




Oil Price and the Oil & Gas industry: A Victim Of Its Own Success

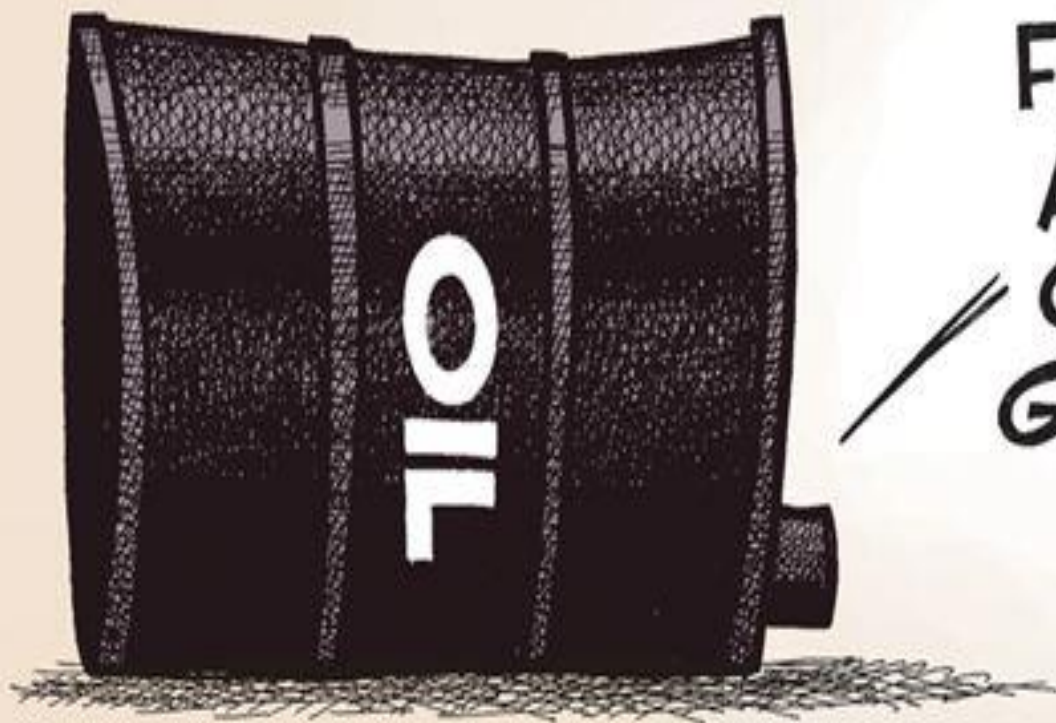


A look into the Geopolitics of the oil price collapse, how did it happen, and what the future oil price may be.

Structure of Talk

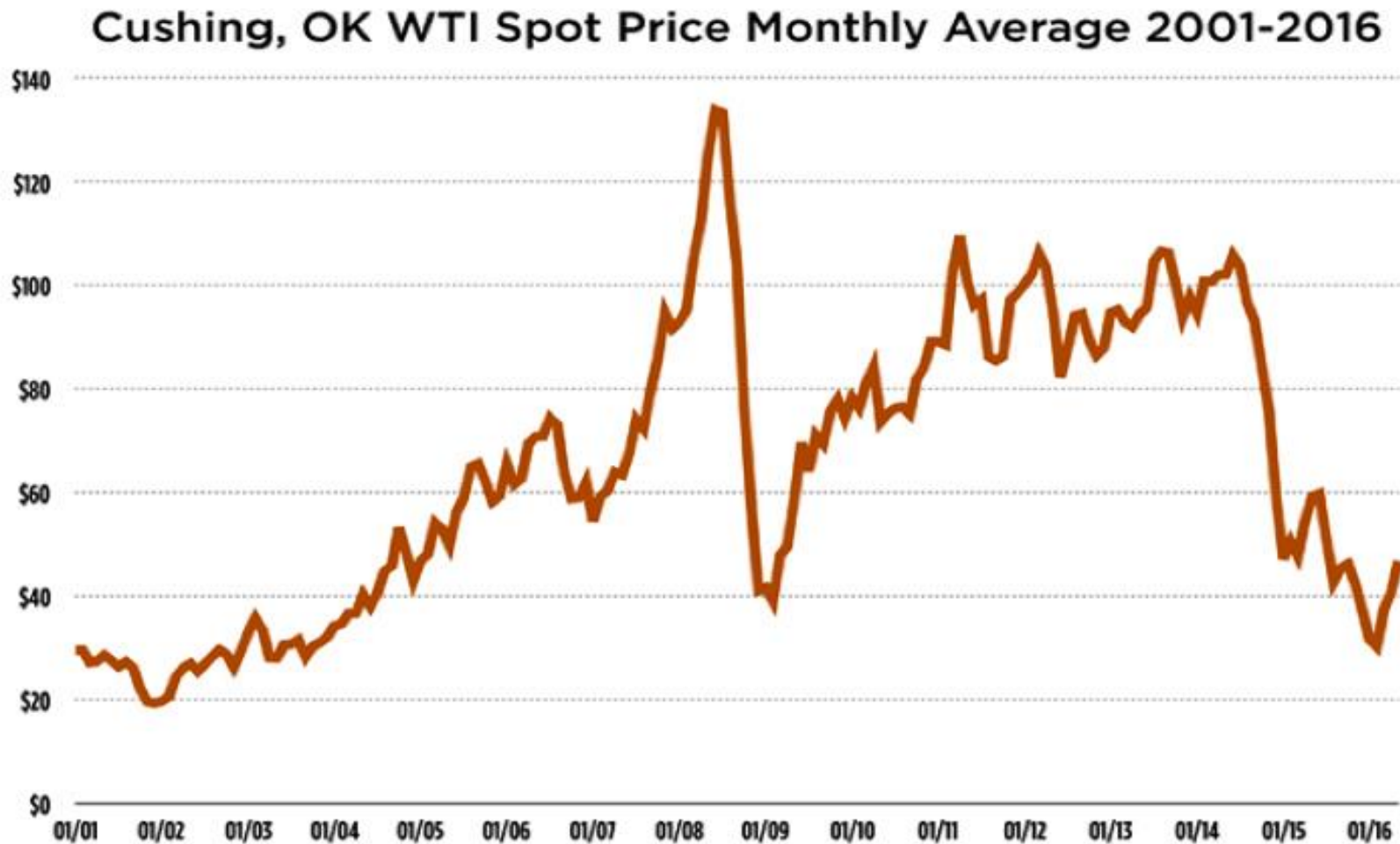
-  First talk on subject in Edmond SCAUG meeting last February (When oil was at its lowest price in recent history).
-  This talk shorter, put my BIO, Info on CLR (the company I work for), Info on GIS at CLR and in the oil and gas industry at end of talk. Will probably not have time to go over it.
-  I am the unofficial CLR ambassador to the GIS community, since none of my GIS co-workers are willing to attend any GIS event outside of work.

B. Rich
HEDGEYE



HELP!
I'VE
FALLEN
AND I
CAN'T
GET UP

Oil Price last 15 years



source: Energy Information Administration

Importance of Oklahoma in determining Oil Price

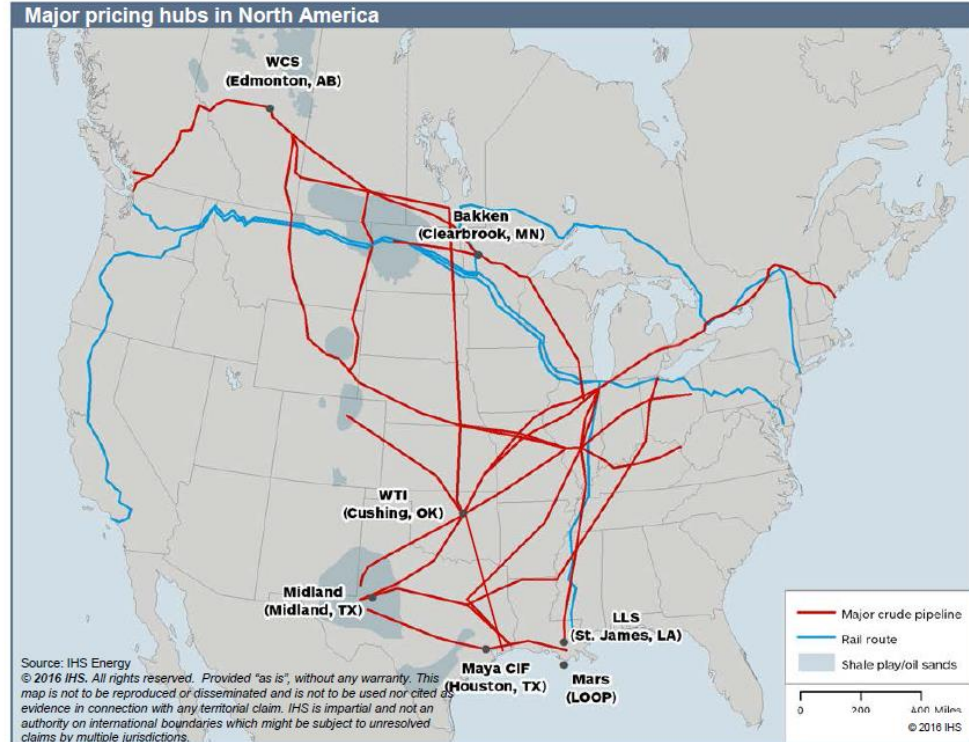
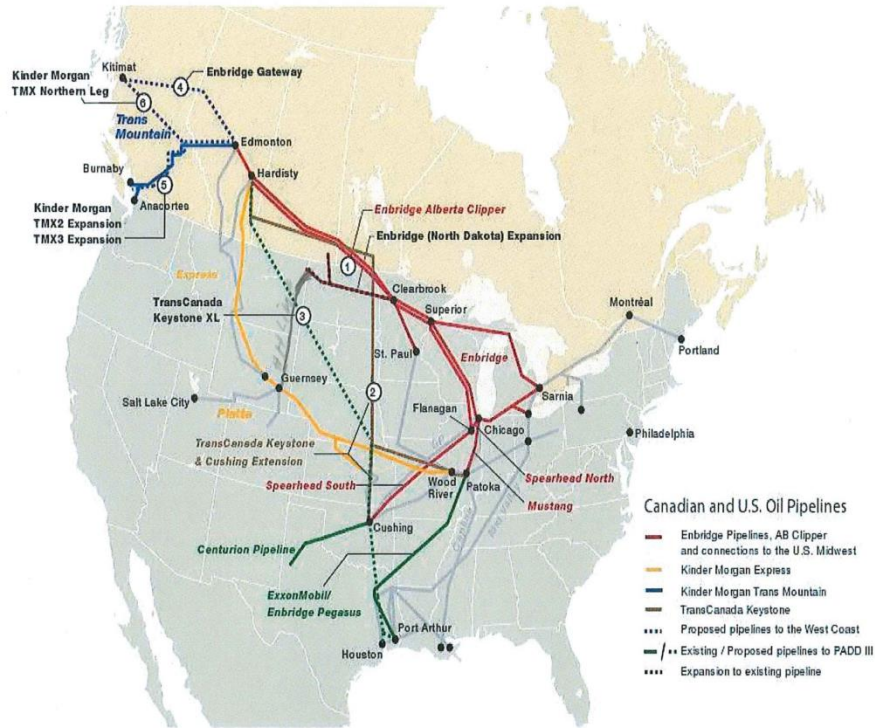
🔥 ***WTI price vs. Brent***

🔥 ***Cushing Hub***

- 🔥 World's Largest Oil Storage Facility (up to almost 50M BBL)
- 🔥 Pipeline Crossroads of the World
- 🔥 Pricing hub for West Texas Intermediate Crude on NYMEX exchange
- 🔥 Delivery point for light sweet crude



US and Canada Oil Pipelines

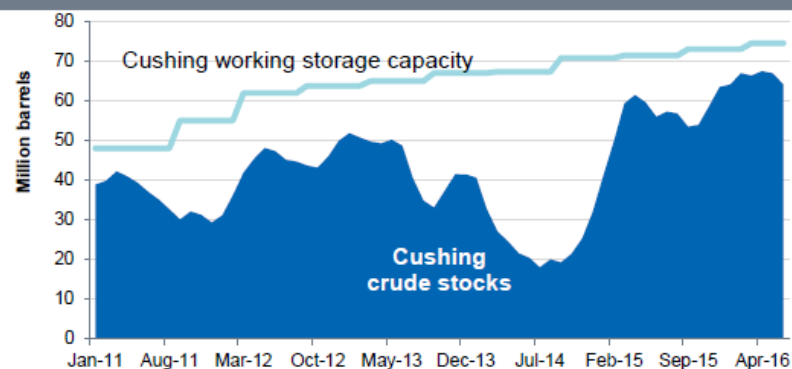


Notes: WTS = West Texas Sour; WCS = Western Canadian Select; LLS = Light Louisiana Sweet; ANS = Alaska North Slope.
Source: IHS Energy

Petroleum Administration for Defense Districts

United States commercial crude oil storage levels and working storage capacity

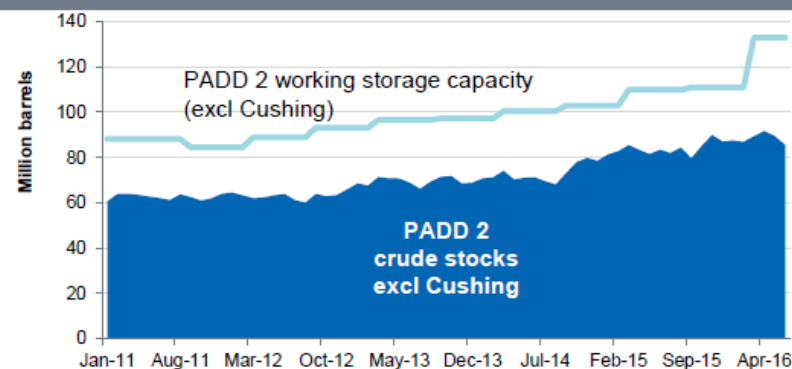
Cushing storage capacity and end-month inventory



Notes: Last two months based on EIA weekly data
Source: IHS, EIA

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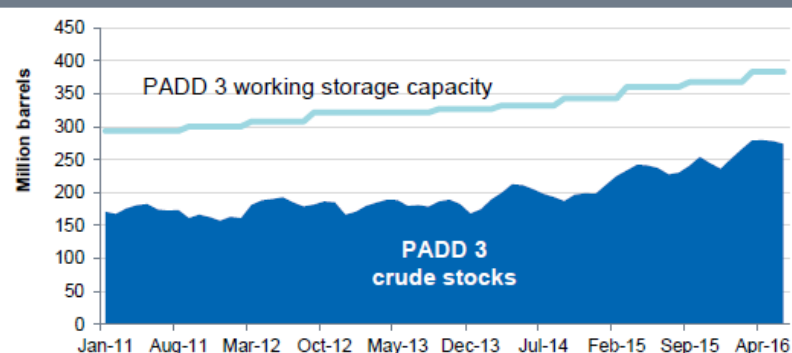
PADD 2 (excl. Cushing) storage capacity and end-month inventory



Notes: Last two months based on EIA weekly data
Source: IHS, EIA

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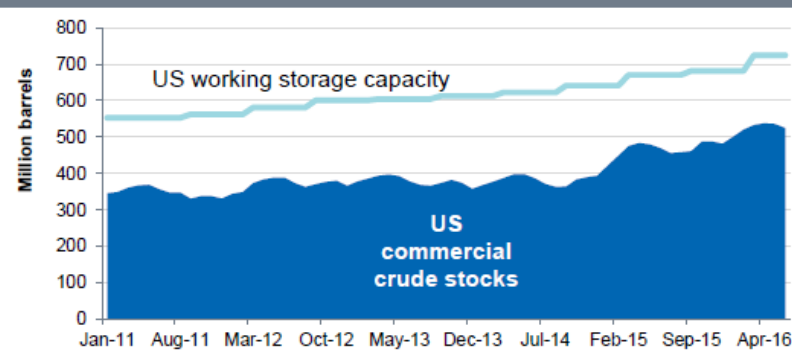
US Gulf Coast (PADD 3) storage capacity and end-month inventory



Notes: Last two months based on EIA weekly data
Source: IHS, EIA

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United States storage capacity and end-month inventory




Notes: Last two months based on EIA weekly data
Source: IHS, EIA

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Oil Storage Trade

 The **oil-storage trade**, also referred to as **contango**, a market strategy in which large oil companies purchase oil for immediate delivery and storage—when the price of oil is low—and hold it in storage until the price of oil increases. [\[Wikipedia\]](#)

Oil Storage Trade

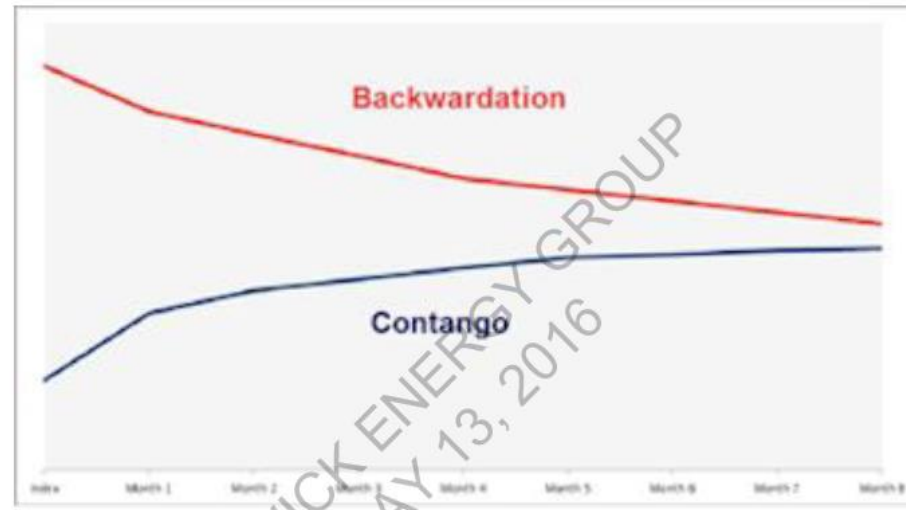
 Investors bet on the future of oil prices through a financial instrument, oil futures. Crude oil is stored in salt mines, tanks and oil tankers. [\[Wikipedia\]](#)

Futures, Contango vs. Backwardation



Needs to Knows

Backwardation vs Contango – Just Vocab

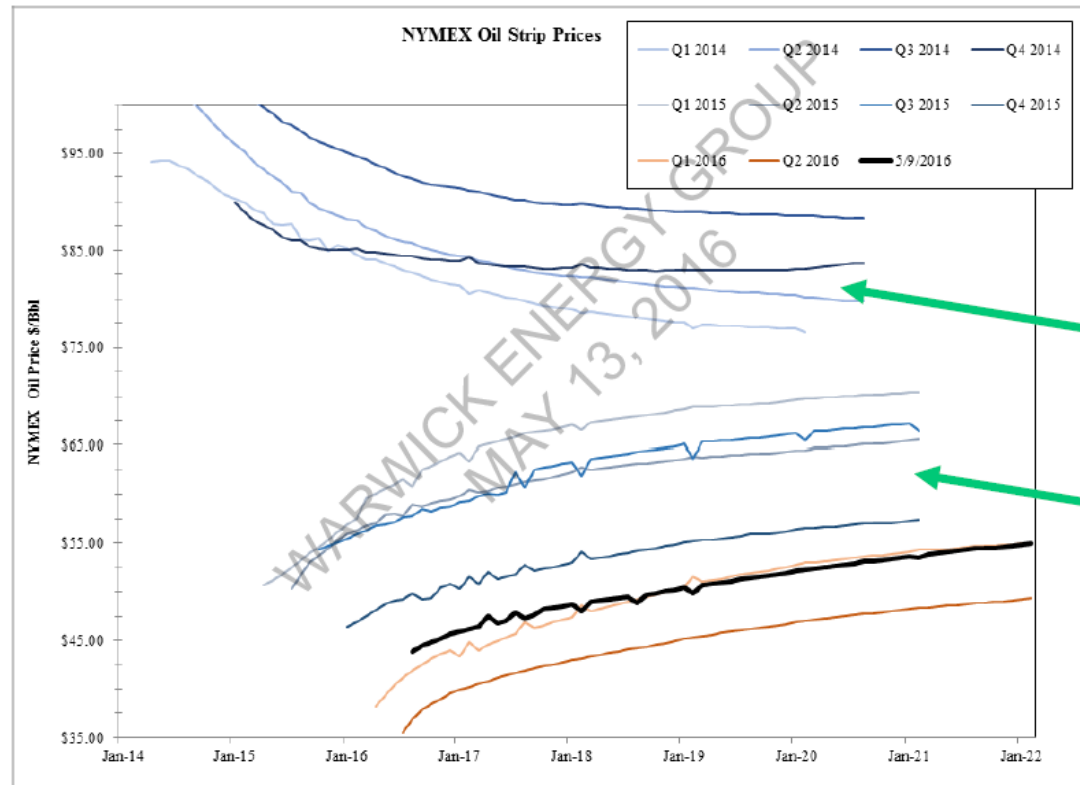


- Contango and backwardation are terms describing the **shape of the futures curves**
- Normally futures curves show prices for contracts for each month in the future
- **Contango**: market is predicting higher prices in the future
- **Backwardation**: market is predicting lower prices in the future
- **Flat**: market is predicting flat prices in the future relative to today

Contango Now, Backwardation before



Crude Price Movement Since 2014



Backwardation in
2014 and H1 2015

Contango in
H2 2015 and 2016

Financialization of Crude Futures



Selection tool for text and images

Financialization of Crude

- Without even the inclusion of options on futures, the other more than two dozen futures contracts that trade oil nor the over-the-counter market, **the six primary energy vehicles that transact business on the NYMEX and ICE have traded an ~3 billion barrels per day so far in '16**
- **That daily flow is more than 30-times the rate of global oil demand forecast for '16, and it's the highest multiple of activity ever witnessed.**
- "Paper barrels" warrant discussion partly owing to the fact that oil's *financialization* is, at times, a meaningful component of crude's trading activity
- Keys market sentiment

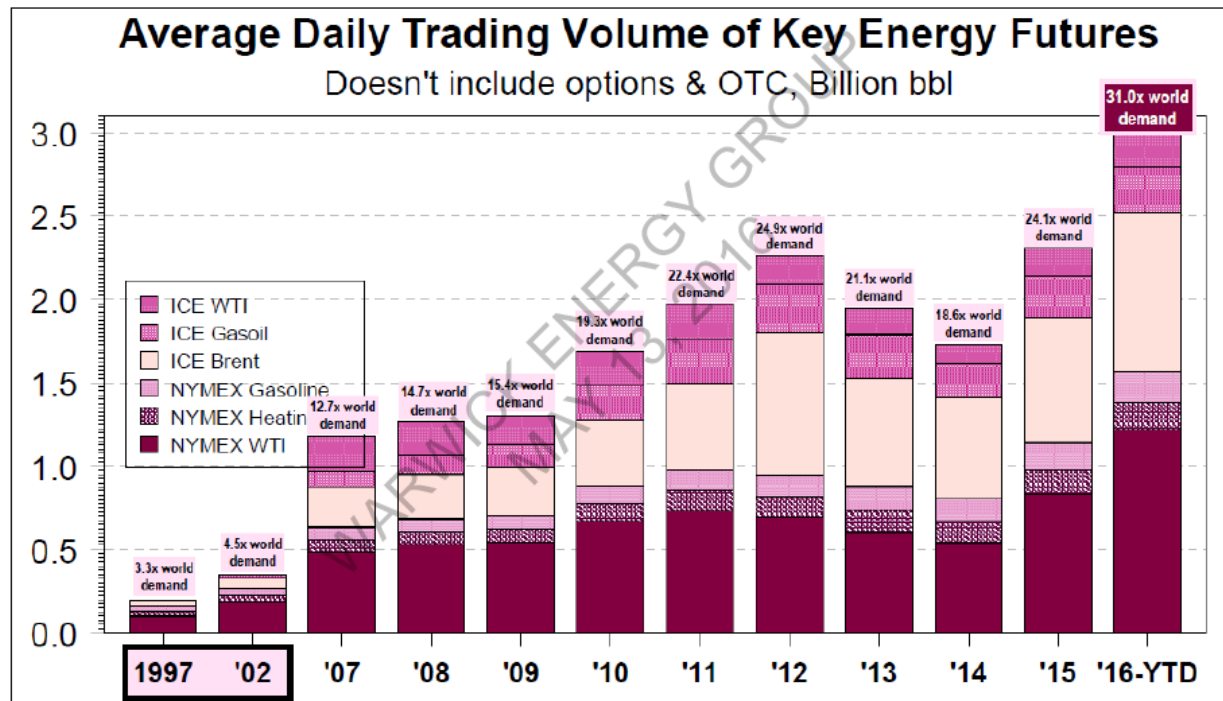
WHY THIS MATTERS

- Number of data points over the past few months suggesting the global oil balance is tighter than has been generally believed
- Growing prospects that supply/demand variables such as the contraction we are seeing in non-OPEC output portend eventual pressure on available supply


Paper Market 30x larger than actual



Paper Market for Crude vs Physical Market 30x Larger (!!!)



Oil Storage Trade






 Investors can choose to take profits or losses prior to the oil-delivery date arrives. Or they can leave the contract in place and physical oil is "delivered on the set date" to an "officially designated delivery point", in the United States, that is usually Cushing, Oklahoma. [\[Wikipedia\]](#)

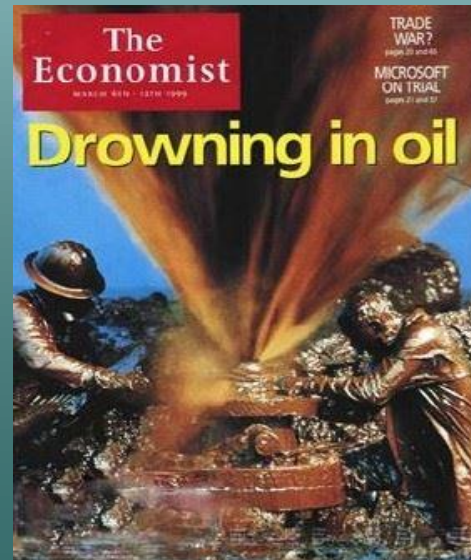
Cushing running out of space



Crude oil storage tanks are seen from above at the Cushing oil hub, appearing to run out of space to contain a historic supply glut that has hammered prices, in Cushing, Oklahoma, March 24, 2016. REUTERS/Nick Oxford



Drowning in Oil

-  ***Cushing reaching or has reached capacity, causing bottlenecks and an oil glut***
-  ***Facilities full around the country***
-  ***Oil Tankers full with no where to deliver it***
-  ***Most Refineries in U.S. set up to process heavy crude, not light crude, no where for oil to go***
-  ***How did this happen?***






North American increased production and Oil Export Ban

Nixonian Era Oil Export Ban

-  Light Sweet Crude could not get to refineries around the world to process it. U.S. refineries mostly refine heavy oil.
-  Local operators had to sell oil at a discount to world market prices.

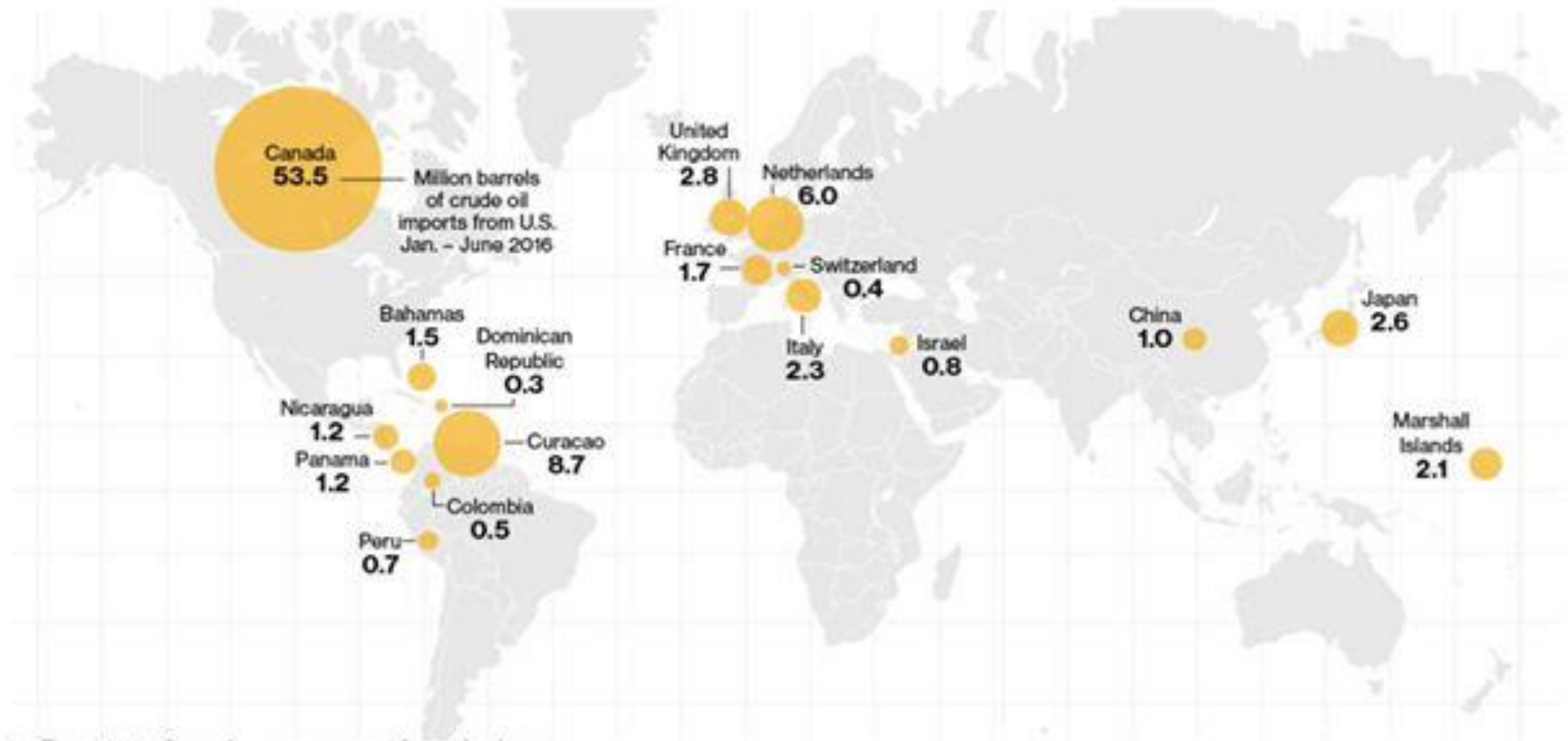
Ban lifted in December

-  Took 2.5 years of lobbying in Washington.
-  Harold Hamm, CLR CEO, spearheaded effort.
-  Argument: Iran's export ban is being lifted, how about letting U.S. export oil also.

Oil Export Ban Lifted

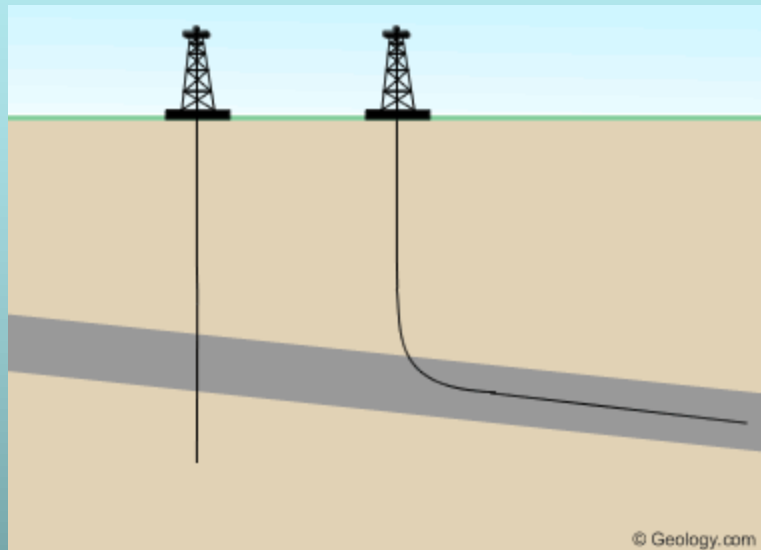
U.S. Oil Reaches the World

The U.S. has exported 87 million barrels of crude oil since a ban on exports was lifted in December.

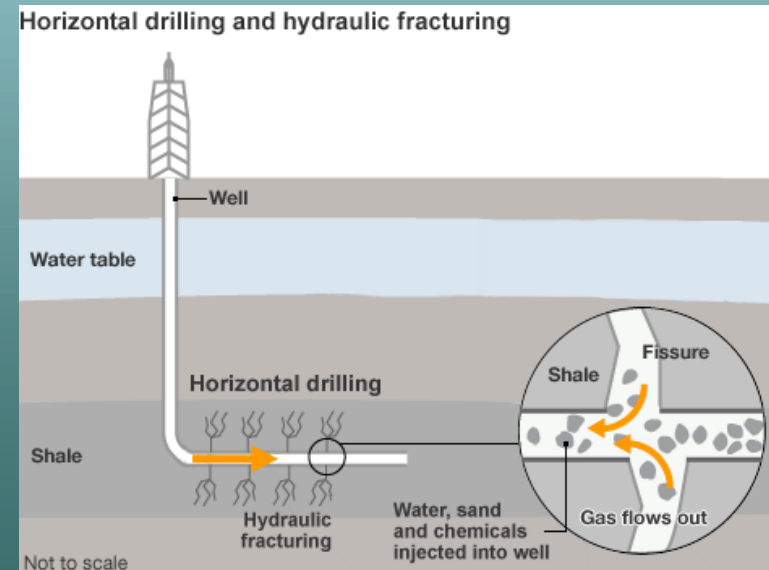
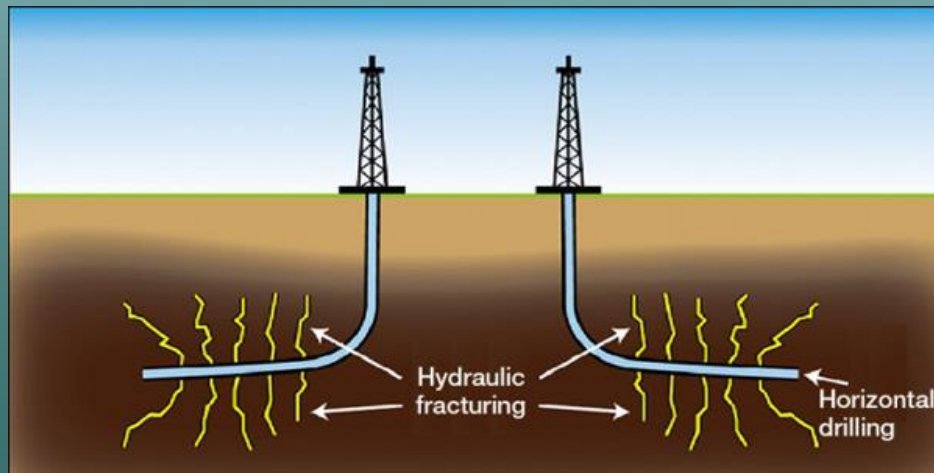


Note: Exports to Canada were exempt from the ban
Source: U.S. Census Bureau

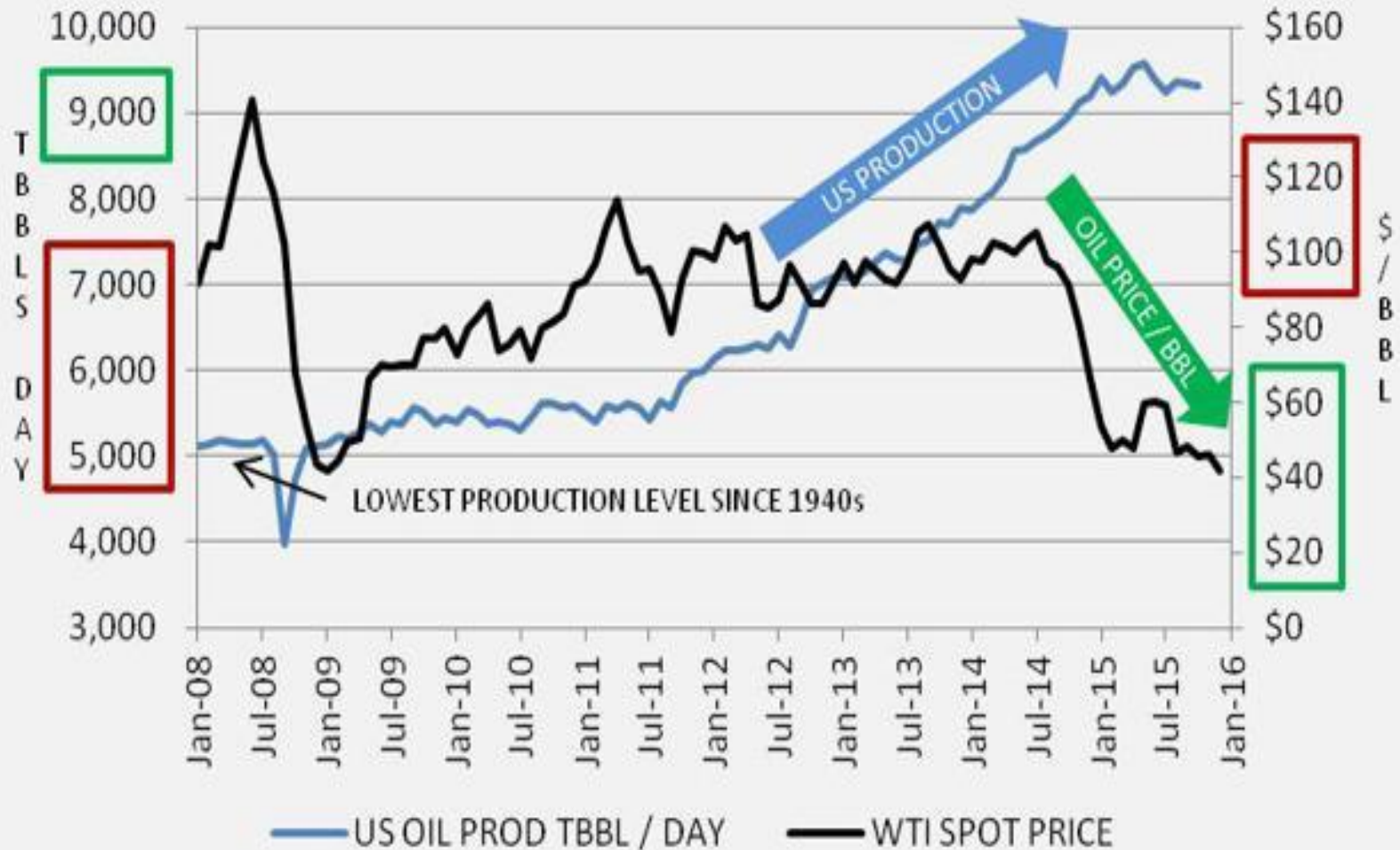
How did North America increase production so rapidly?



Horizontal Drilling &
Hydraulic Fracturing
Led to Oil industry
“Renaissance Period”



US Production Ramp Up Price Fell From Oversupply



Graph by Author using EIA oil production and price data (12/10. 2015)

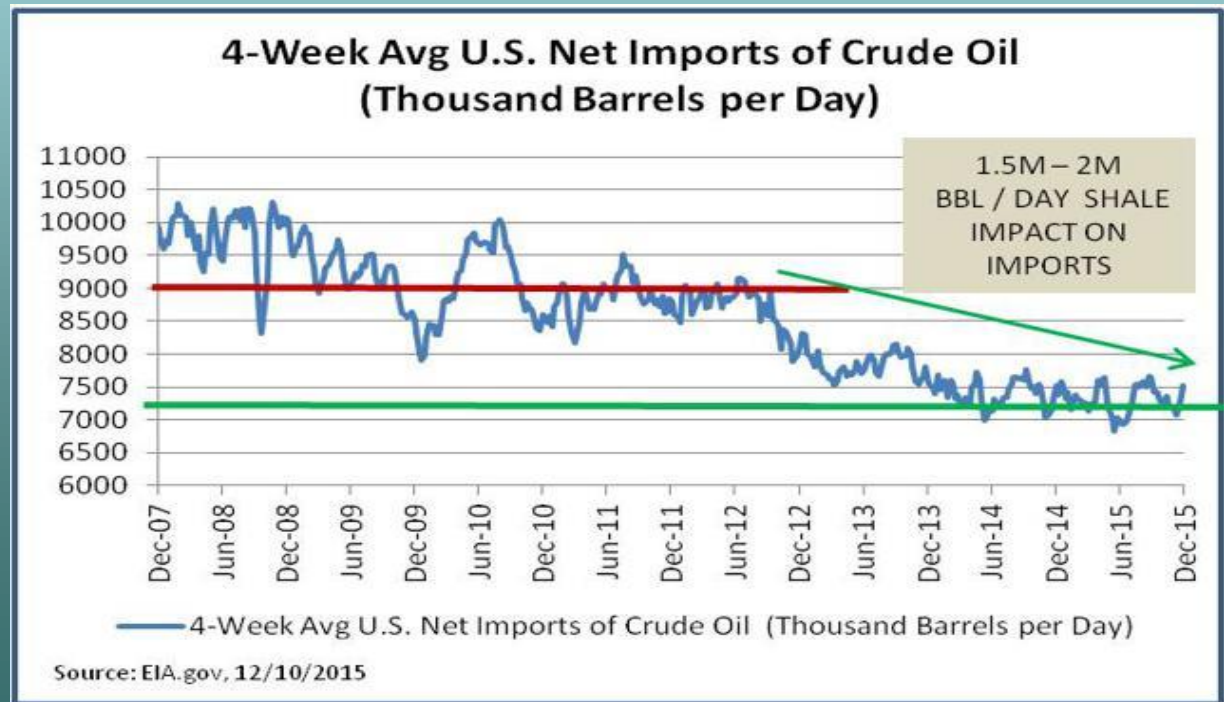
Step toward “Energy Independence”

🔥 Price Fell

🔥 From \$100 barrel to \$30 barrel.

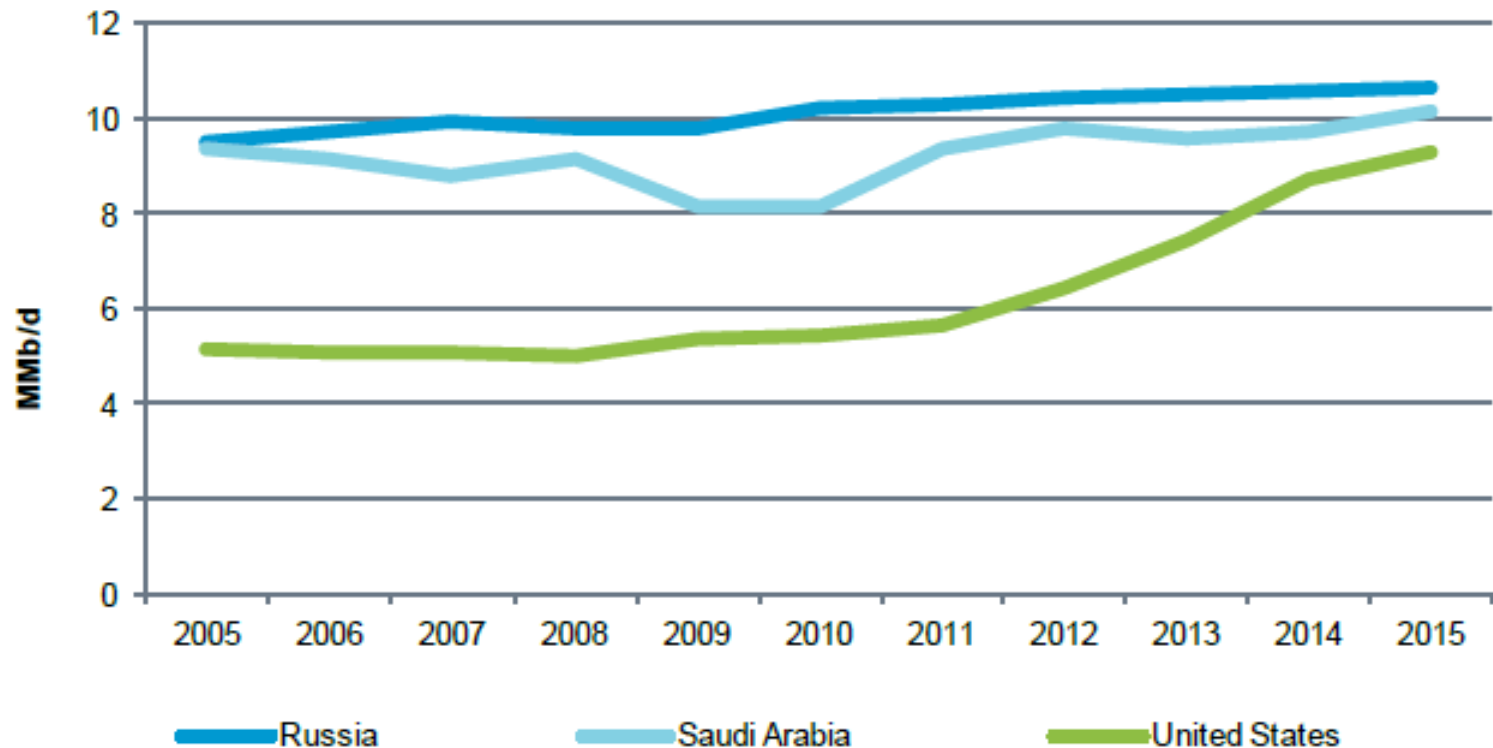
🔥 ~\$4.00 to \$1.30 a gallon at pump.

🔥 Less imports from OPEC and other countries.



U.S. almost became biggest Oil Producer

Russia, Saudi Arabia, and United States oil production



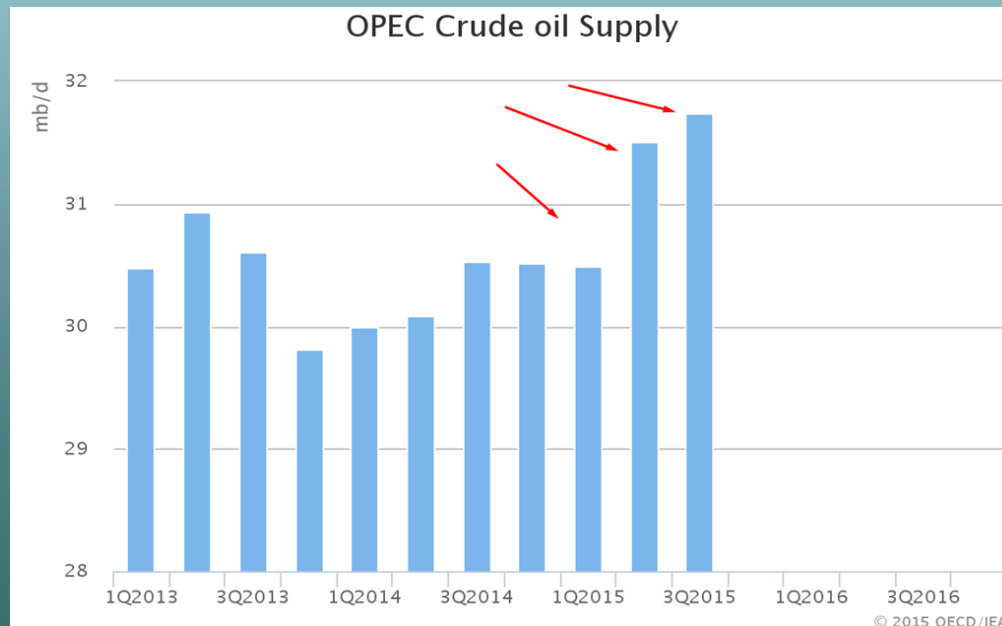
Notes: Data are annual. For the United States and Russia, production data includes condensates in addition to crude oil. For Saudi Arabia, the production data are for crude only and include 50% of Neutral Zone production. In all cases, the data do not include natural gas liquids. 2015 data are estimates.

Source: IHS

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Saudi Arabia Responds

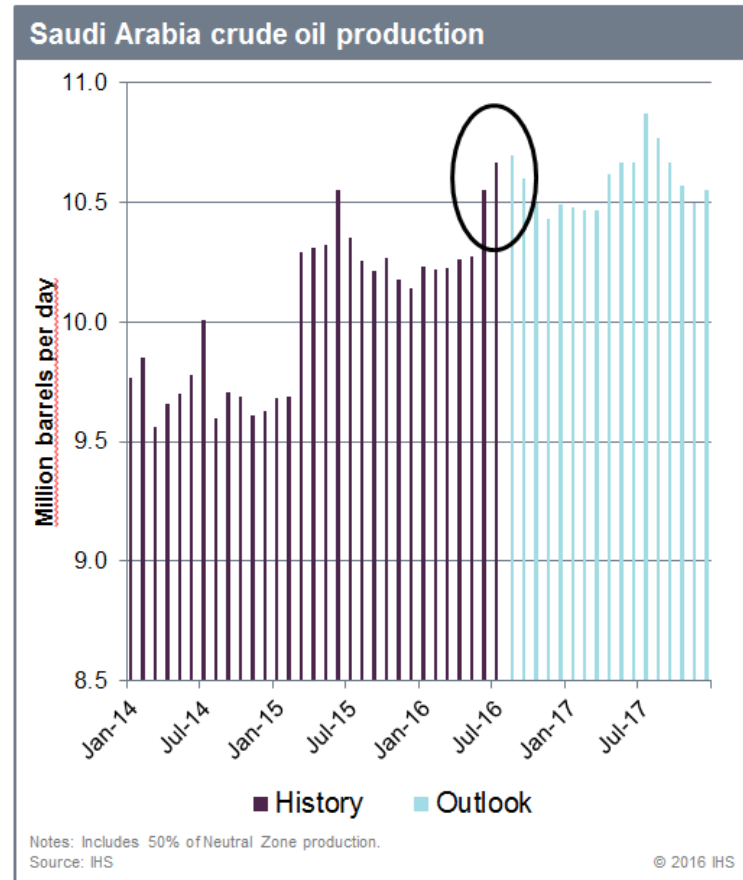
- 🔥 Saudi Arabia has been “swing producer”
 - 🔥 Keeping oil at about \$100 barrel last few years by increasing or decreasing supply.
 - 🔥 Losing market share to U.S., responds by increasing production instead of decreasing.
 - 🔥 Oil price falls further.



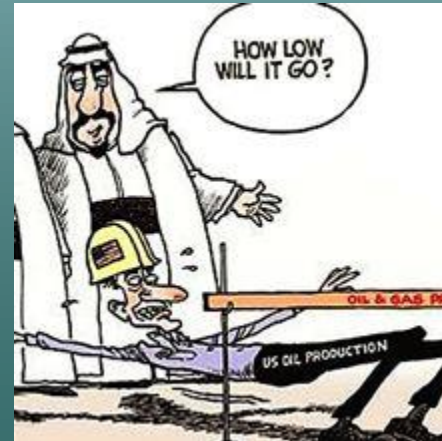
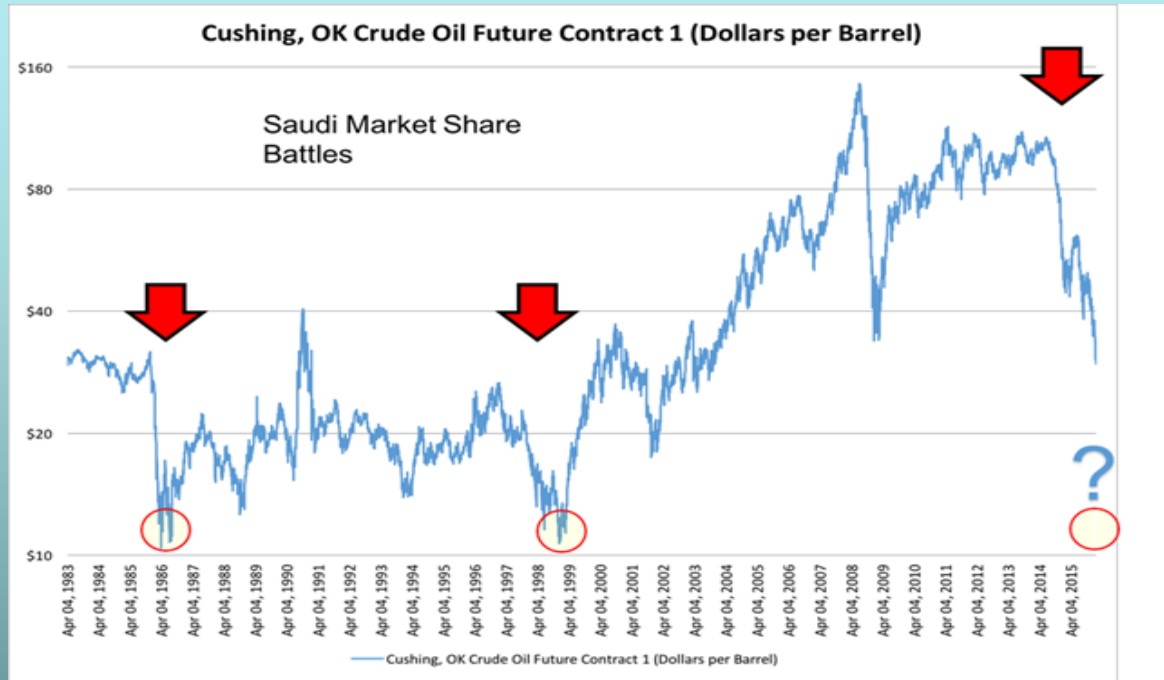
Saudi Arabia Oil Production

Saudi Arabia has stepped up crude oil production; output reached a record 10.67 MMb/d in July






- Record high Saudi output last month was primarily the result of greater demand for crude domestically for power generation amid an unusually hot summer, as well as to supply domestic refineries and provide full contract volumes to term customers.
- Intentionally or unintentionally, record high Saudi output likely signals to Iran that Saudi Arabia will keep production high following the sharp post-sanctions rise in Iran's output.
- Our outlook anticipates continued high Saudi crude production for the rest of the summer, with only a moderate step down in subsequent months under the assumption that Saudi Arabia will increase output as world demand expands.
- Next summer, we project that Saudi output will reach just under 11.0 MMb/d, with the likelihood it will exceed this level in the summer of 2018 if the new 400,000 b/d Jizan refinery enters service by then. Global spare capacity would then be under 1 MMb/d.



Saudi fights to keep Market Share



Trillion Dollar Mistake by Saudis

-  Kept their market share, but....
-  OPEC lost trillion dollars so far after decision not to cut production.
-  Might pay off in the long run, but it will be many years.
-  Did not kill U.S. production, just made operators cut costs, reduce capex, etc..
-  Hurt their competitors (Iran, Russia, etc..), but also hurt friends in OPEC.

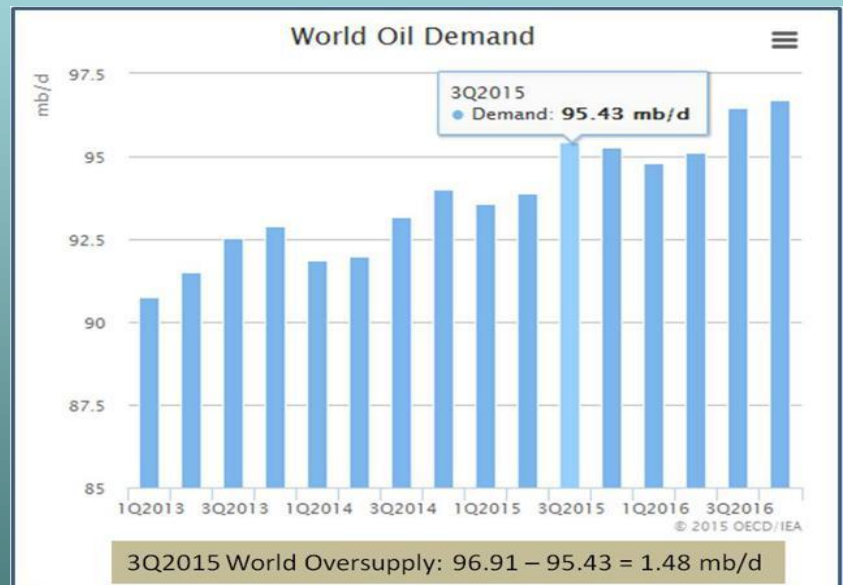
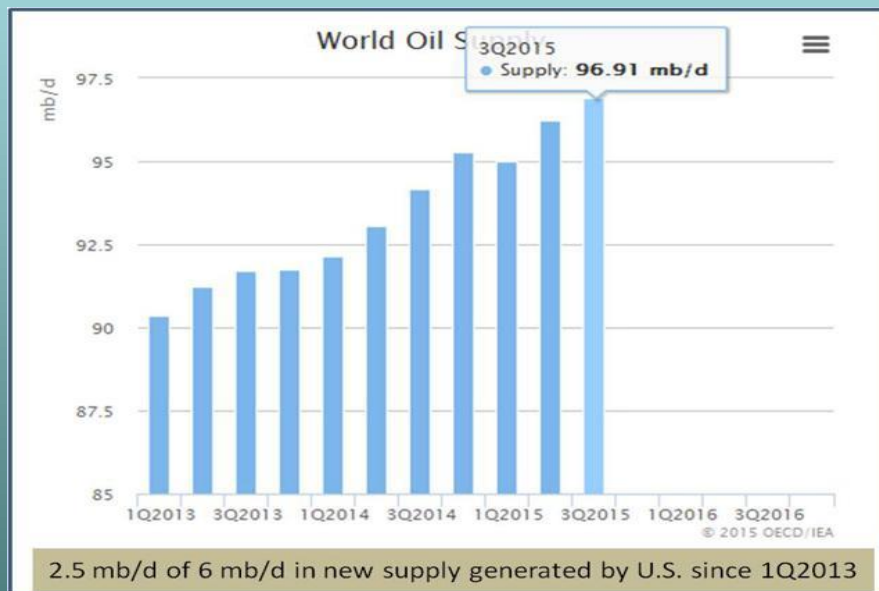
Decision by Saudis created volatile market place for oil since 2014. Oil price subject to wild swings depending on what is happening worldwide.



World Oil Supply & Demand

🔥 U.S. has 42 % of new production last two years.

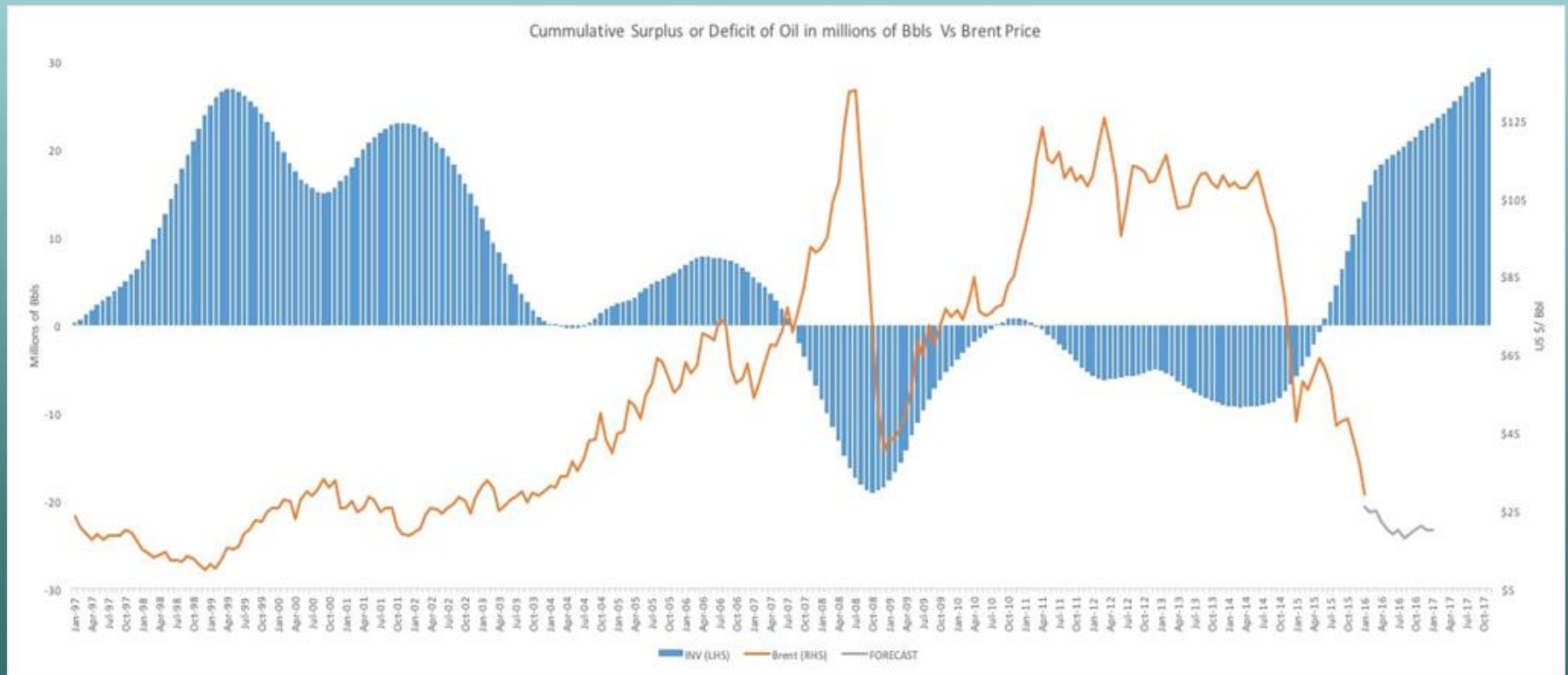
🔥 Market oversupplied by 1.5 M Barrels.



World Oil Supply & Demand

🔥 Surplus vs. Deficit since 97 through 2017

🔥 Large Surplus now and near future



Oil Price Collapse, Victim of Success?








Winners and Losers Worldwide

 Positive: Short term boost to economy.

 Consumers pay less at pump.

 Oil is so cheap even pirates aren't stealing it anymore.

Winners and Losers Worldwide

-  Negatives: Shows weakness in world economy.
-  Thousands of Layoffs.
-  Many companies going bankrupt.
-  Budget shortfalls for oil producing states and nations.
-  Billion dollar shortfall for Oklahoma.

Story for many households



Winners and Losers Worldwide

World's largest producers

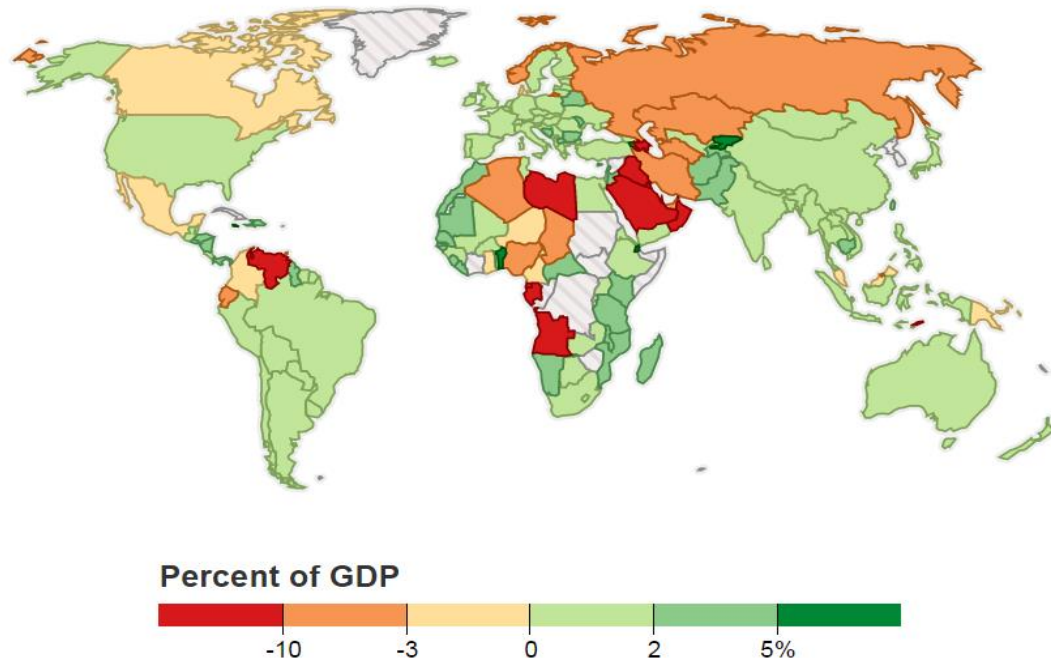


Winners and Losers Worldwide

🕯 Some countries totally dependent on oil for GDP .

Oil's Fall: Winners & Losers

As crude prices plunge to a five-year low from above \$108 a barrel in June, oil importers will save on their energy bills while exporters will lose revenue. Here's the annualized value of those gains and losses, expressed in percent of GDP:



Source: Rhodium Group, EIA and IMF

Created with [Datawrapper](#)

Countries Hurt by Low Price of Oil



Venezuela



Iran



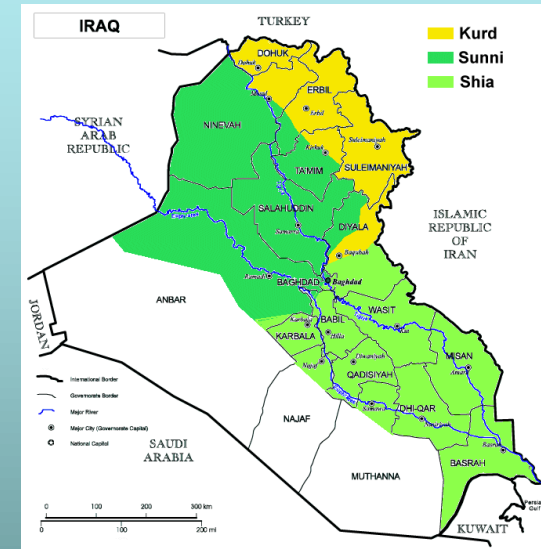
Saudi Arabia



Russia

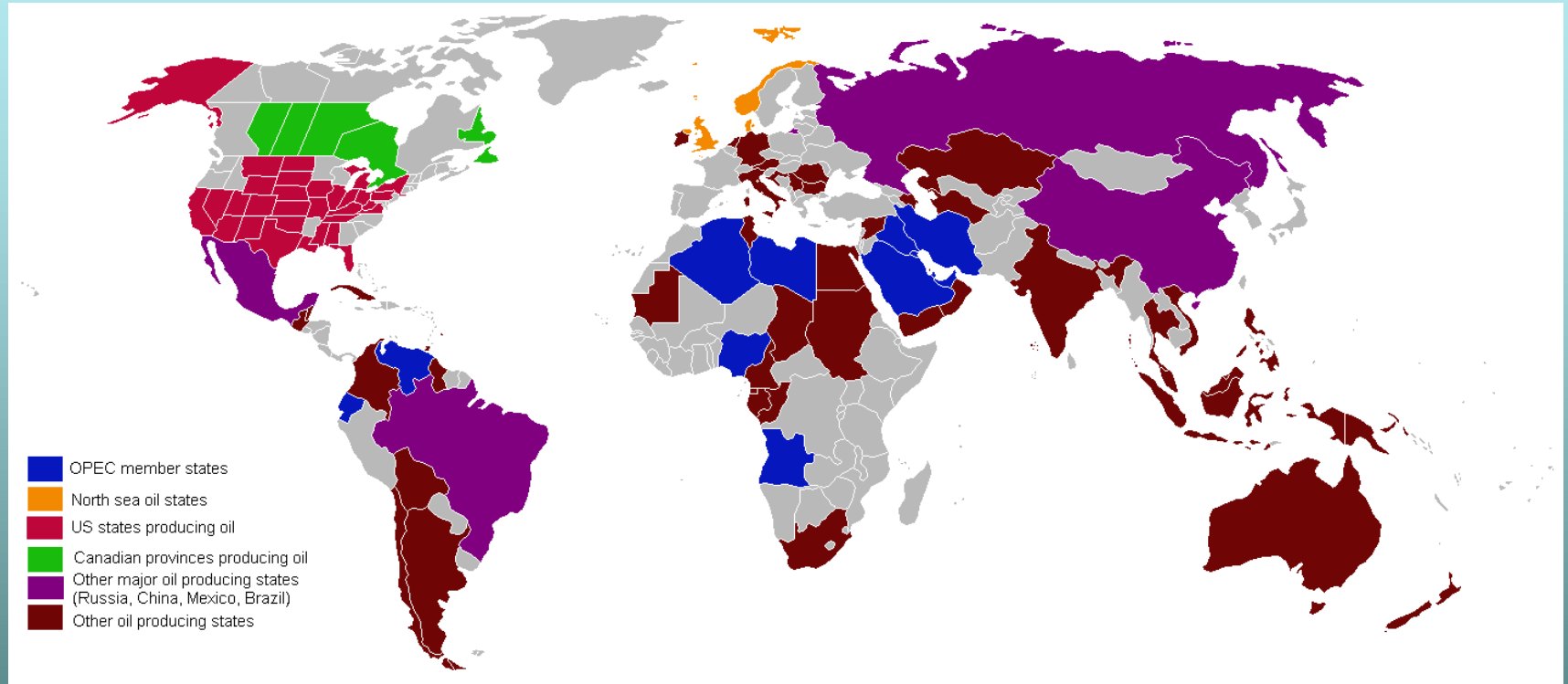


Iraq

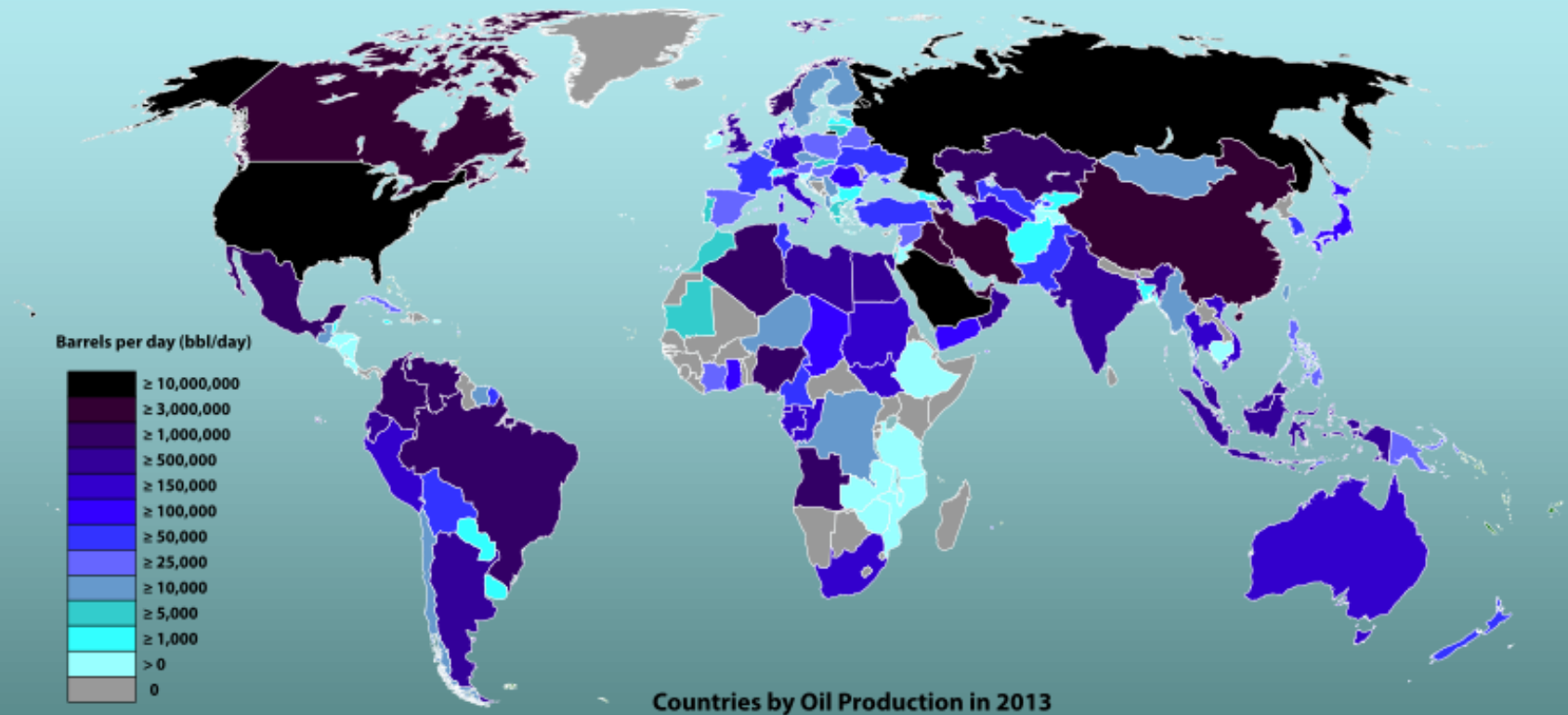


US States Producing Oil

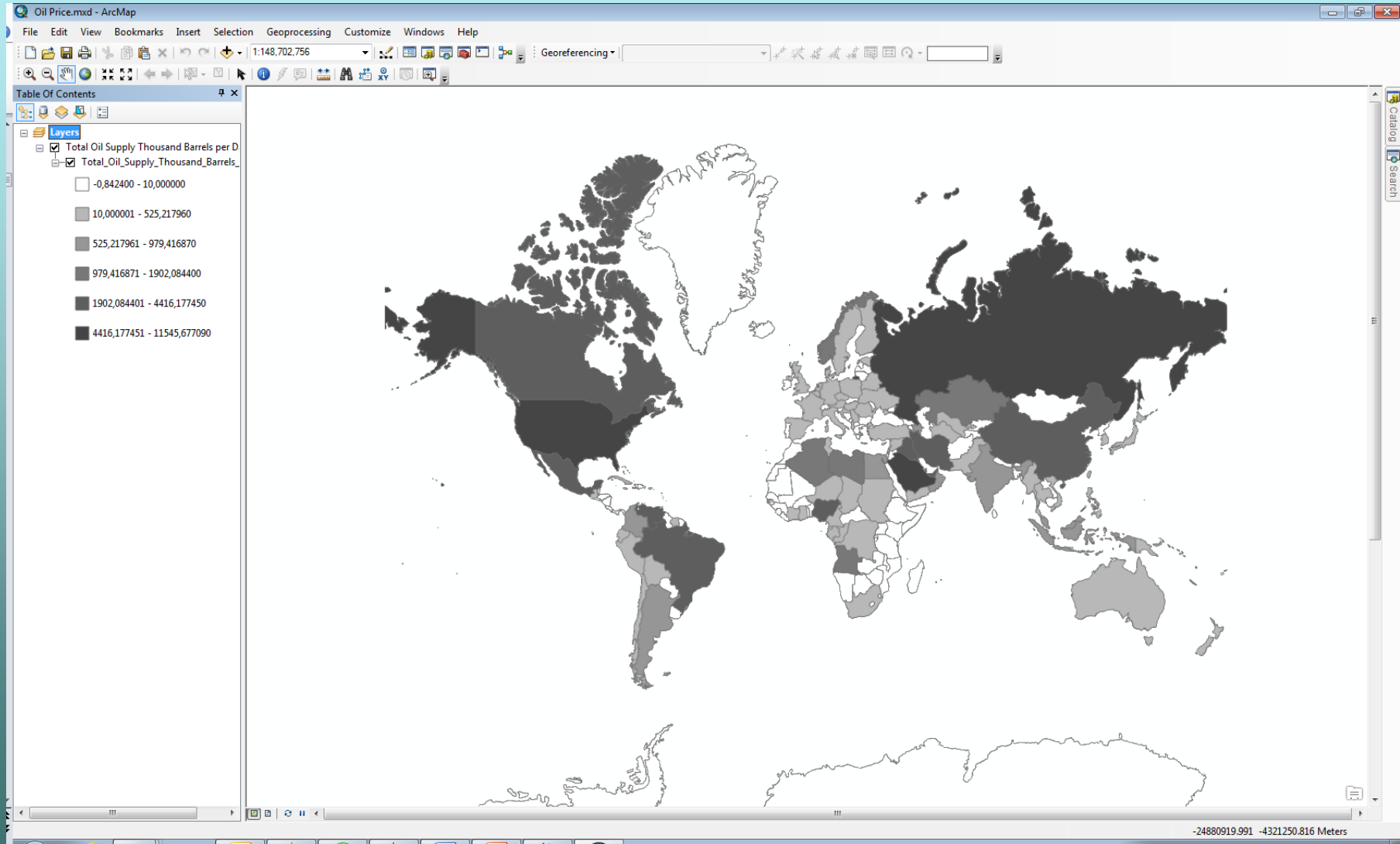
Oil producing Countries



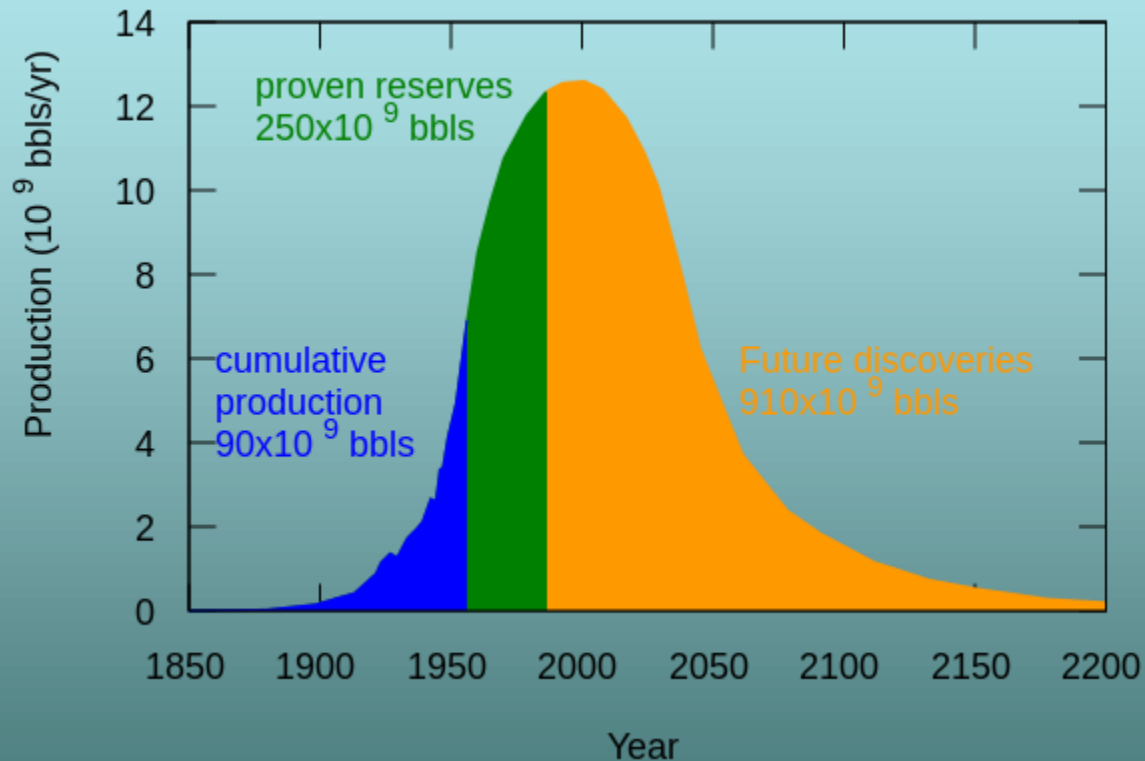
Countries by Oil Production



Total World Oil Supply




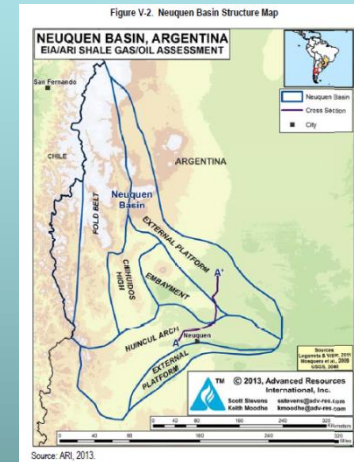
Conventional Peak Oil Theory





Up and coming big shale producers

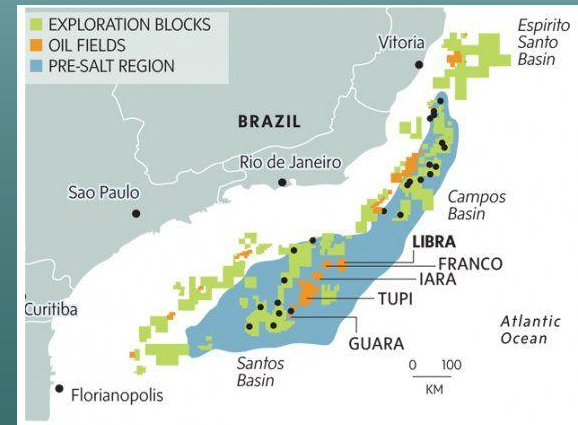
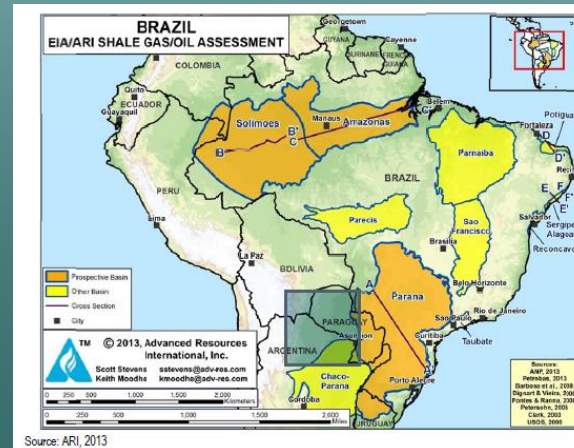
Argentina

-  Argentina made the third largest shale discovery in the world in Patagonia in Neuquen Basin called the Vaca Muerta Shale.

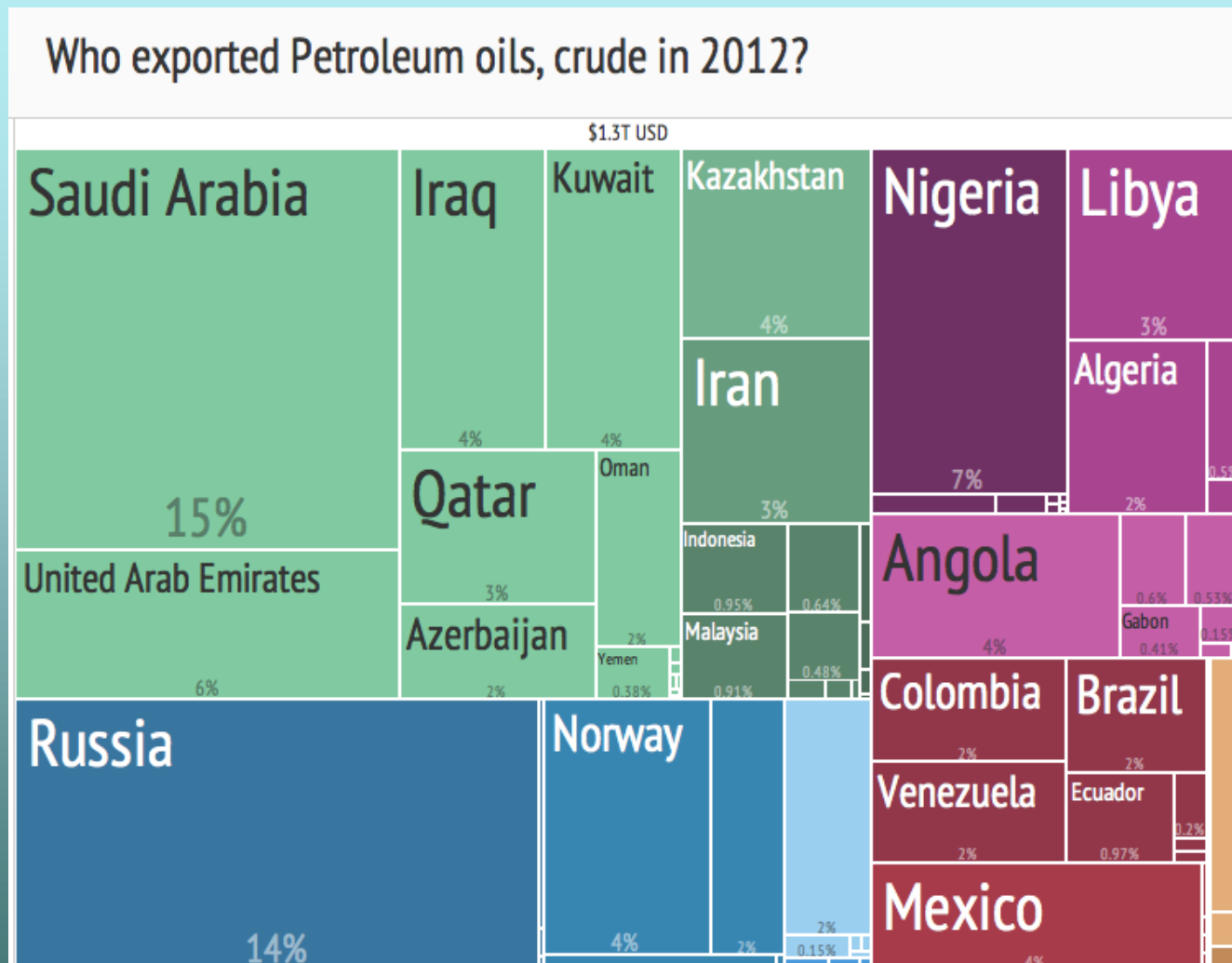


Brazil

-  Brazil to quadruple production by 2020
-  Oil discovered offshore under mineral salts under ocean, large reserves onshore



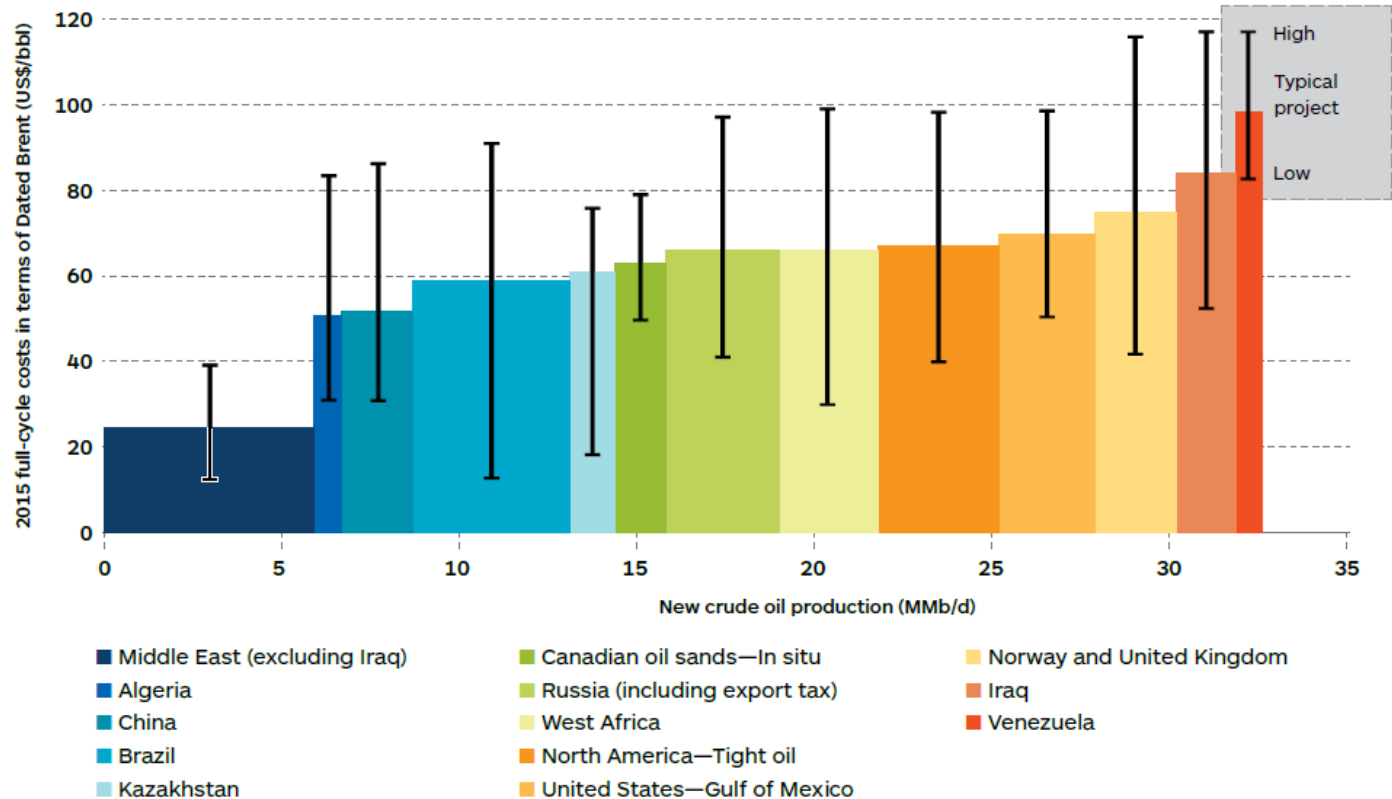
Exporting Countries



Crude oil export treemap (2012) from Harvard Atlas of Economic Complexity [110](#)

Cost of Producing Oil around the World

Cost curve of projected new crude oil supply to 2030 (2015 cost structure)

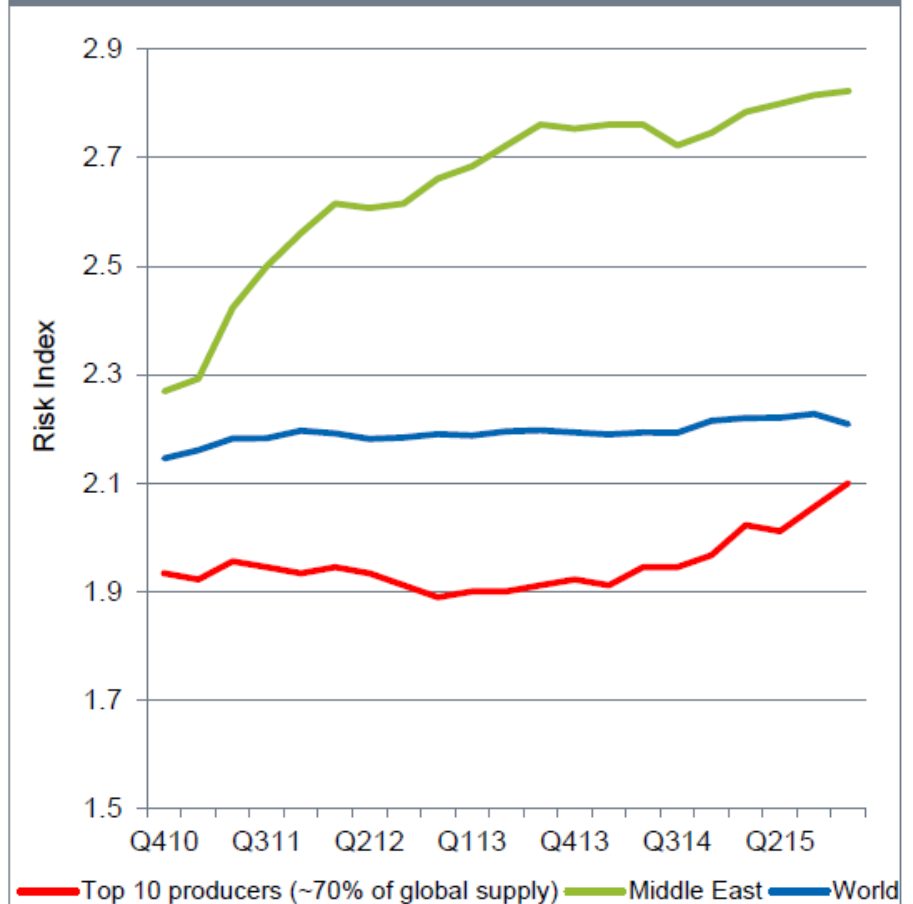


Note: This cost of oil is expressed by the Dated Brent price necessary for projects to "break even," assuming a 10% IRR. The break-even cost estimates are for greenfield projects. The low- and high-cost projects are chosen from among the approximately 700 that IHS has modeled or our cost of oil analysis. For North American tight oil, the cost estimates are for subplays. The supply outlook is consistent with the IHS 2015 Global Crude Oil Markets Annual Strategic Workbook, released in April 2015. For each region, the supply additions are gross additions in 2015–30, which are calculated by summing the maximum annual production of fields under development (FUD), of fields under appraisal (FUA), and of yet-to-find (YTF) categories for the areas. Exceptions are North American tight oil, the tight oil components of other producing areas, and Canadian oil sands, all of which are simple net additions. The break-even cost estimate for in-situ Canadian oil sands is based on a steam-assisted gravity drainage (SAGD) project. The break-even cost estimate for Iraq is high owing in part to the security risk to operations; payment of a hazard premium to skilled workers and engineers; and the added cost of building required new oil infrastructure. The Middle East includes Saudi Arabia, Kuwait, Neutral Zone, United Arab Emirates, Oman, Iran, Qatar, and Bahrain. West Africa includes Nigeria and Angola. Break-even costs for groups of countries are weighted by volume. See Appendix A for details on how the cost curve was constructed.

Geopolitical risk around the world

- 🔥 Risk increase since downturn.
- 🔥 Reduced revenues for oil producing governments.
- 🔥 Financial tension exacerbates geopolitical risk.

Geopolitical Risks for Oil Markets Rising



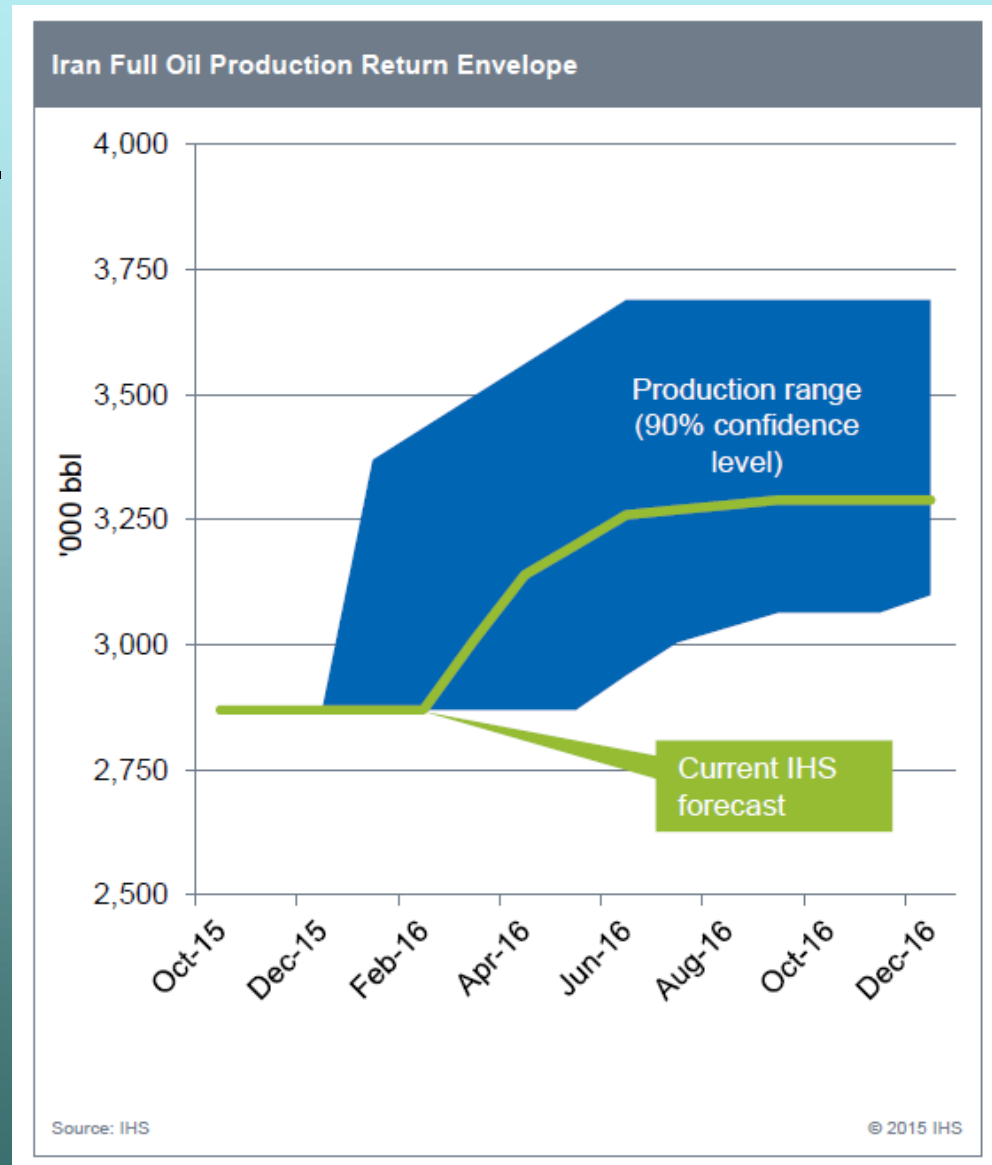
Source: IHS

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The risk index is from IHS' Country Risk team and is assessed quarterly. Scores range from 0 to 10, with anything above 3 considered high risk.

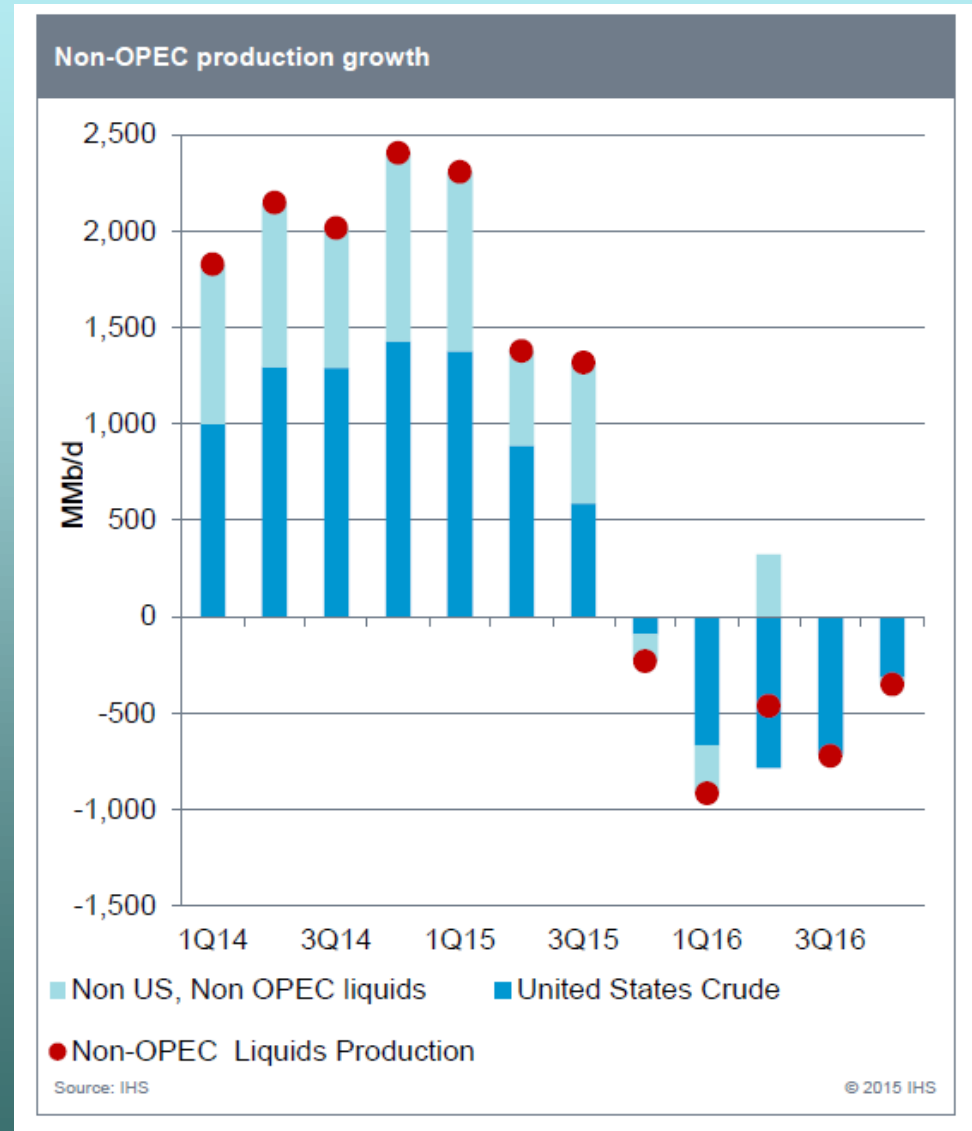
Iran production increase

- 750 M BBL new supply in 2016.
- Competition with Saudi Arabia for buyers in Europe, Asia.
- Market share battle between Iran, Saudi Arabia and Russia.
- As of August Iranian production at 3.63 BBL.



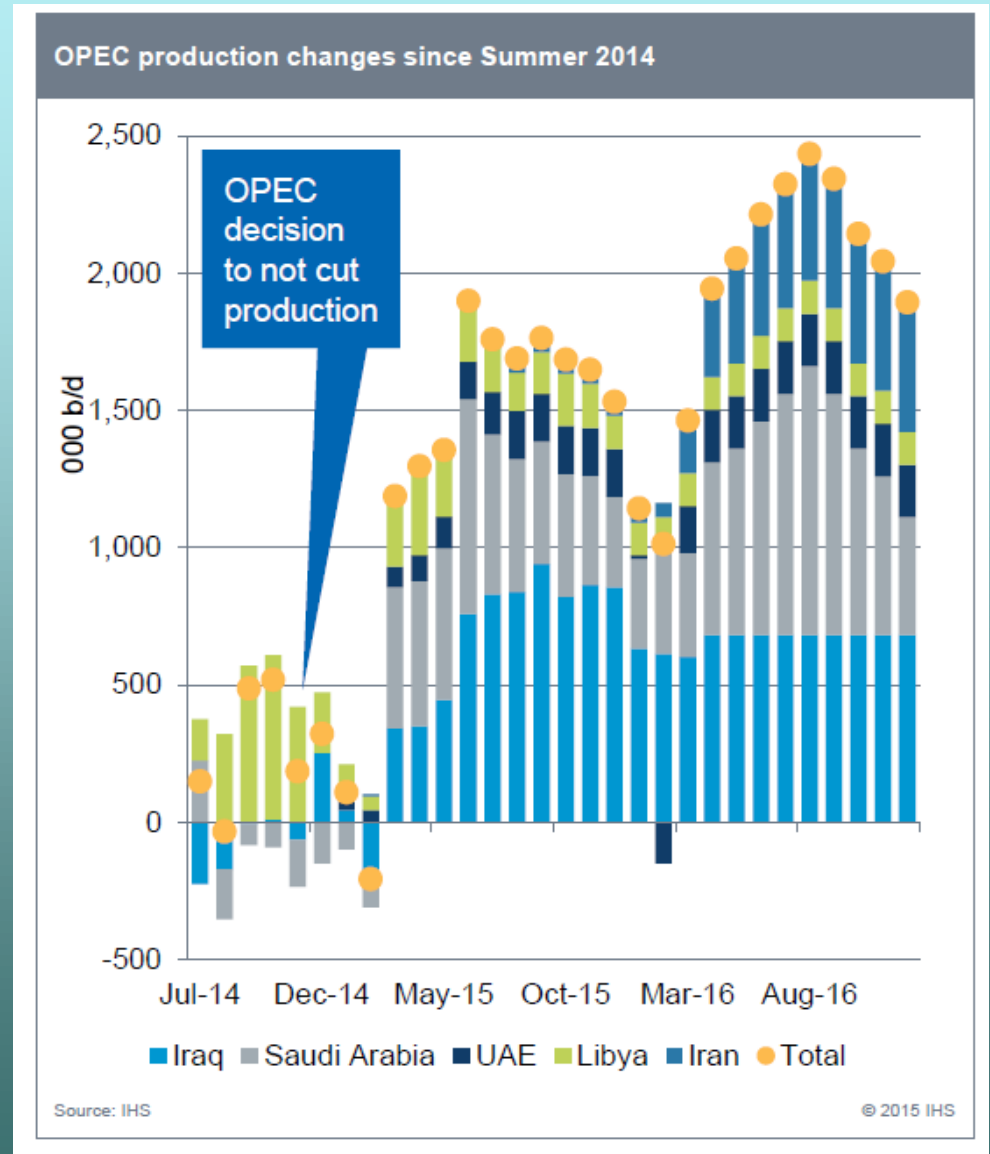
Non-OPEC production growth

- 🔥 U.S. production resilient from efficiency gains .
- 🔥 Mindset of produce as much as possible to make up for low oil price.
- 🔥 Lower production overall in 2016, but not enough to make up for oversupply.



OPEC production changes

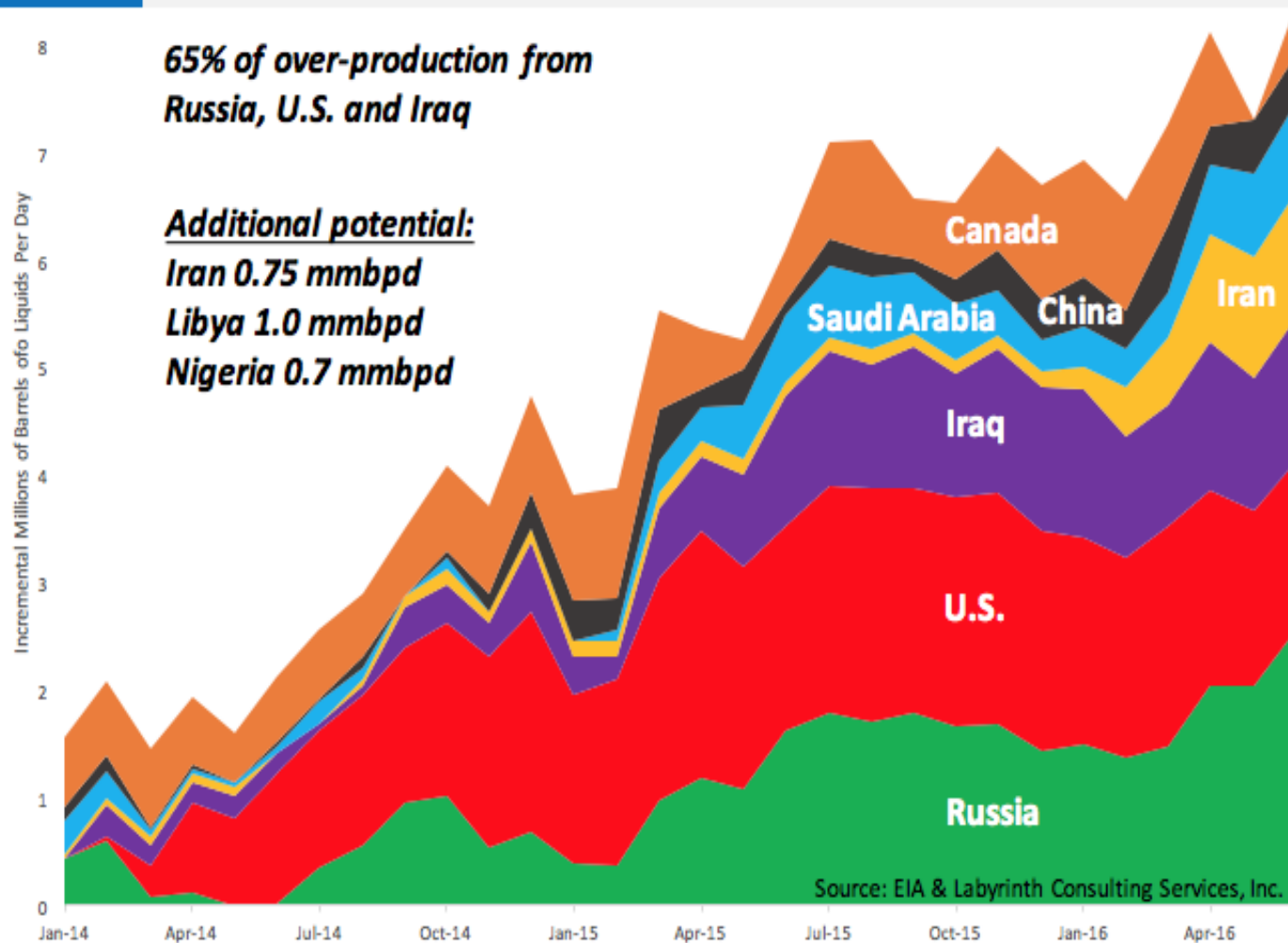
- 🔥 OPEC decision still the same
Unlikely to change in 2016.
- 🔥 Saudi government has had many leadership changes adding to uncertainty.
- 🔥 Saudi willing and able to manage lower revenues.



Biggest contributors to glut

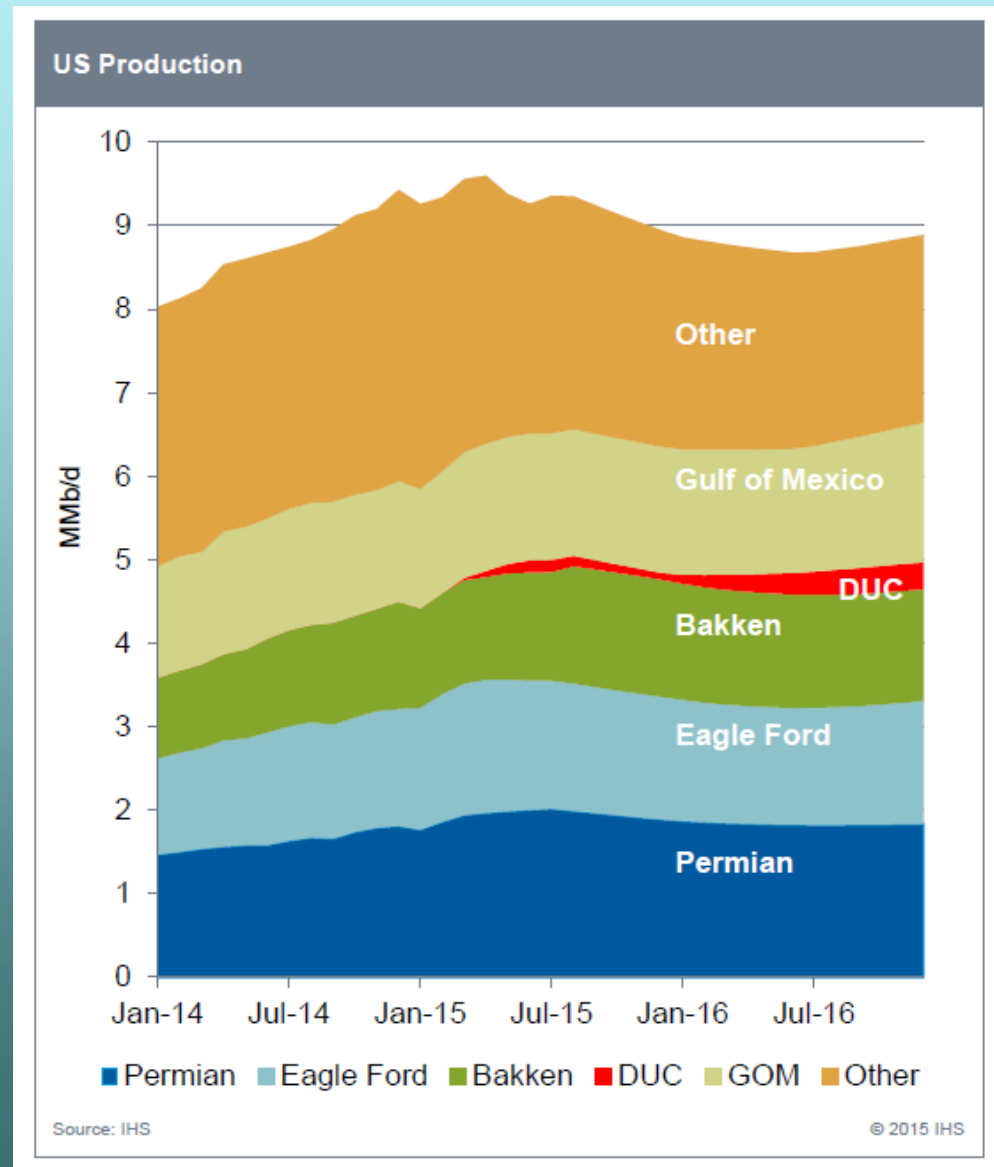
**August
2016**

Biggest 7 over-producers added 6.8 mmbpd since January 2014



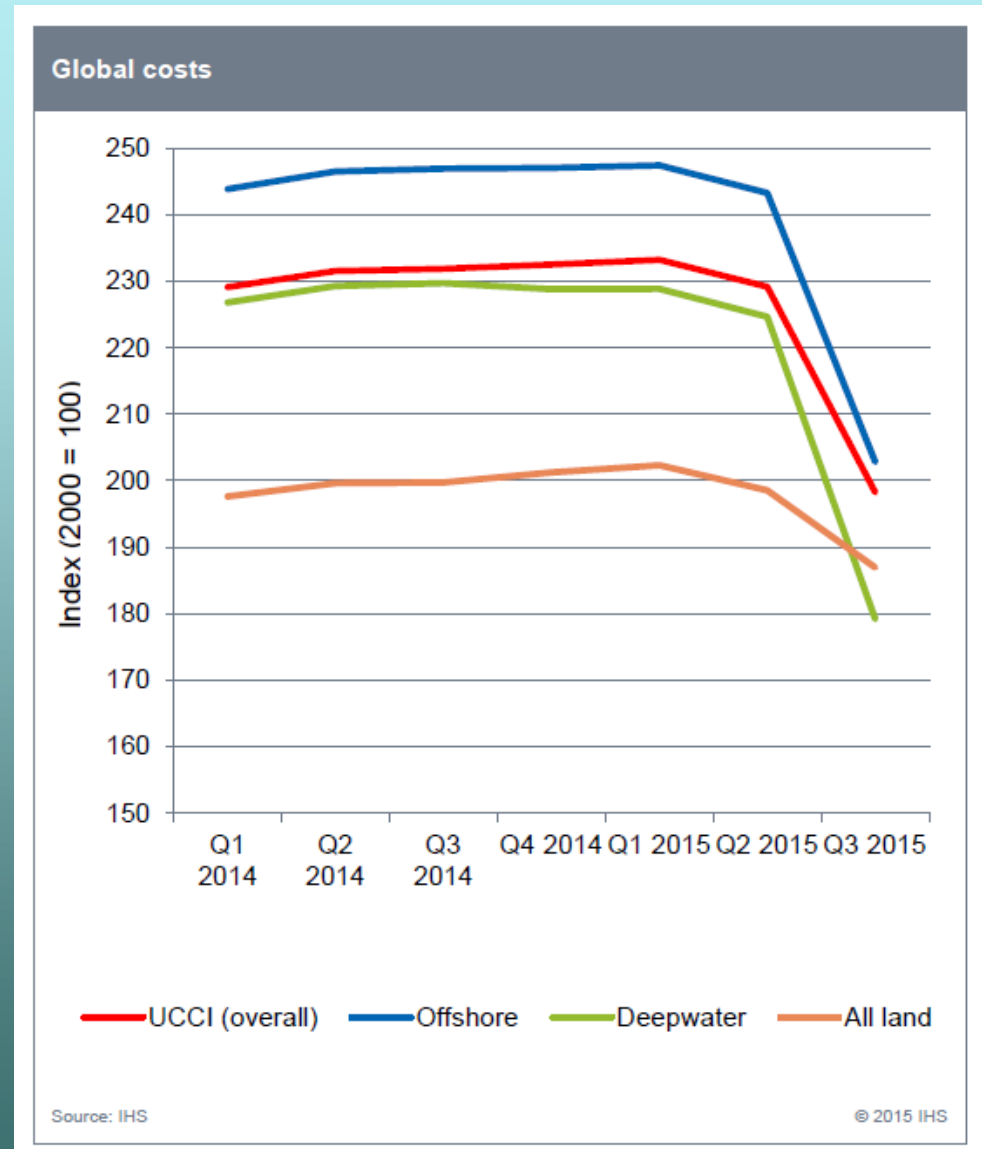
US production

- US production key for global oil markets to balance.
- Industry resilient through cost discipline.
- US production is expected to fall to 8.7 MMb/d this year.



Global costs

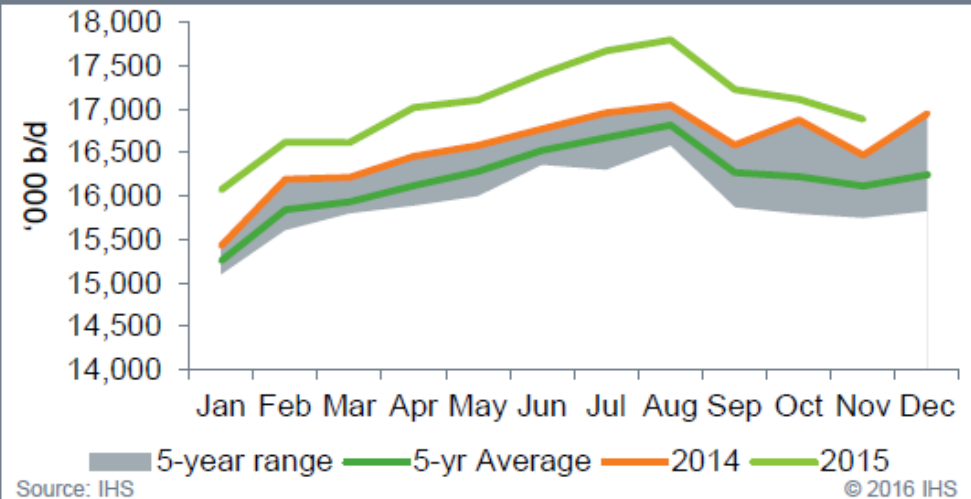
- Costs down 15% in 2015.
- In US many costs down 50%.
- Service companies charging much less, trying to survive.



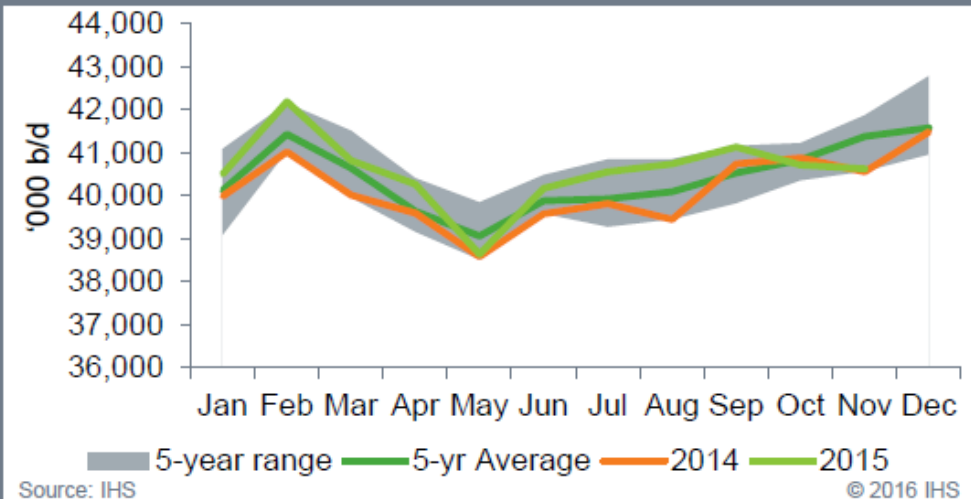
China Oil Demand

- China's economy is slowing down.
- 30% of world demand for oil.
- Focusing on less polluting renewable energy to combat worsening air pollution.
- China is About to go through a Non-Performing Loan Crisis Like Asia Experienced in the 90's and the US Experienced with Subprime Real Estate Crisis.

OECD & China Motor Gasoline Demand



OECD & China Total Products (ex Gasoline) Demand

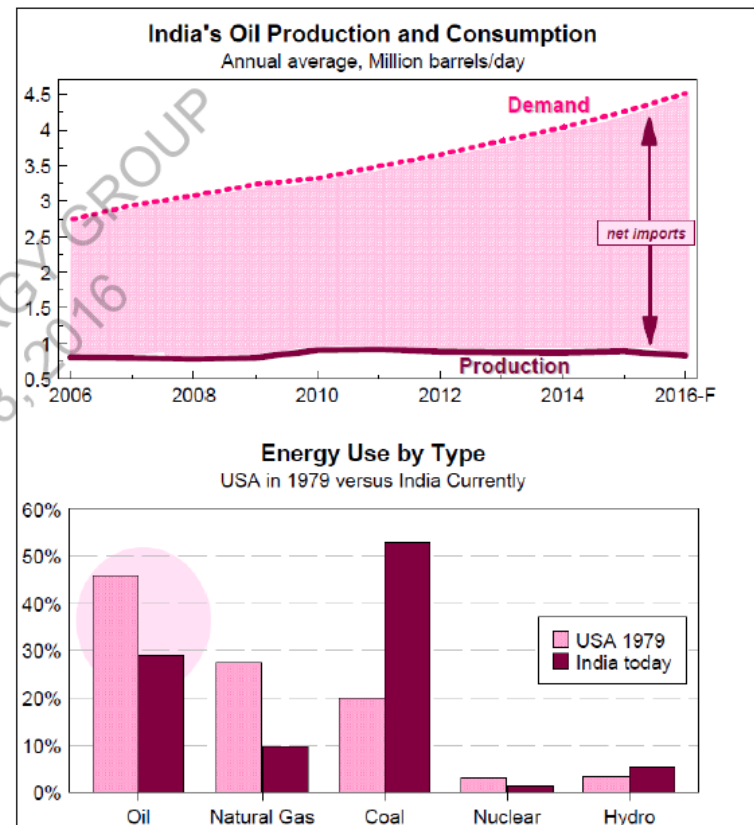


India Oil Demand



India Has Been a Bright Spot for Crude Demand...

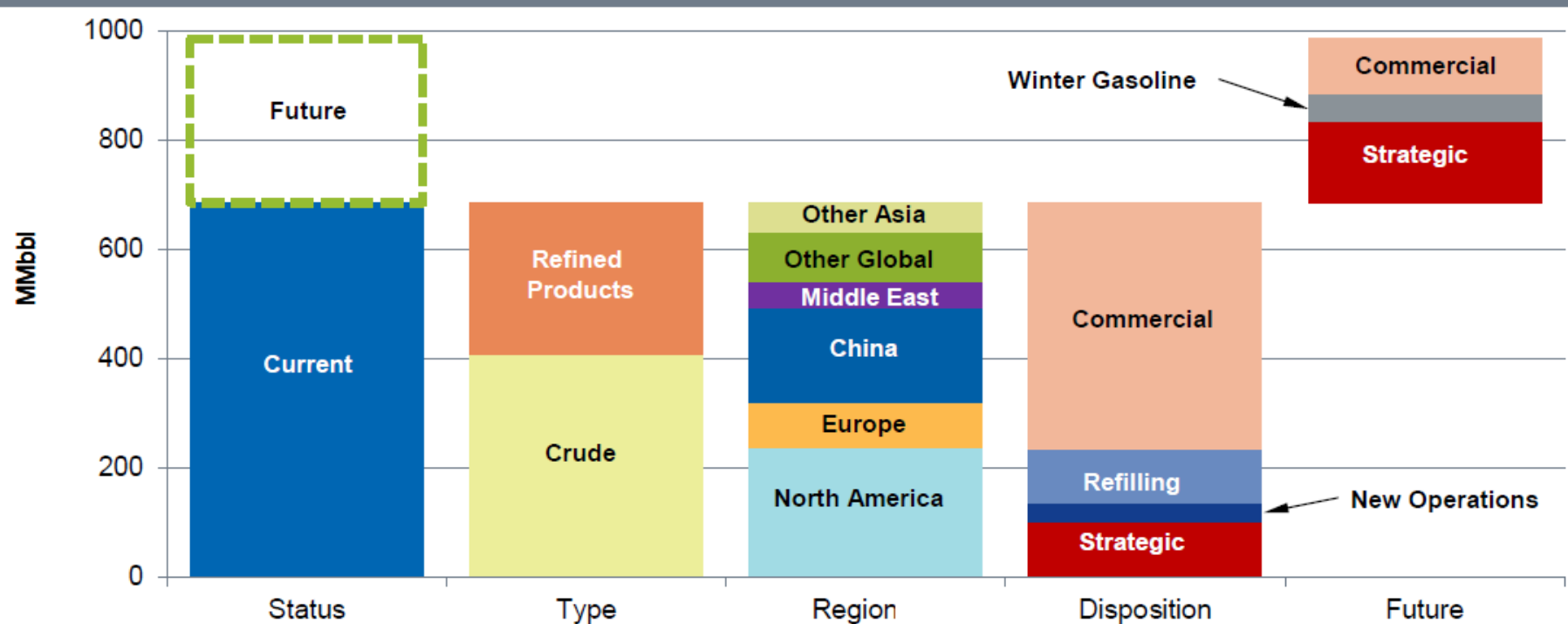
- Non-OECD oil demand is ~53% of global crude demand
- Non-OECD oil demand grew about 45% over the past 10 years
- Most emerging market demand stories over the past year have been about China, but India has starred in the story this year



Global Oil Stock

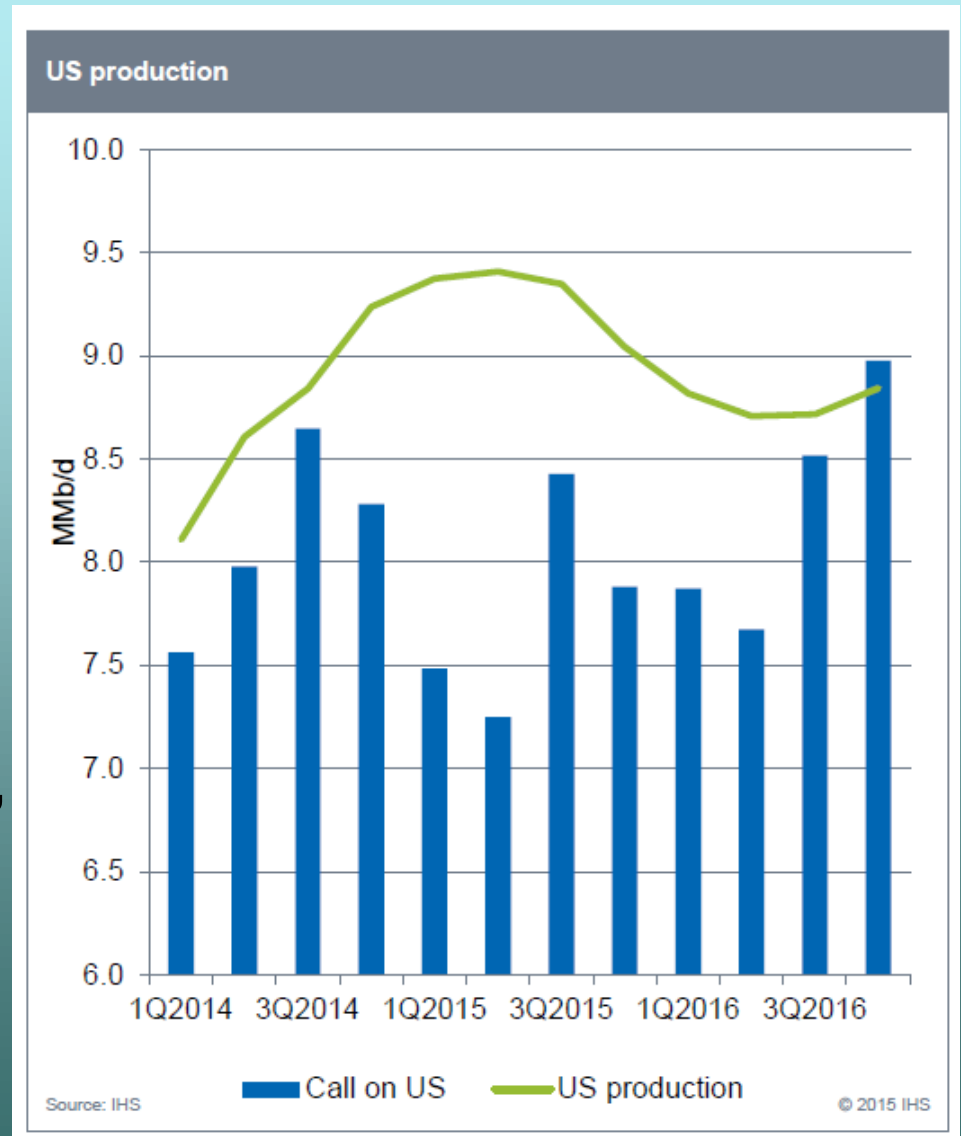
- 300 million more barrels have been added this summer.
- Half of billion barrels is over-supply, the rest is a market price anchor.
- Global stocks and strategic stocks will influence price recovery.

Global stock building Jan 2014 - Jun 2016



US new “swing producer”

- 🔥 US producers can ramp up or slow down at a faster rate than the rest of the world.
- 🔥 IHS prediction that markets will balance in second half of 2016
- 🔥 Takes into account geopolitics, Iranian production, Saudi Arabian production, market share efforts, US production, costs, demand, & stocks.



Predictions

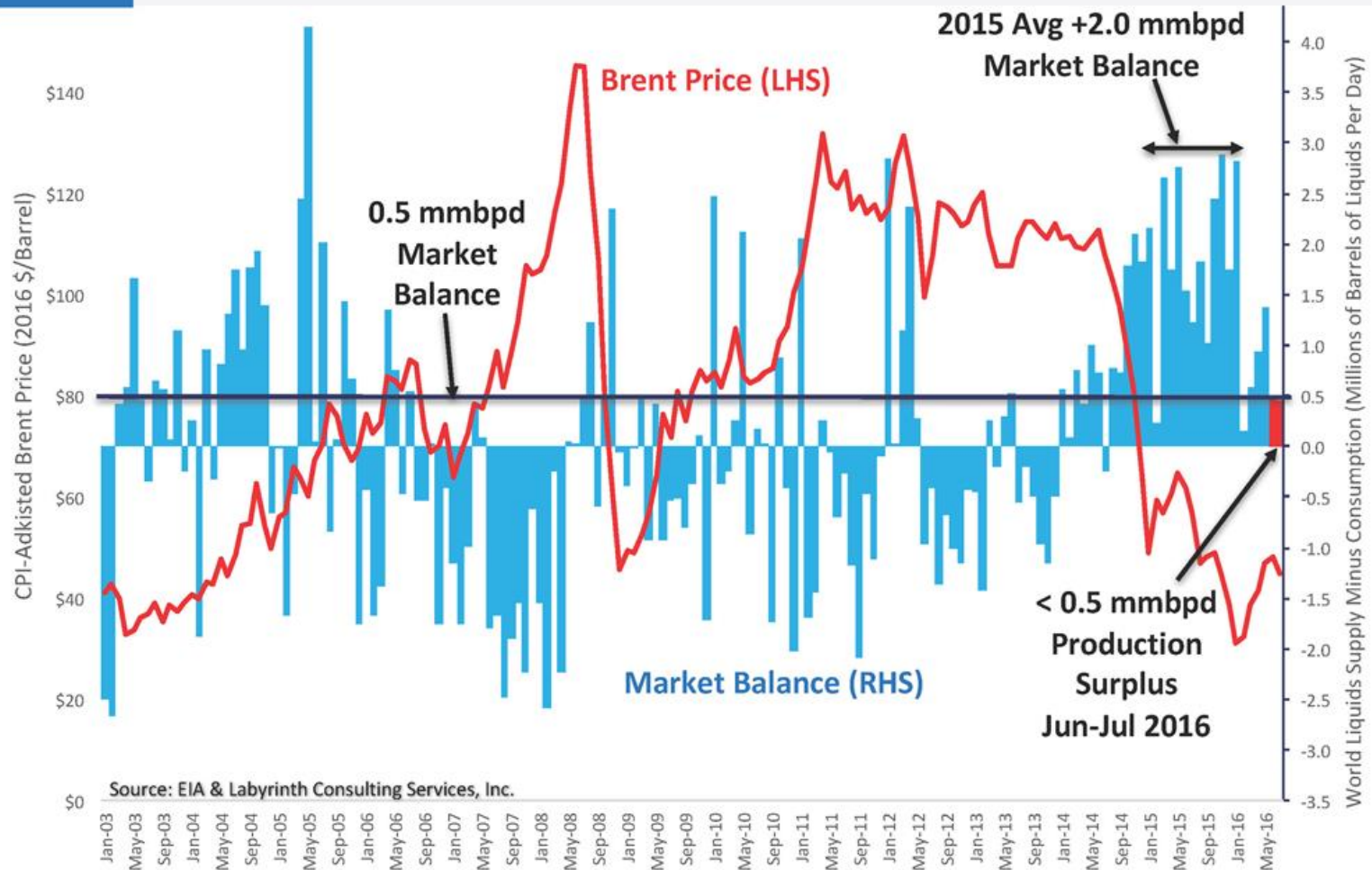


■ Oversupply ■ Undersupply ● Global Supply ● Global Demand

Supply and Demand in Balance

August
2016

The world liquids market is as close to balance as it ever gets

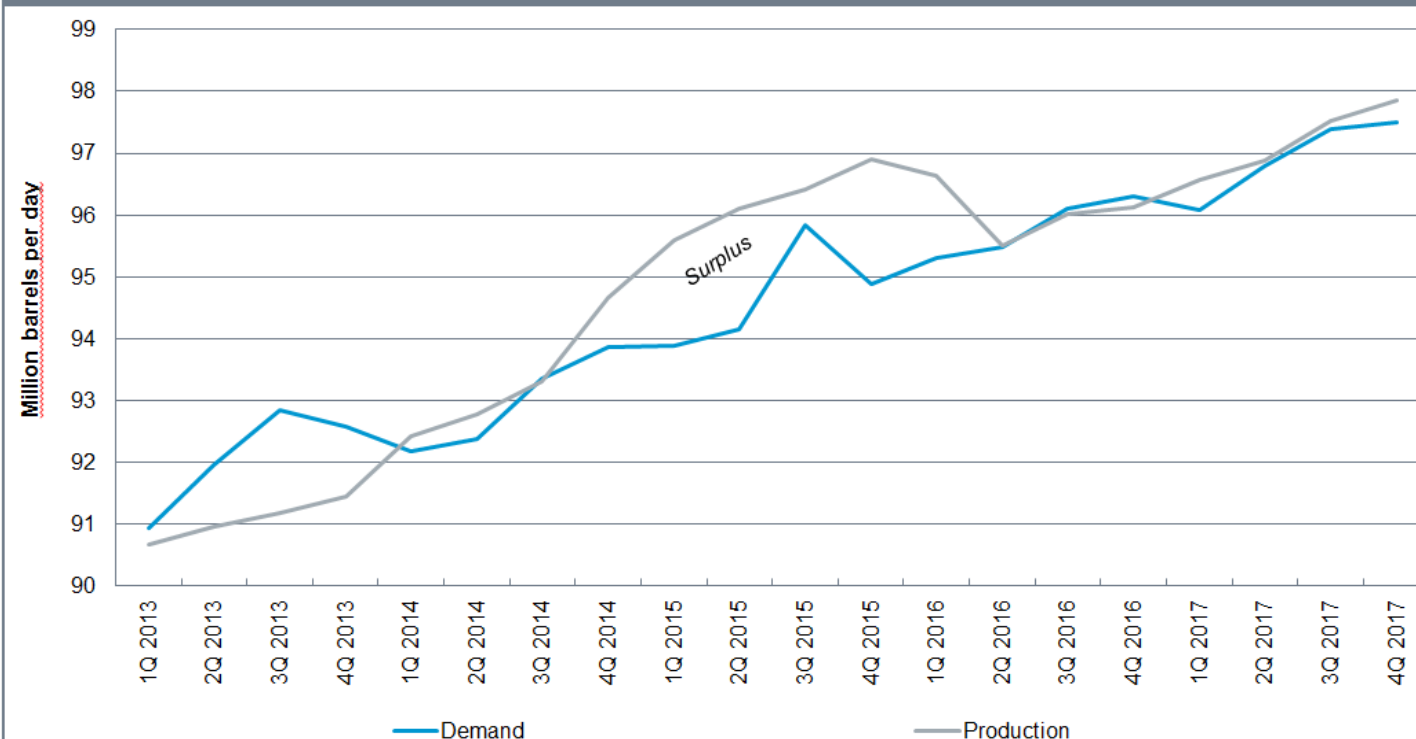


Supply and Demand until YE 2017



Global oil demand and production to be more or less balanced through end-2017

World oil (liquids) demand and production by quarter



Source: IHS

© 2016 IHS

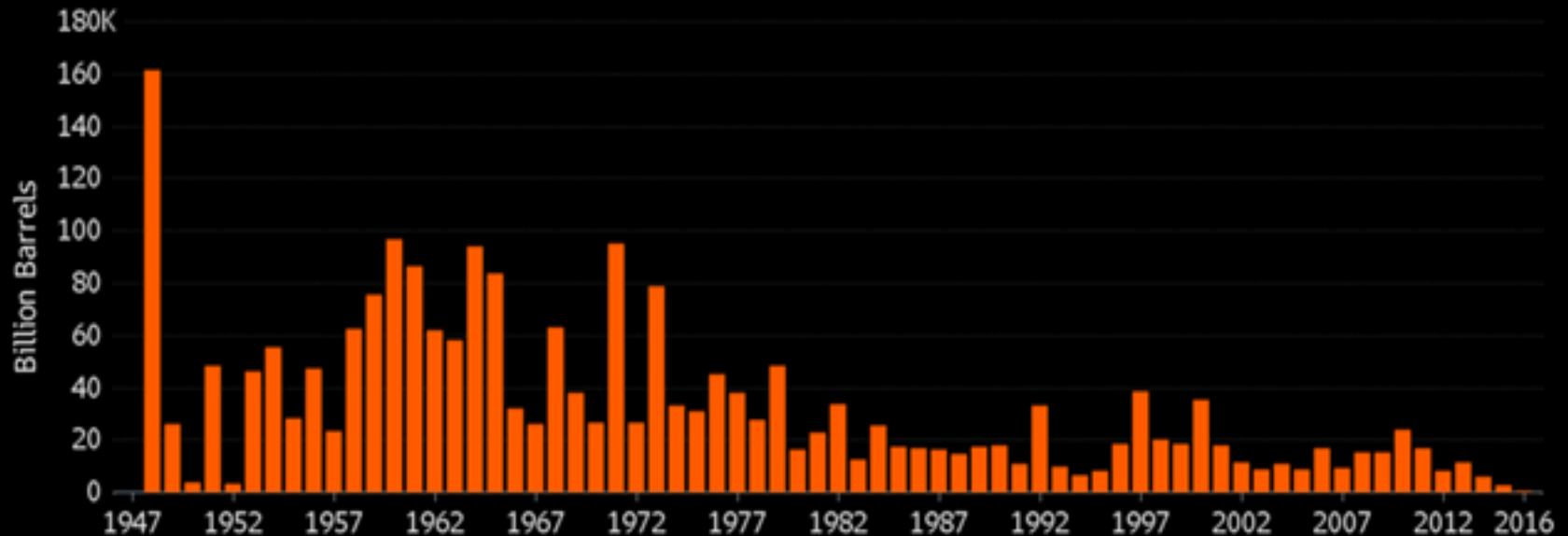
Note: For more details on our global balance, please see the data file, "IHS Energy Global Crude Oil Markets Outlook for Oil Market Fundamentals," posted with this report.

Explorationists cut spending

Oil Discoveries Lowest Since 1947

Explorers slash spending after price collapse

Conventional Oil Discovered



Source: Wood Mackenzie

Note: 2016 figure covers exploration results to August. Discoveries amounted to just 230 million barrels in 1947 but ballooned the following year with the Ghawar find in Saudi Arabia, still the world's biggest field.

OPEC Meetings past and future

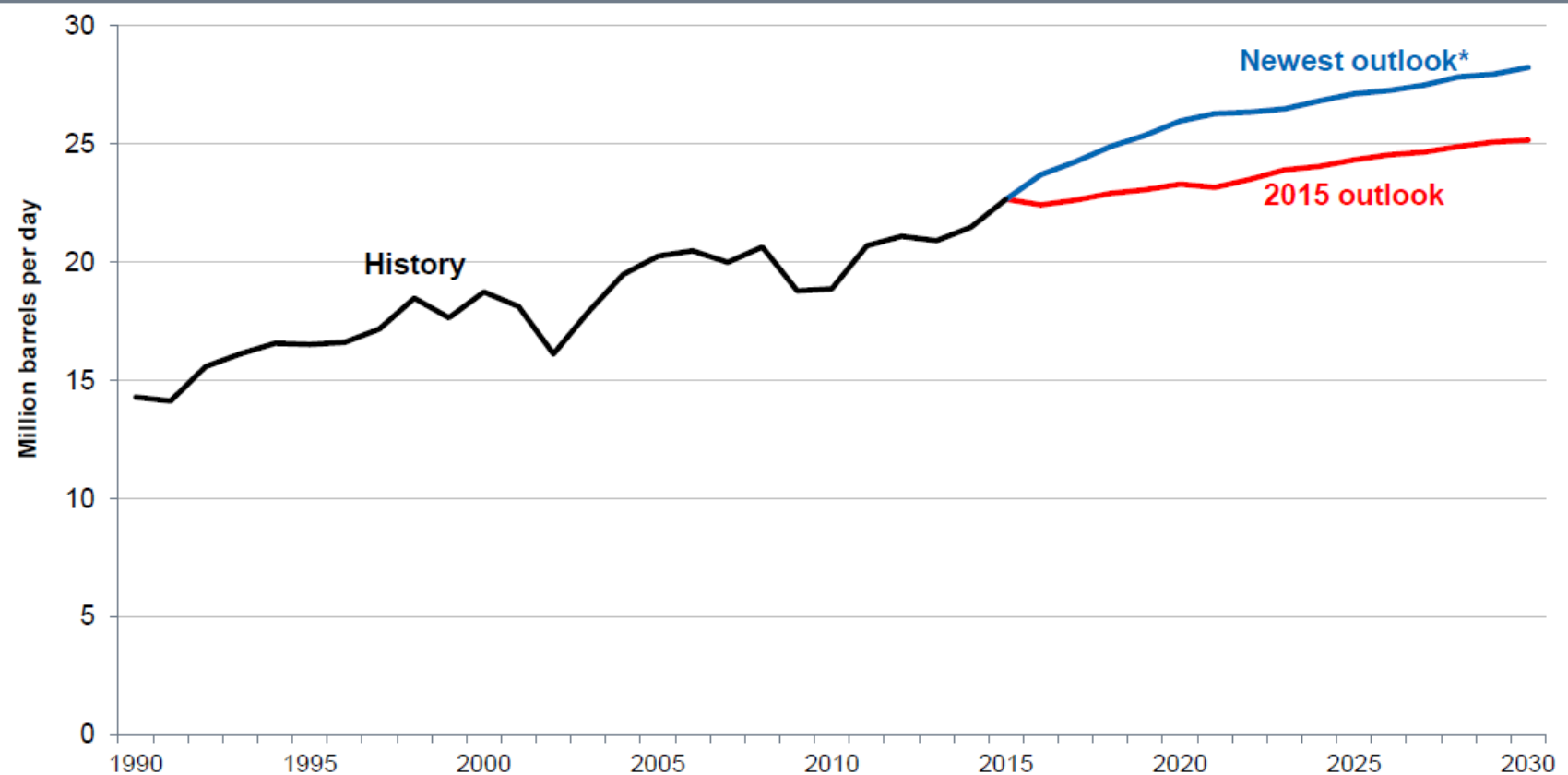


G-5 & Russia = Large market share

More low cost crude oil production expected from the G-5

The G-5 are what we call a group of low cost producers in the Gulf region: Saudi Arabia, the UAE, Kuwait, Iran, and Iraq

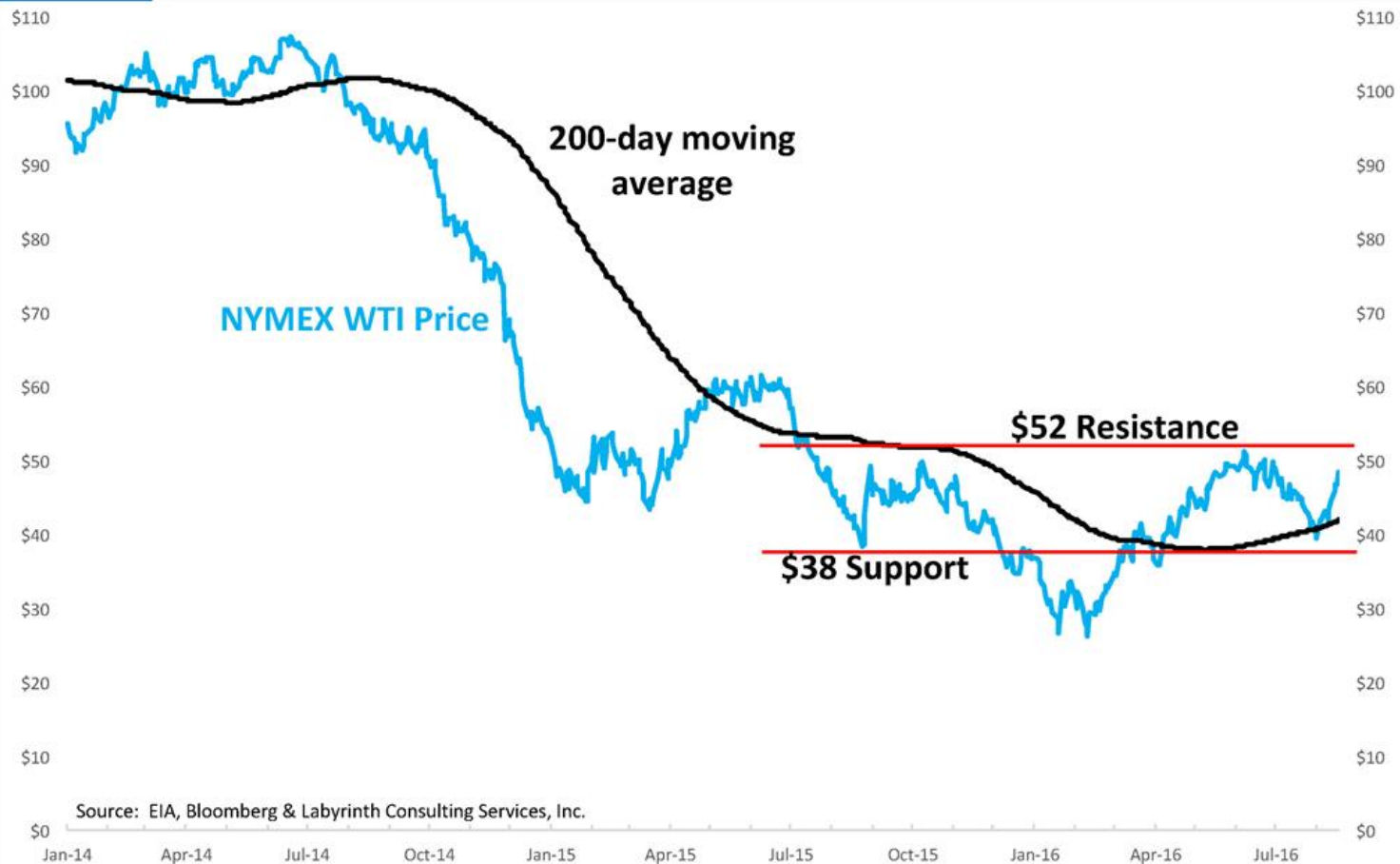
"G5" crude oil production, 1990-2030 (projected)



For the rest of 2016:

August
2016

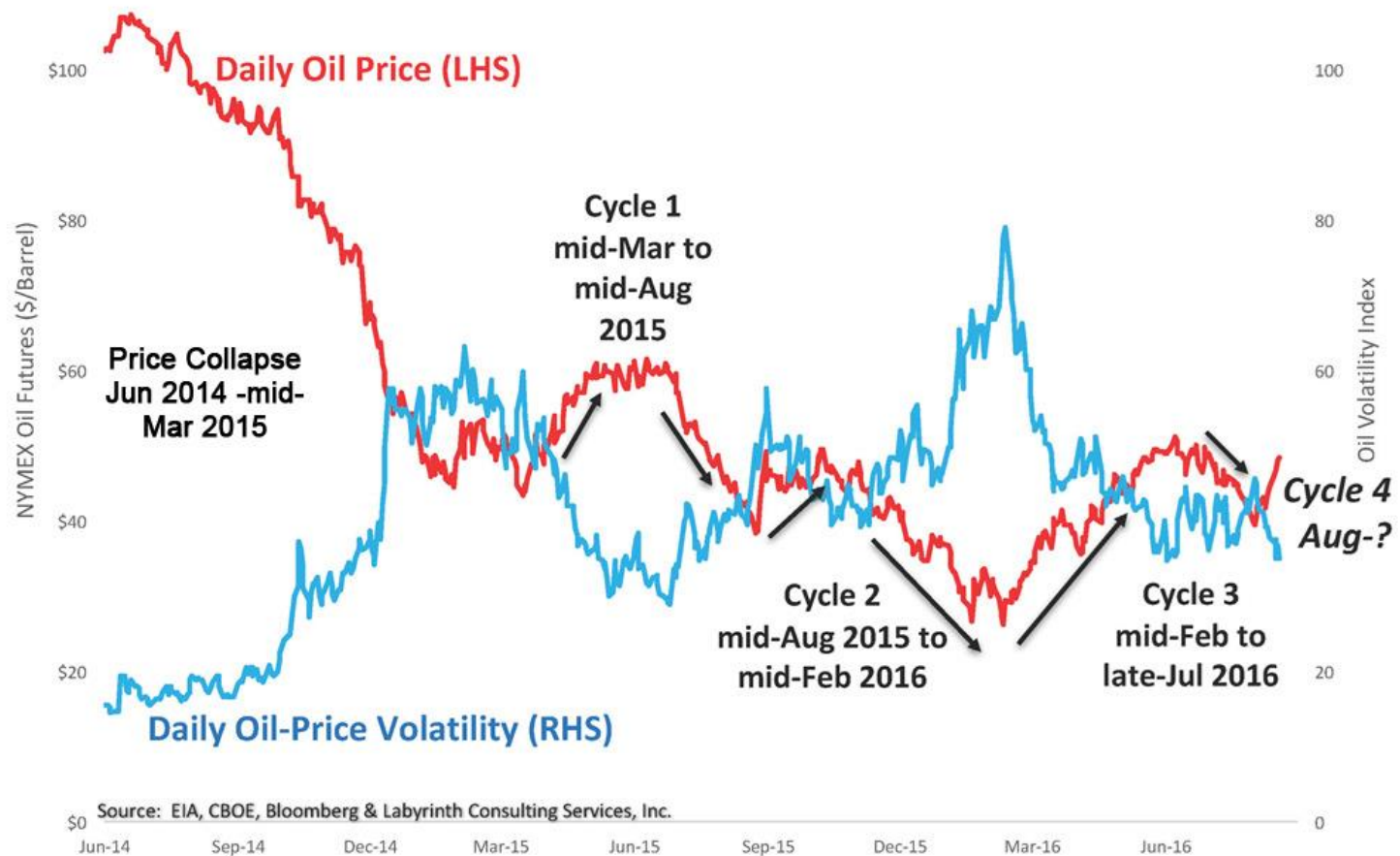
Oil prices are likely to remain between \$52 and \$38 per barrel



Recent price cycles

August
2016

Four oil-price cycles in 2015 & 2016, each lasting about 6 months



Price of oil through 2017

Snapshot of global oil fundamentals and price outlook

	2013	2014	2015	2016	2017
FUNDAMENTALS					
World economic growth (from previous year)	2.4%	2.7%	2.6%	2.5%	2.7%
World oil (liquids) demand growth (from previous year in MMb/d)	1.4	0.8	1.7	1.1	1.1
World oil (liquids) production growth (from previous year in MMb/d)	0.9	2.2	3.0	(0.2)	1.1
US crude oil production growth (annual average in MMb/d)	1.0	1.3	0.7	(0.6)	(0.2)
Gulf-5 crude oil production growth (annual average in MMb/d)	0.0	0.4	1.2	1.1	0.5
Implied change in global liquids inventories (annual average in MMb/d)	(1.1)	0.4	1.5	0.3	0.3
PRICES					
Dated Brent (annual average per barrel)	\$ 109	\$ 99	\$ 52	\$ 43	\$ 57
WTI - Cushing (annual average per barrel)	\$ 98	\$ 93	\$ 49	\$ 42	\$ 55

Notes: Gulf-5 includes: Saudi Arabia, Kuwait, United Arab Emirates, Iraq, and Iran. Liquids supply includes crude oil, condensate, and natural gas liquids (NGLs). Liquids demand includes all refined products, blended biofuels, synthetic fuels, as well as liquefied petroleum gases (LPGs) and ethane. A positive number for implied change in global liquids inventories indicates an implied stock build. A negative number indicates an implied stock draw. Figures are rounded. MMb/d = Million barrels per day.


Source: IHS, Argus Media Limited


© 2016 IHS

Long term Prediction through 2040

GLOBAL OIL PRICES OUTLOOK (ANNUAL)																
Rivalry (base case scenario) - nominal prices																
Benchmark crude oil prices	2005	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2025	2030	2035	2040
Dated Brent, FOB North Sea	54.61	79.51	111.21	111.68	108.68	98.94	52.37	44.35	57.03	64.02	71.02	78.01	110.29	122.46	136.44	152.23
Louisiana Light Sweet (LLS), St James	57.05	82.83	112.37	111.67	107.38	96.90	52.35	45.63	58.25	65.72	72.71	79.73	112.43	124.85	139.44	155.60
West Texas Intermediate (WTI), Cushing	56.60	79.48	95.04	94.12	98.03	93.28	48.71	43.96	56.18	62.37	68.67	75.00	105.21	117.10	130.52	145.43
Maya, FOB Mexico	41.01	70.26	98.72	99.57	97.33	85.82	44.11	37.31	48.71	55.17	61.24	67.77	91.40	106.65	119.22	132.82
Dubai, FOB	49.47	78.07	106.35	108.97	105.45	96.46	50.73	41.65	54.13	61.01	67.89	74.78	105.30	117.86	131.21	146.27
Dubai, CIF Singapore	50.50	79.13	107.34	110.03	106.44	97.57	52.07	42.71	55.32	62.26	69.22	76.19	107.03	119.80	133.37	148.67

The Future of the Oil Market

 The one thing I do know is that when people try and predict what is going to happen in the oil market they are wrong. They may be wrong high or they may be wrong low but they will invariably be wrong because we can't control what happens geopolitically.

 “The fundamentals of oil prices are rarely based on real time data, and the price can diverge from fundamentals for extended periods of time. That’s the primary reason I dislike making short term predictions on oil prices — it’s just not much better than a guess.” Daniel Yergin

Short BIO


 Who am I?


 Education

 University of Arizona - Bachelor's in Geography/Astronomy

 University of Kansas – Masters in Urban Planning with Graduate Geography/GIS classes

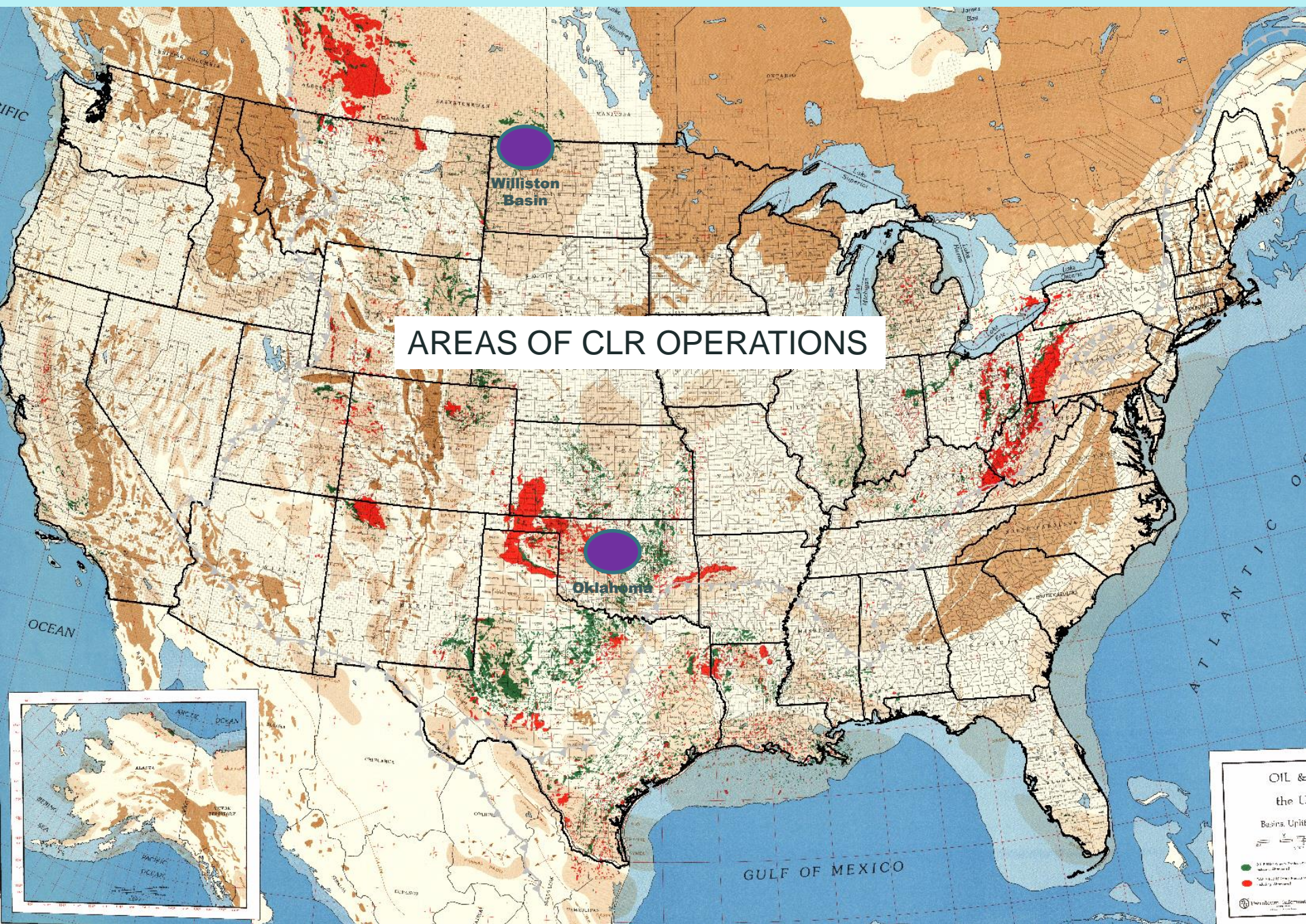
 Work experience

 90's working AZ department of Water Resources, Kansas Geological Survey, Various CAD jobs with Civil Engineering firms, GIS tech for Cedar Park, TX planning Department.





 Wife joined Air Force for 8 years, we travelled overseas to Germany, Guam. Became interested in Geopolitics in travel around Europe, Asia-Pacific region. Landed in Enid, OK at Vance Air Force Base.

 Got GIS/Geotech job at Continental Resources, Inc (CLR). Working for 11 years now for CLR, now Senior Geotech.




 Continental moved to OKC in 2012, now live in West Edmond/Northern OKC area with wife and three kids.






Who are the GIS experts at Continental?

-  Exploration Department: Me (Scott Highby), Steffany Copeland (Southern Group), David McMahan (Manager Strategic Services), Ben Ainsworth (Works mainly for the Geophysicists)
-  Land Department: Jeff Papirtis (Cartography), Ben Clift (Database Administrator)
-  Engineering Department: Glenn Fast, Tommy Jensen, Miles Standefer (CAD and GIS Analysts)
-  IT department: Jeff Griggs

GIS and the Oil and Gas Industry

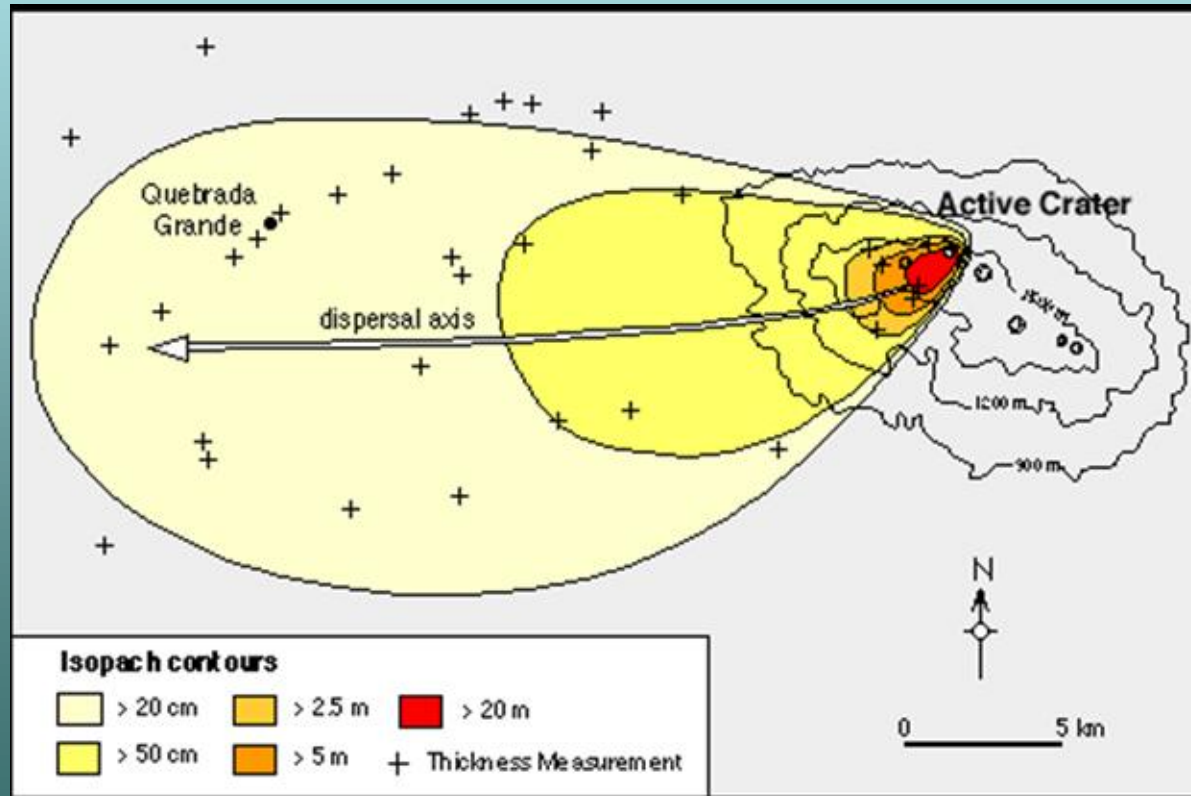
-  Everyone uses GIS from small independent oil companies to large international major companies.
-  The positions are often called a **GEO-TECH** or **GIS Analyst**, or **Information Systems Analyst**.
-  The technology is being used continuously, every single day, globally. Virtually every single stage of Exploration, Development, Transportation, Refining, and Distribution uses GIS technology

GIS software used

-  I mostly use Geographix and sometimes Petra. They are software primarily used by Petroleum Geologists for exploration.
-  I use ArcGIS for geospatial tasks and analysis that Geographix cannot do.
-  Geographix and Petra better for sub-surface mapping, ArcGIS better for surface geography.

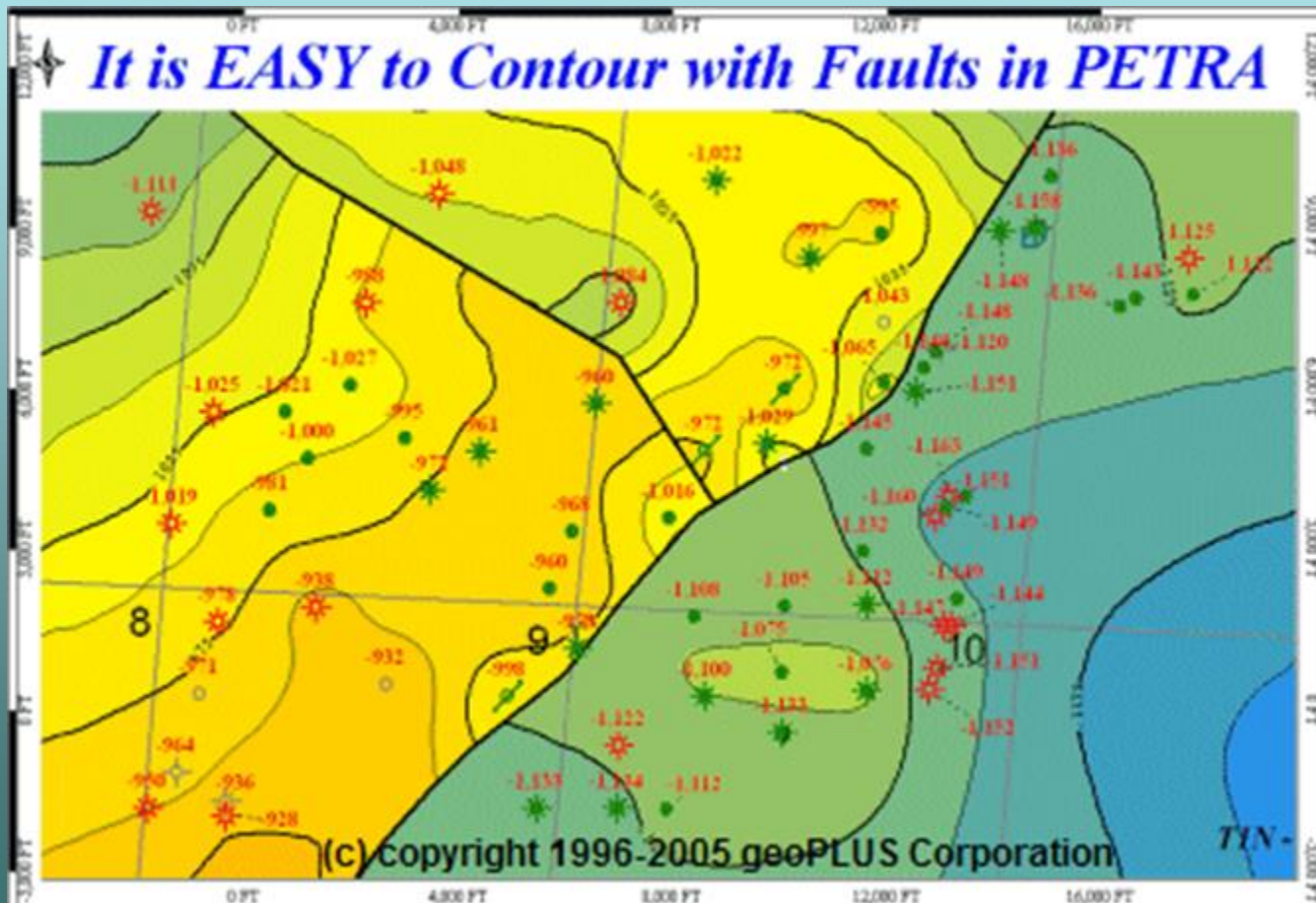
Geological Mapping

The Isopach Map (reservoir thickness map)



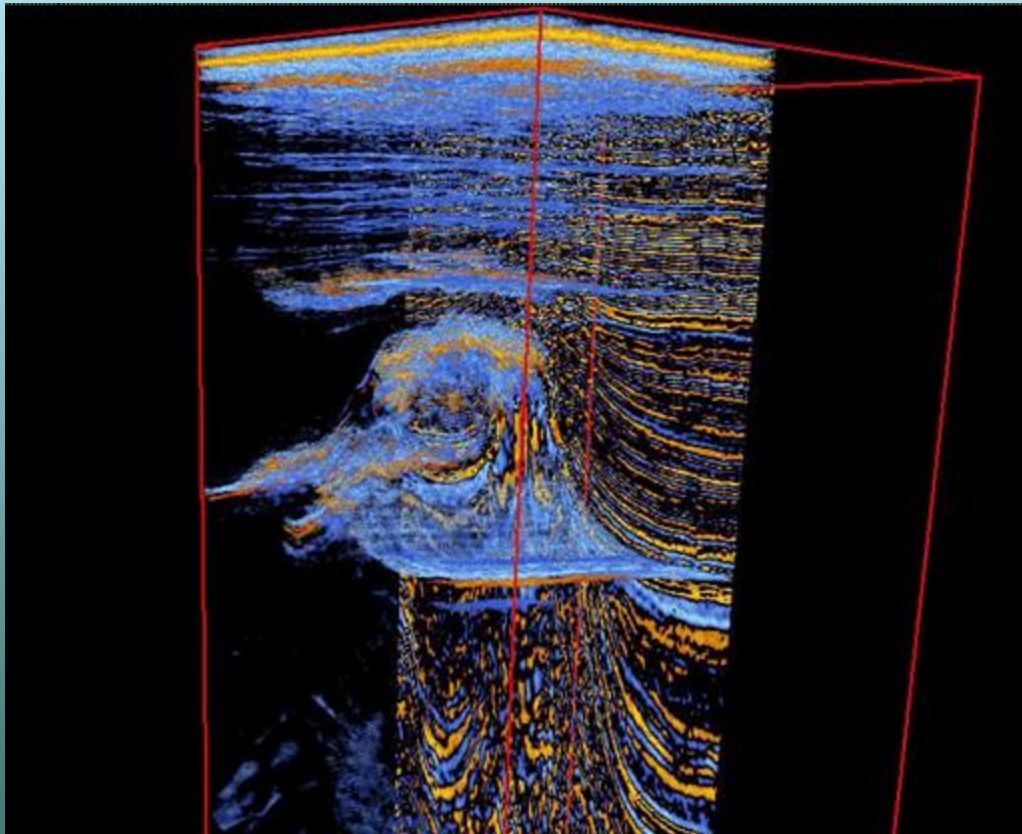
Geological Mapping

The Structure Map



Geophysical Mapping

 The seismic interpretation.



Example: Ames Hole 3D project

