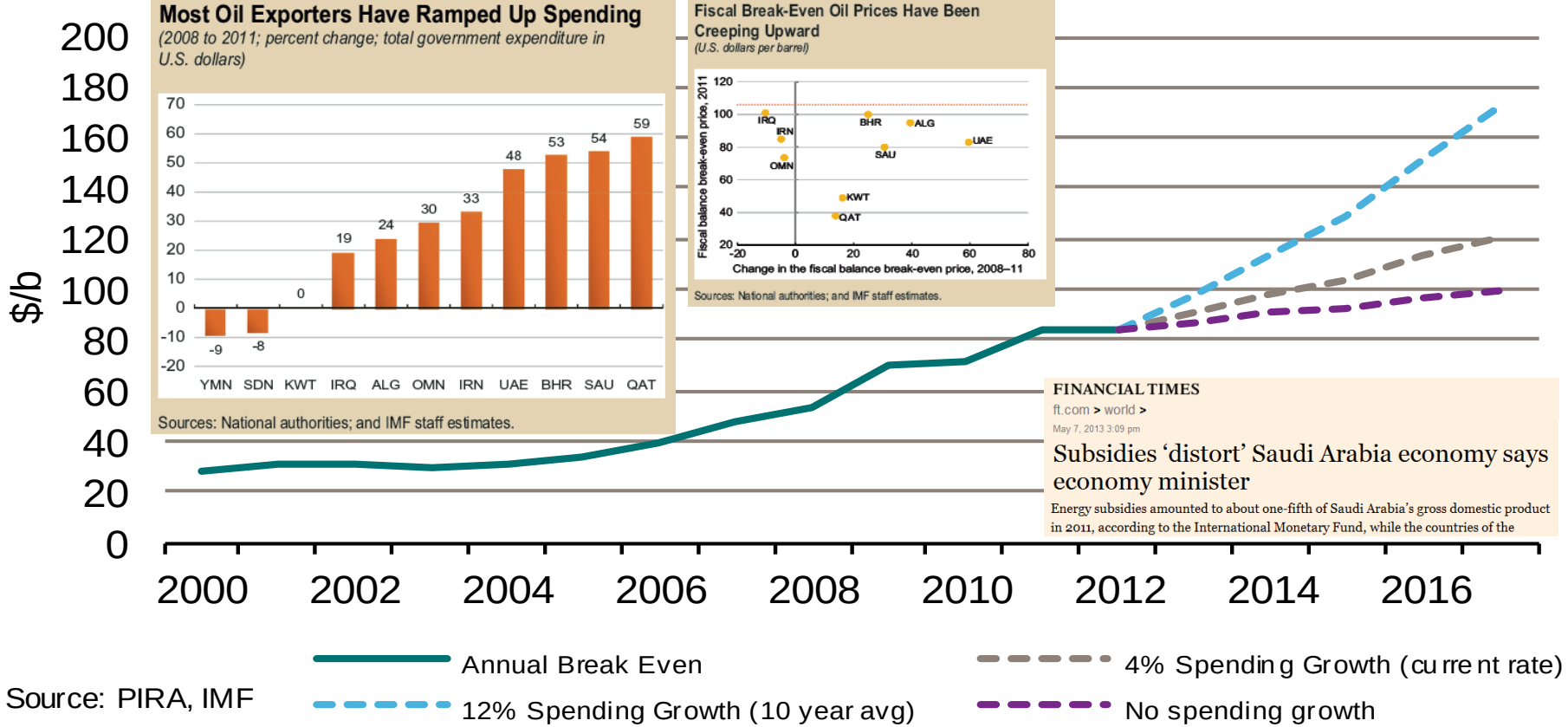
- Saudi exports assumed to be: 2013-2017 in million b/d: 8.3 – 8.0 – 7.8 – 7.5 – 7.3

Saudi Break Even Budget Oil Price

FINANCIAL TIMES
ft.com > world >
May 7, 2013 3:09 pm

Subsidies 'distort' Saudi Arabia economy says economy minister

Energy subsidies amounted to about one-fifth of Saudi Arabia's gross domestic product in 2011, according to the International Monetary Fund, while the countries of the



Source: PIRA, IMF

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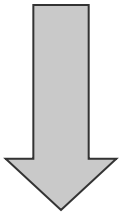
The Saudi Price Target

- Both upwards and downwards pressure

Upped to 100-110 $/b Brent?
Old target 70-80 $/b Brent

- **Internal Domestic Budget**
- Fighting Taxation In Consumer Countries
- Political Pressure From Other OPEC Countries
- Weak US Dollar

Saudi Arabia's Al-Naimi on June 8 - 2011 when asked if Saudi Arabia still favour an oil price of 70-80 $/b:
"That was several years ago".
The same Al-Naimi in a CNN interview on January 16th - 2012:
"Our wish and hope is we can stabilise this oil price and keep it at a level around 100 $/b".
… and on Dec 7th 2012 in an interview in Doha (Brent trading at 107 $/b):
"The prices are fine and customers are happy"



- Long Term Sustainability
  - **Demand**
  - **Non OPEC Supply**
  - New Energy Technology
- Political Pressure From Big Consumer Countries

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Which Strategy Will Saudi Choose?

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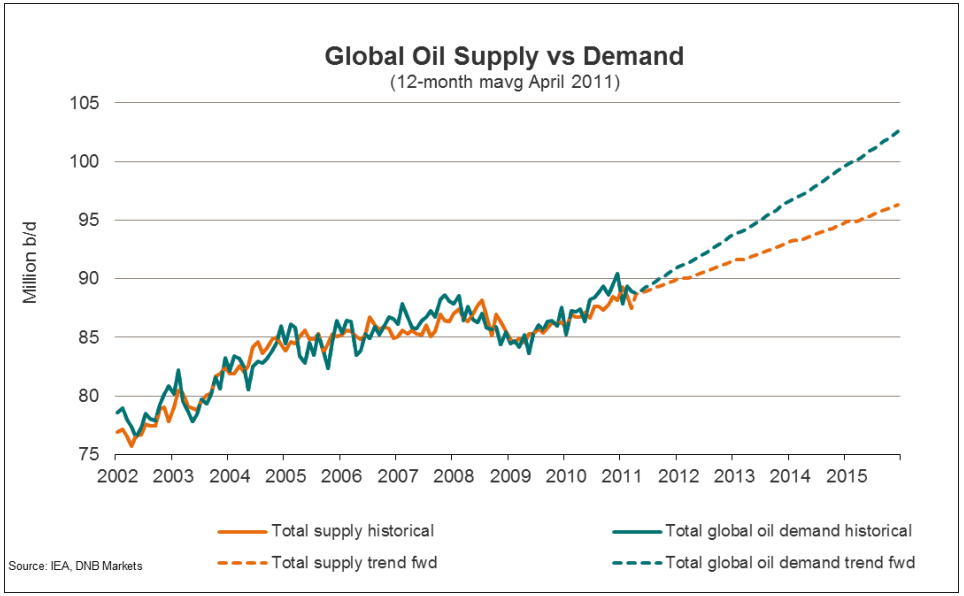
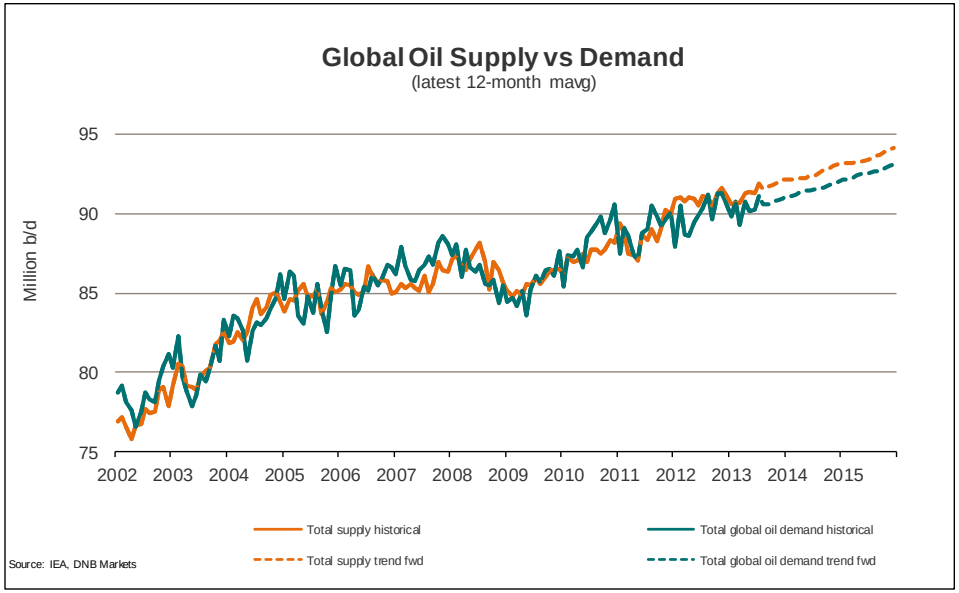
Global Supply-Demand Trends

-12 month moving average based on the latest monthly data suggest decreasing 'Call on OPEC' in coming years
- In 2011 the situation was different (see the graph to the left)





Current Trend Line Figures	Trend Line Growth	2012	2013	2014	2015	2012-15 change
OECD demand	**-1.1%**	46.0	45.5	45.0	44.5	**-1.5**
Non-OECD demand:	**3.4%**	43.9	45.4	46.9	48.5	**4.6**
Total demand		89.9	90.9	92.0	93.1	**3.1**
Demand change:			**1.0**	**1.0**	**1.1**	**1.1**
Non-OPEC (incl. non-core OPEC)	**1.3%**	75.8	76.8	77.8	78.8	**3.0**
Call on core-OPEC crude		14.1	14.1	14.2	14.3	**0.1**
Change in Call on core-OPEC crude			**0.0**	**0.0**	**0.1**	

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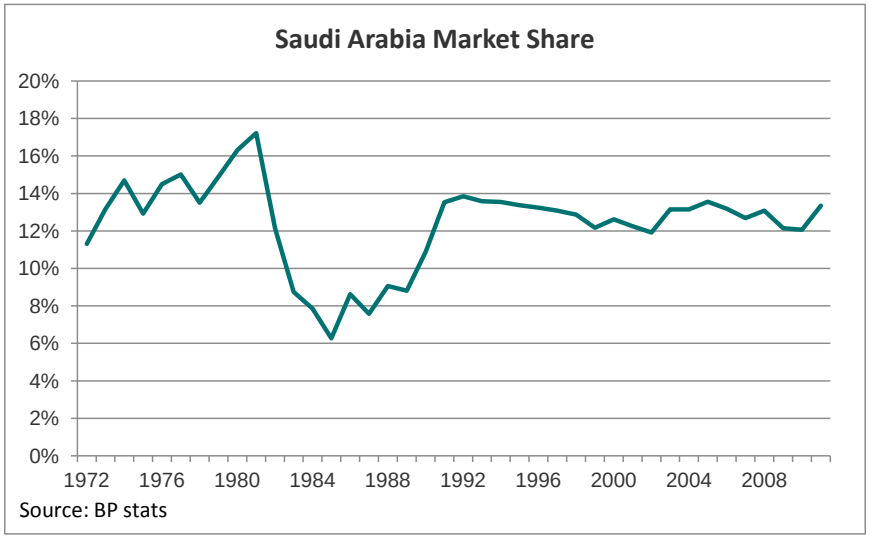
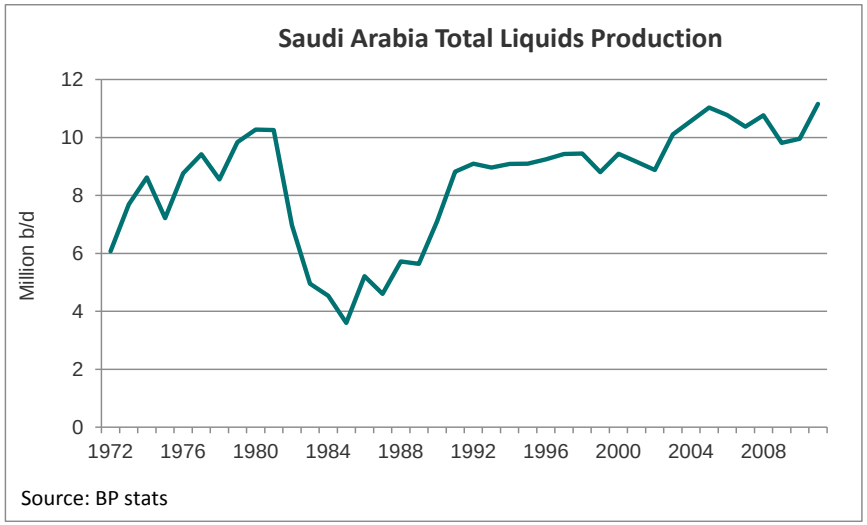
Do We Risk A Repetition Of 1986-1991 From Saudi?

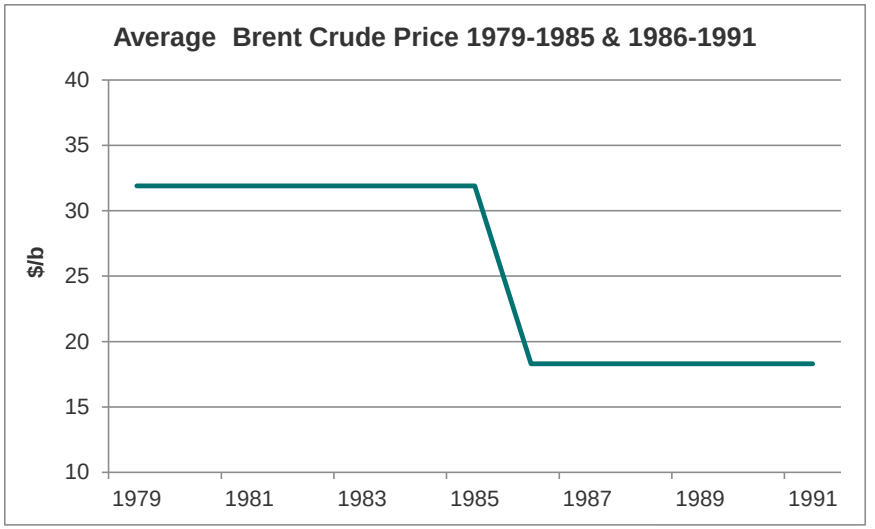
- Or is it better for Saudi to just keep market share and let prices slide a bit??

Volume cut: 2013-15	Million b/d	$/b price	Revenue mill $/d
Saudi crude production:	9.8	100	**980**
Saudi production cut:	**1.5**		
Saudi production after cut:	8.3	**100**	**830**

No volume cut: 2013-15	Million b/d	$/b price	Revenue mill $/d
Saudi crude production:	9.8	100	**980**
Saudi production cut:	**0.0**		
Saudi production after cut:	9.8	**85**	**830**







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We Do Not Need To Find & Develop 4 New Saudi Arabia

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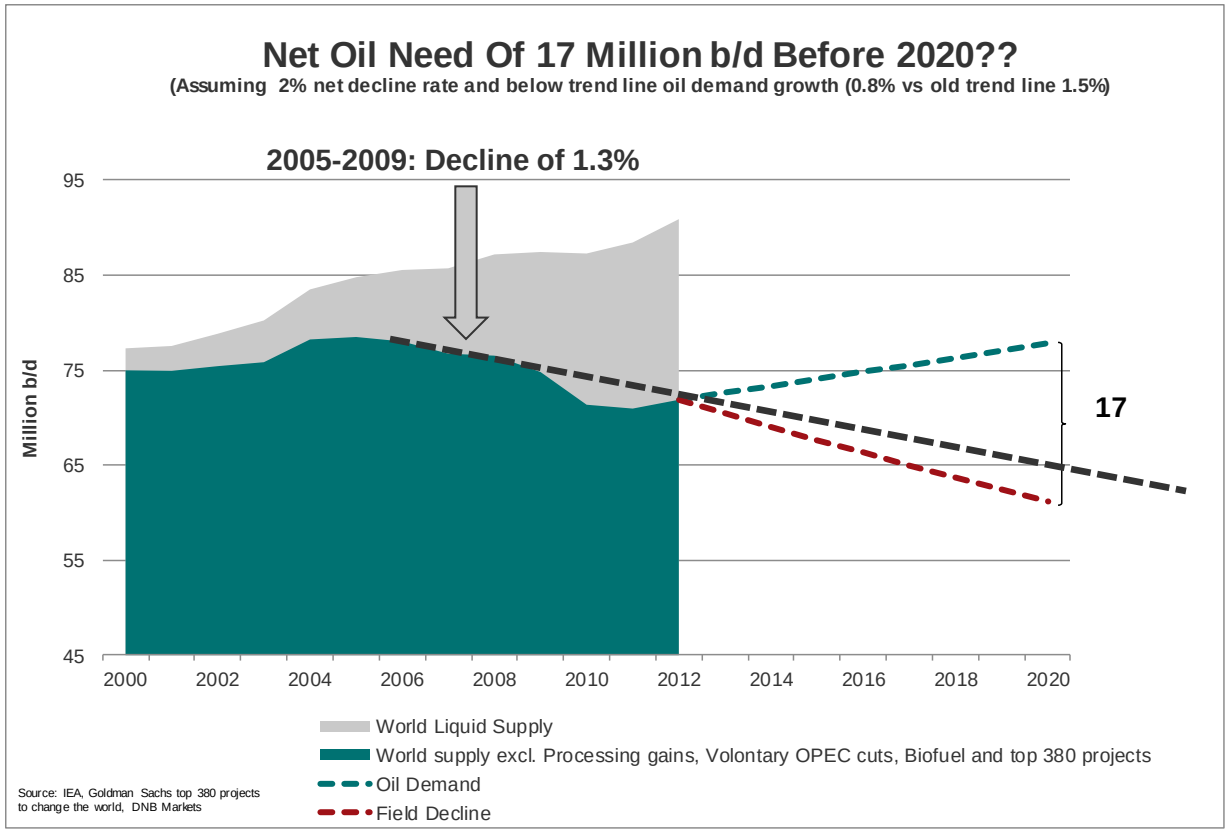
Existing Projects Will Cover The Oil Need By 2020



Conclusion:

- **The gap by 2020 will be covered by existing, known projects.**
- **In a 2020 perspective the world does not need to find any new resources to develop in order to balance supply and demand. Top 380 projects will cover most of the gap - the remaining will be covered by smaller projects.**
- **Top 380 are 45% of the oil majors CAPEX next 4 years, so there are also other smaller projects contributing**

- **Net need of new barrels by 2020 in million b/d:** 11+6 **=17**
  - Lost supply from decline rates: **11** million b/d (2%)
  - Trend line demand growth of 1.5% will fall to 0.8%: **6** million b/d.

- **How much can supply increase?:**
  - GS top 380 (April 2012): Estimated growth in world oil liquids supply from the worlds top 380 projects 2012-2020 (page 4): **25** million b/d. (**17.5** million b/d if adjusting for normal project slippage)

Source: DNB Markets, Goldman Sachs top 380 projects to change the world – 12 April 2013

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Has The World Brought On 4 New Saudi Arabias Since 2000?

- Of course not. Top 380 projects has added about 15 million b/d. In other words; net decline is much, much lower than 3.8%.

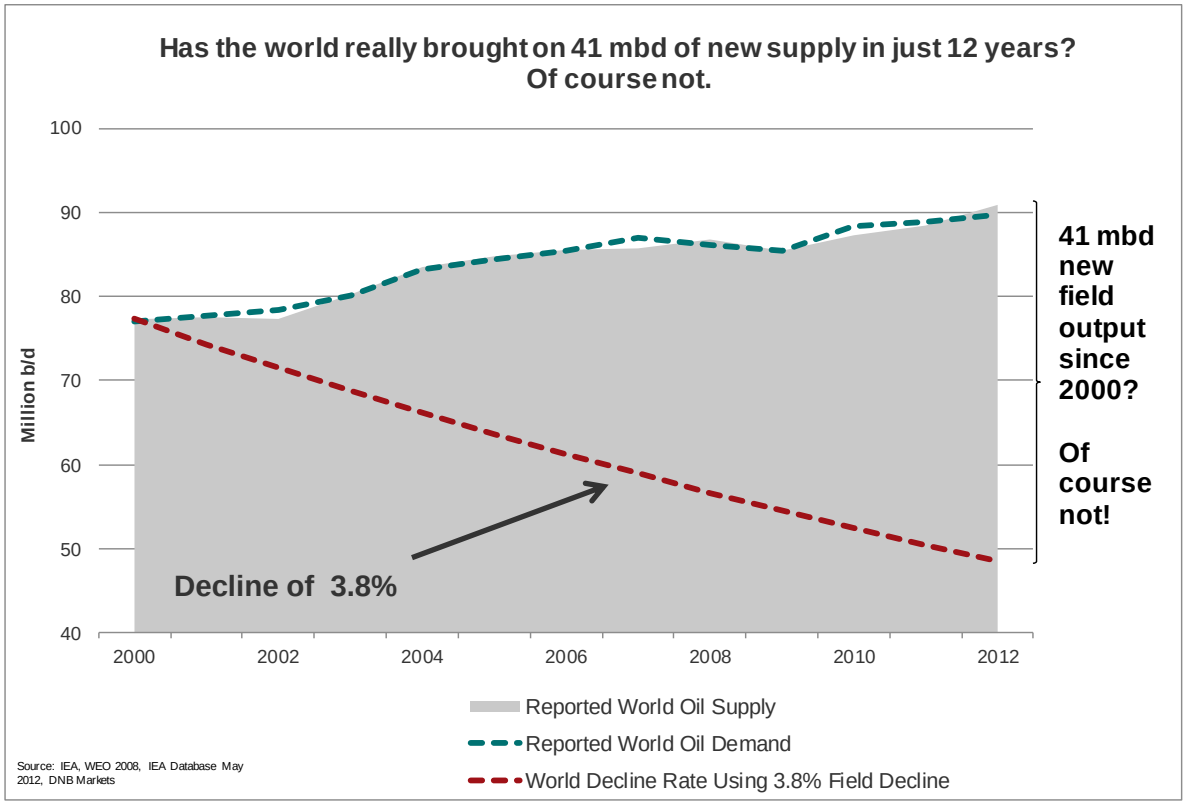

Table 10.8 • Production-weighted average observed decline rates by size and type of field

	Post-peak				Post-plateau			
	Super-giant	Giant	Large	Total	Super-giant	Giant	Large	Total
Onshore	3.4%	5.6%	8.8%	4.3%	4.9%	5.5%	9.4%	5.3%
Offshore	3.4%	8.6%	11.6%	7.3%	1.2%	9.0%	11.7%	7.2%
Shelf	*3.4%*	*7.7%*	*11.2%*	*6.6%*	*1.2%*	*8.6%*	*12.2%*	*6.7%*
Deepwater	-	*13.1%*	*14.2%*	*13.3%*	-	*10.8%*	*12.6%*	*11.2%*
Carbonate	2.3%	6.6%	8.9%	3.4%	2.7%	6.9%	9.3%	4.3%
Sandstone	4.8%	6.5%	10.9%	6.3%	5.5%	6.5%	11.1%	6.6%
World	**3.4%**	**6.5%**	**10.4%**	**5.1%**	**4.3%**	**6.6%**	**10.7%**	**5.8%**

Sources: IHS, Deloitte & Touche and USGS databases; other industry sources; IEA estimates and analysis.

Table 10.12 • Estimated production-weighted average annual observed post-peak decline rates for all fields worldwide by region

	Based on 580 field dataset	All fields
OECD North America	6.5%	9.7%
OECD Europe	11.5%	11.9%
OECD Pacific	11.6%	12.6%
E. Europe/Eurasia	5.1%	5.8%
Asia	6.1%	6.7%
Middle East	2.7%	3.4%
Africa	5.1%	6.8%
Latin America	6.0%	6.6%
World	**5.1%**	**6.7%**

Sources: IHS, Deloitte & Touche and USGS databases; other industry sources; IEA estimates and analysis.

- Non-OPEC production of crude oil and NGLs declines from 44.8 mb/d in 2007 to 43.5 mb/d in 2015 and then falls further to 42.9 mb/d in 2030 in the Reference Scenario. Non-OPEC non-conventional oil production, in contrast, rises from 1.5 mb/d in 2007 to 7.9 mb/d in 2030.

→

Non-OPEC crude production including NGL's is as of May 2013 (in the IEA database) reported at 48 mbd for 2007 and 50 mbd for 2012. In order to see a 1.3 mbd production decline from 2007-2015 the non-OPEC supply must from 2012 decline by 3.3 mbd by 2015… Plausible???

IEA's WEO 2008 (page 255): Output of crude oil from existing oil fields drop from 70 mbd in 2007 to 51 mbd in 2015, **in other words a field decline of 3.8% per annum**. This is not including EOR but IEA write that EOR is projected to contribute 6.4 mbd from 2007 to 2030 with most of that occurring after 2015. EOR from 2007 to 2015 looks to be about 1.7 mbd (figure 11.10 on page 261 in WEO 2008). **Adjusting for the 1.7 mbd of EOR the net decline from 2007 to 2015 estimated by the IEA looks to be 3.5% (production down from 70 mbd to 52.7 mbd).**

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