



CORNERSTONE ANALYTICS

THE MORNING ENERGY UPDATE

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CHARTS OF THE MONTH

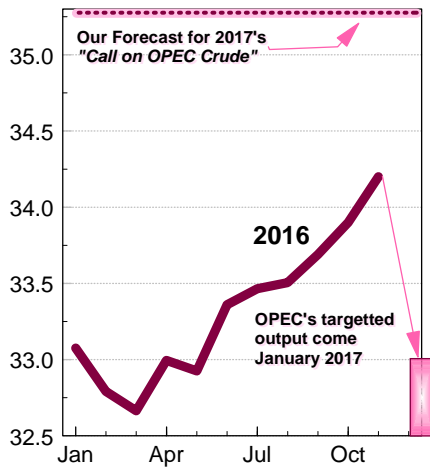
A COMPENDIUM OF DECEMBER'S KEY ANALYSES

	October '16 Output (IEA)	Output Referenced in OPEC Deal	New Quota as of 1/1/17	Output Change from October (IEA)	Output Change from Reference
Saudi Arabia	10.550	10.544	10.058	-0.492	-0.486
Iran	3.720	3.975	3.797	0.077	-0.178
Iraq	4.590	4.561	4.351	-0.239	-0.210
UAE	3.080	3.013	2.874	-0.206	-0.139
Kuwait	2.930	2.838	2.707	-0.223	-0.131
Qatar	0.620	0.648	0.618	-0.002	-0.030
Nigeria	1.570		1.570		
Libya	0.510		0.510		
Algeria	1.120	1.089	1.039	-0.081	-0.050
Venezuela	2.120	2.067	1.972	-0.148	-0.095
Angola	1.520	1.751	1.673	0.153	-0.078
Indonesia	0.740		0.740		
Ecuador	0.560	0.548	0.522	-0.038	-0.026
Gabon	0.200	0.202	0.193	-0.007	-0.009
Total Crude	33.830		32.624	-1.206	-1.432

OPEC agreed to implement a larger than expected output cuts starting January 2017, and the sense we gathered at the meeting was that the largest reductions would be made to US customers to specifically target the storage overhang. Countries like Venezuela may see unplanned outages, but we expect Saudi Arabia, Kuwait and the UAE will carry most of the proverbial water. Keep in mind that what drove OPEC to this deal stemmed largely from a Saudi push to resuscitate oil income. Also make note that the ability of OPEC to "cheat" is vastly different than what we dealt with in the '80s and '90s when they sat on significant volumes of spare production capacity. The second phase of the deal took place the weekend of December 10th with selected non-OPEC countries agreeing to cut output by about 600,000 b/d.

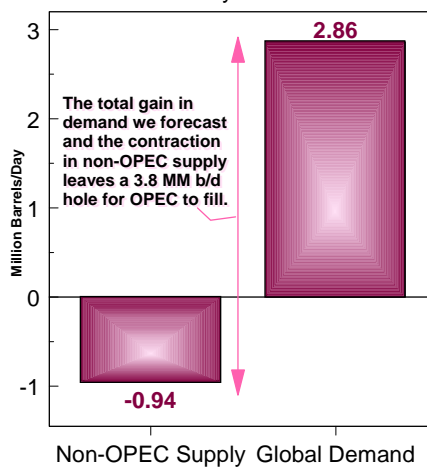
OPEC's Monthly Oil Production

Million barrels per day



Cumulative Deltas 2017 vs. 2015

Cornerstone Analytics oil balance math



Non-OPEC Output Cuts

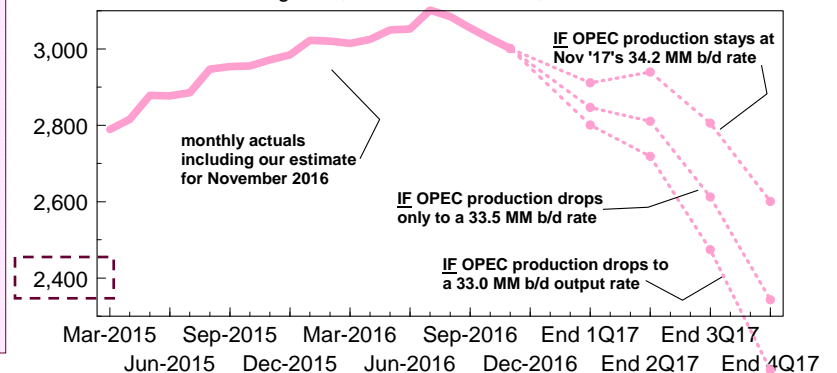
Thous bbl/day

	Pledged
Russia	300
Mexico	100
Azerbaijan	35
Khazakistan	20
Oman	40
Subtotal	495
Bahrain, Brunei, Equatorial Guinea, Malaysia, Sudan	63
TOTAL	558

This inventory chart details our storage forecast under different OPEC output scenarios. It seems most unlikely that the cartel would continue to produce the 34.2 million b/d rate estimated for November. One scenario assumes just a 700,000 b/d reduction from November, and another has OPEC cutting back to 33 million b/d – somewhere between these last two scenarios appears likely. As a matter of record, the lowest inventory level ever recorded was a wee less than 2.4 billion barrels. That noted, our inventory forecast portends significant upward oil price pressure to develop during 2017 given the strong inverse correlation between storage levels and oil prices.

Global Oil Inventories

Month ending level, actual and forecast, Million barrels



While the figure is preliminary and subject to revision, we estimate global oil demand for the 4Q-to-date decidedly eclipsed the all time high having come in at a wee over 99 million b/d. The estimate we generated for the combined October- November period is 400,000 b/d above our working forecast and more than 2.0 million b/d above the consensus figure. The latter is a direct result of the "missing oil" issue discussed below. The demand growth appears concentrated in non-OECD countries, which is the expected pattern. If one chooses to be skeptical about the demand growth we show (and the absolute level of demand in the analysis), the question to then ask is "where's the excess physical oil?" The IEA's demand projection for 4Q '16 is 96.95 million b/d. For the October-November period, total global supply averaged 98.17 million b/d or 1.22 million b/d above the IEA's number (IEA figures are the consensus' figures). So a 1.22 million b/d excess for two months means stocks should have *built* by 74.4 million barrels. The IEA showed October stocks being *down* 28 million and we estimate November stocks drew 26 million barrels. That, our friends, is a silly amount to try and explain away by saying that the "oil's on the water."

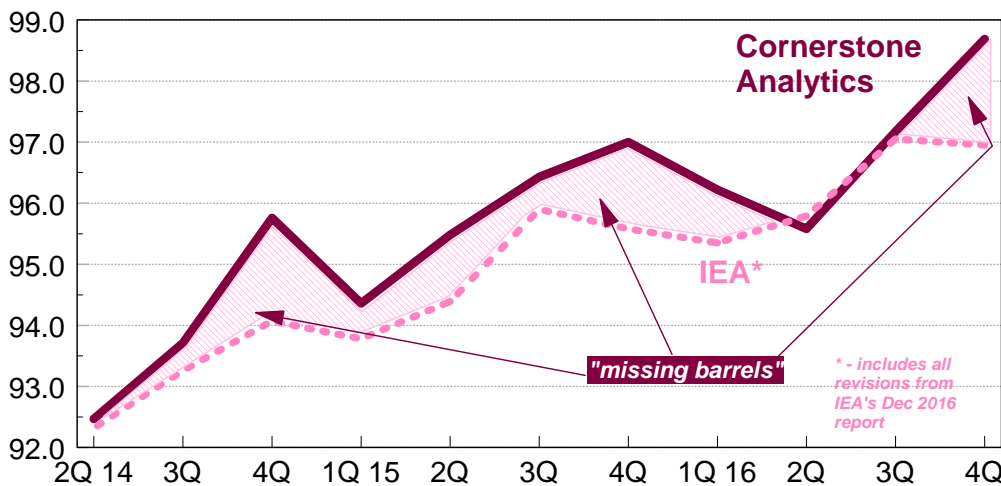
Apparent Demand "Math" for 4Q '16
Million barrels per day

World supply (Oct & Nov)	98.17
Commercial stock change	-0.89
Emergency stock change	-0.01
Global Apparent Demand	99.07

Y/Y growth based on our analysis	2.07
Y/Y growth of our forecast	1.67

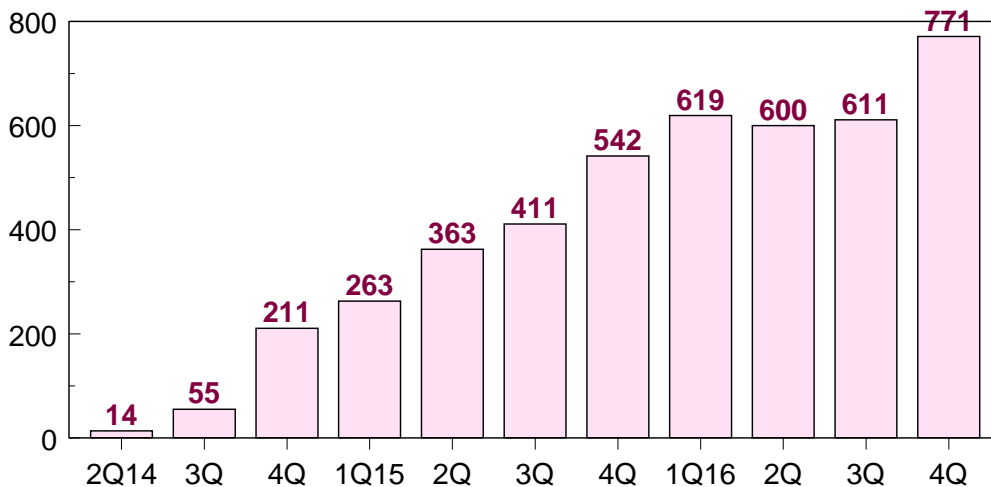
Consensus forecast for 4Q16	96.95
Consensus vs. global apparent est.	-2.12
Consensus vs. our forecast	-1.72

Demand Series Comparison
Quarterly, 2Q 2014 to 4Q 2016, MM b/d



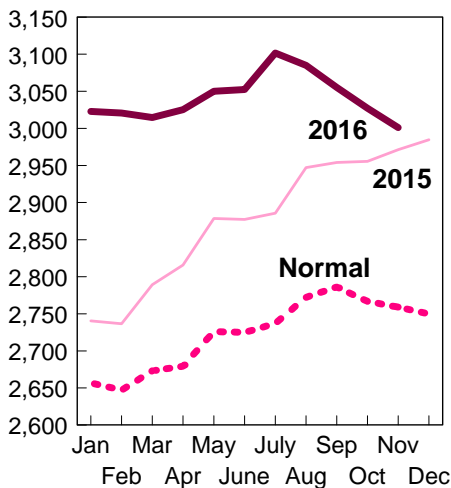
The IEA's method to estimate recent history demand in the non-OECD is built on presumed GDP growth and an assumed ratio of oil demand growth to GDP growth. The methodology is problematic since there are >100 countries with close to real time measures for activity being suspect. In countries where we have better and more timely data (like the US), the oil use to GDP growth ratio fluctuates sharply. The other way to measure demand (what we do) is to assess how much physical oil the global system absorbs. It's called apparent demand. It presumes global oil supply data is close to the mark (which is the evident pattern) and that stock changes in the OECD are the proxy for global storage changes. Non-OECD countries use oil on a hand-to-mouth basis with the primary exception being China (whose stockpiling has been smaller than believed). "Missing oil" refers to a gap between apparent demand and econometrically estimated use. Historically, bouts of "missing oil" are resolved by the IEA revising up its demand numbers. The underlying issue is an underestimation of non-OECD use. Despite the demand revisions made by the IEA thus far, "missing oil" since 2Q '14 totals a massive 771 million barrels. *Why does all this matter?* Global demand being higher than generally realized means the call on OPEC crude is also higher than generally believed. It portends excess storage being worked off at a faster than expected pace.

Accumulated "Missing Barrels" since 2Q 2014
Millions of barrels



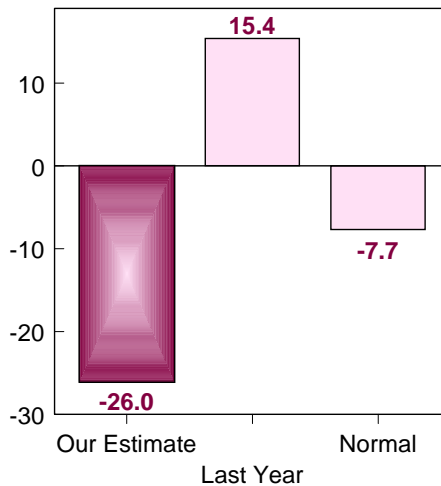
Total OECD Oil Stocks

Month ending level, Million barrels



November's OECD Stock Change

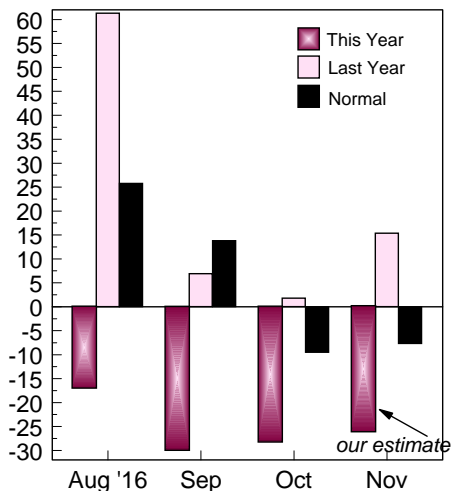
Month/month delta, Million barrels



We spend a great deal of time on oil inventories. At the end of the day, stock changes represent the intersection of oil supply and demand. It's for this reason that there exists a strong inverse correlation between changes in oil prices and changes in oil inventories. It feels like few oil market watchers realize (or believe) OECD petroleum stocks -- the proxy for global storage -- has been drawing since August. To the left we detail our figure for end-November stocks. We estimated storage was *drawn* 26 million barrels as compared with last November's 15 million *build* and a normal draw of 8 million. The change in storage is ultimately used in calculations for global demand.

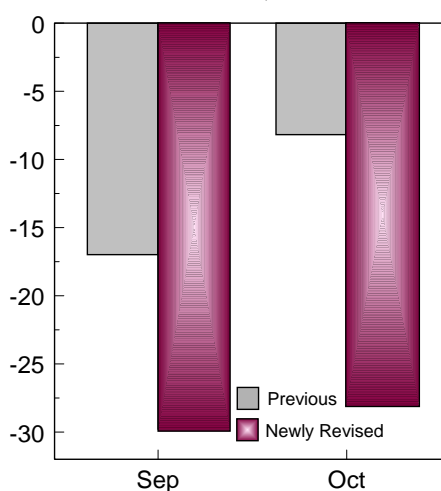
OECD Inventory Change

Month/month delta, Million barrels



November's IEA Stock Revisions

Month/month delta, Million barrels

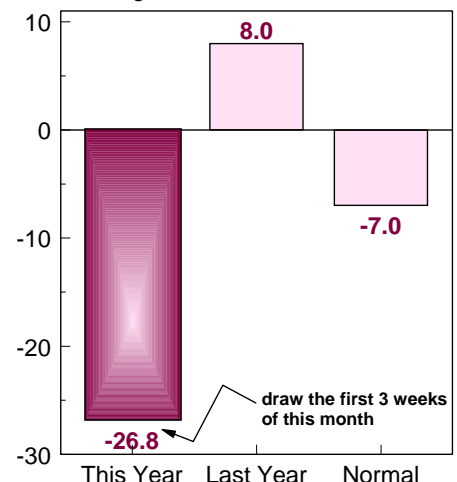


A key point to note is that even with record high OPEC and non-OPEC output, the global oil balance crossed into deficit this past summer. The downward inventory revisions made by the IEA for September and October were missed by most market watchers. Importantly, the IEA's mention of a draw during November (which jibes with our preliminary estimate) contradicts its own oil demand forecast and therefore contradicts the consensus belief that a stockbuild is occurring in the current quarter. Bottom line: demand is stronger and stocks are lower than is generally believed.

The above analyses address inventory changes up through the end of November. Here we focus on the US petroleum stock picture during the first three weeks of December. Inventories were drawn down 27 million barrels, almost 4-times the size of a typical draw for the month as a whole – and there is usually a large stock draw in the final reporting period of December. It's notable that there has been no account of the December stockdraws in the oil trade press. That aside, the change in the level of total US oil stocks is accounted for in global oil balance calculations – not just crude stocks as some have apparently been led to believe. Total US petroleum inventories have, in fact, been drawn down since late August. Amazingly, most seem unaware that total OECD stocks (the proxy for global storage) saw a third of the total inventory overhang wiped out since the end of July.

Total US Inventory Change

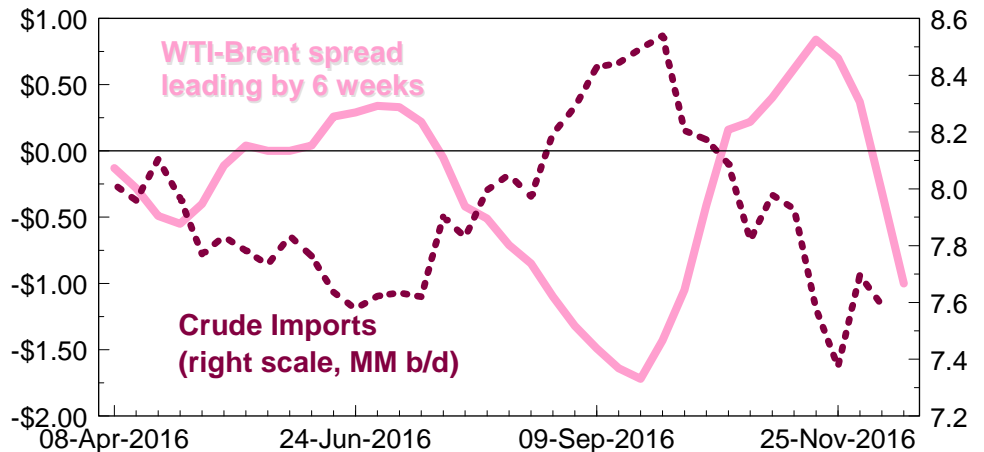
During December, Million barrels



Aside from the prospect of US oil stocks being targeted by OPEC as noted on P1, we developed an analysis examining the relationship between the US-foreign crude price spread and US crude imports. We use the WTI-Brent cash market spread as a proxy for the former, and our work shows that this spread leads changes in US crude import levels by 6 weeks. During December we saw WTI move to a large price discount to Brent (think of this as shutting the import arb). As per above, when that happens to that price spread, crude imports taper off in about a month-and-a-half's time. Such an import drop would help produce draws on US crude stocks when allowing for typical refinery run rates.

WTI-Brent Cash Market Spread versus US Crude Imports

4 week moving average



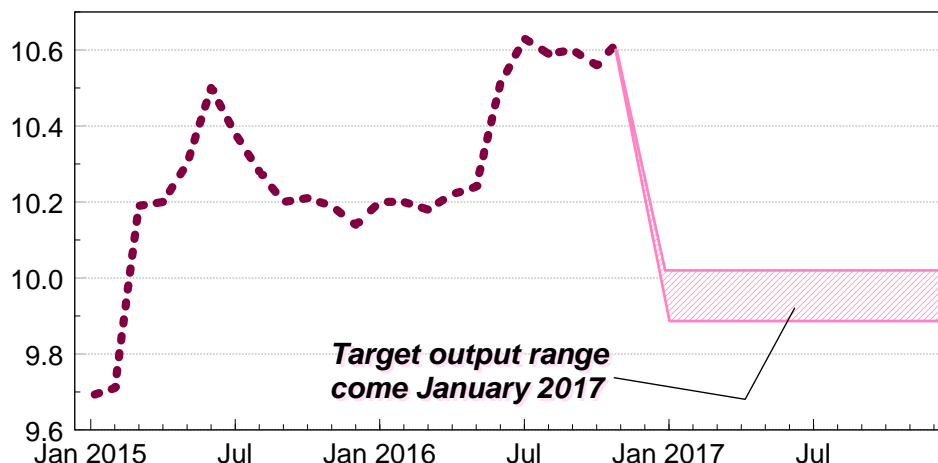
Saudi Arabia's 2017 National Budget

Disclosed Planned Expenditures (Bln \$)	\$240
Legacy welfare programs carried over	\$65
Assumed total budget (Bln \$)	\$305
Projected Oil Exports, Bln bbls	2.81
Projected non-oil income (Bln \$)	57.2
Oil income revenue (Bln \$)	248.1
Implied per barrel revenue for 2017	\$88.26

While the public comments about Saudi Arabia's 2017 budget suggested the Finance Ministry built in an average oil price of about \$55/barrel, our own assessment points to a required average crude price of a wee over \$88/barrel. Part of the reason our figure looks at odds with other accounts relates to our inclusion of \$65 billion in legacy welfare programs – most assessments don't add this in. Also, while we used the exact non-oil income figure offered in the annual budget, we did make an adjustment down of 200,000 b/d in the figure for net oil exports. Our oil export adjustment is conservative. Saudi Arabia's daily production of crude oil last year averaged 10.43 million b/d. The target per the OPEC agreement should reduce the Kingdom's average output rate by between 400,000 and 500,000 b/d, and its domestic oil demand is expected to rise about 220,000 b/d. All that considered, our export reduction of just 200,000 b/d and the consequent oil price figure of \$88.26 looks conservatively low.

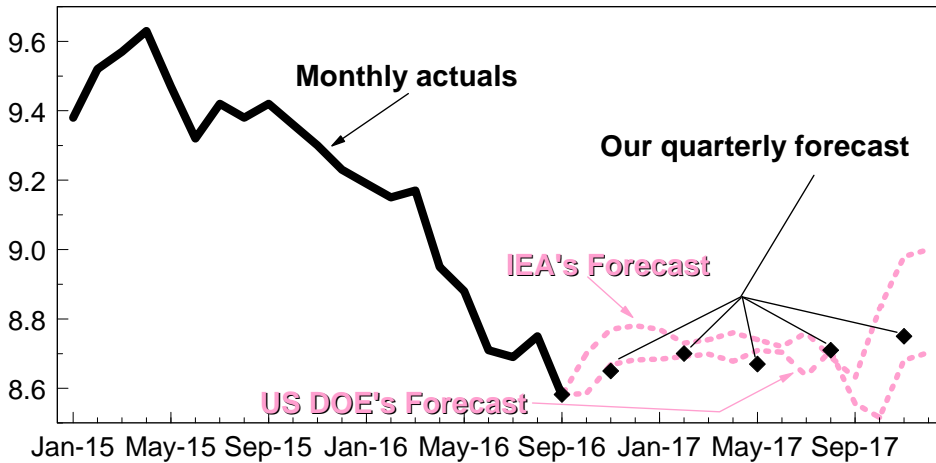
Saudi Arabia's Crude Oil Production

Includes share of Neutral Zone, Million b/d



US Crude Oil Production, Historical & Forecast

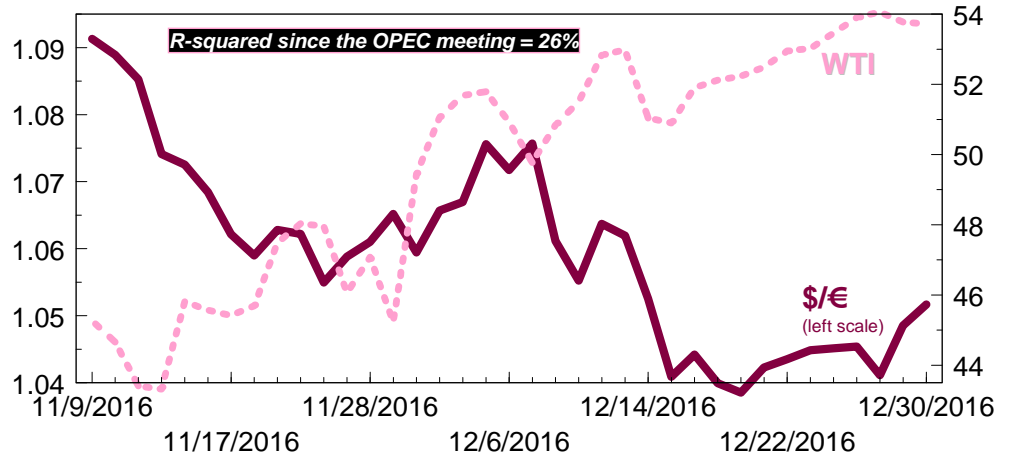
Monthly, Million barrels/day



We don't share the consensus view that OPEC's deal will be self defeating. One construct of that bearish slant centers on US supply and, specifically, output in '17 growing by as much as 1.0 MM b/d (net). We see US crude production declining in 2017 (based on a comparison of full year averages). Our forecast is actually similar to the DOE and IEA projections which see declines of 170,000 b/d and 80,000 b/d, respectively ('17 versus '16, also based on full year averages). We detail both agencies projections along with our quarterly forecast as per our oil balance model on P6. For the US to see a net gain of a million b/d in '17, producers would have to add 2.5-2.7 MM b/d of output (about 1.5-1.7 million of that would be to offset declines from existing fields).

\$/Euro versus WTI Crude

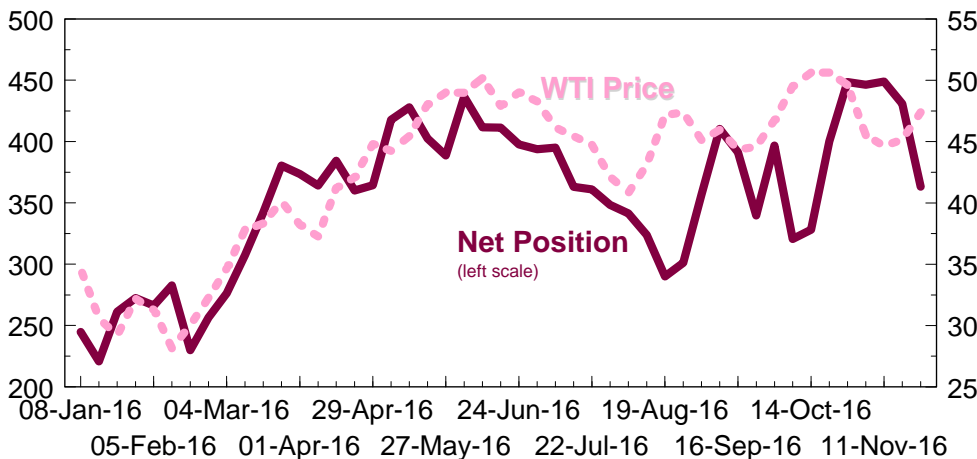
Daily



If the US Dollar continues to strengthen, will it put downward pressure on oil prices? We are of the opinion that in the very short term, macro trades such as the \$/€-crude can influence oil price direction, but we expect oil balance fundamentals will revert back to being the overwhelming influence on oil prices. Changes in oil prices and the \$/€ have an on-again/off-again relationship. The analysis we detail here shows the correlation to be very poor. When we think about where oil prices will move over the near to medium term, we center our attention on the supply/demand outlook and the forecasted draw on oil inventories.

Net Long/Short Position of Hedge Funds in NYMEX Crude

Futures and options combined, Weekly, Millions of Barrels



We receive numerous questions about the possible negative price effects of oil producer hedging. We understand. There is an underlying concern about a resurgence of US upstream activity and a return to a period of a million b/d of annual net production gains – which is not a concern we share. Nevertheless, what we find notable from the COT data regarding the net position of hedge funds in oil is (1) changes in that net position are highly correlated to changes in crude prices and (2) the size of the current net position can be expanded materially from recent levels meaning there is a large volume of "paper barrel ammunition" available to push oil prices much, much higher.



Our Model of the Global Oil Balance, Quarterly 2015-2017 Forecast, Figures in Million barrels/day

	1Q	2Q	3Q	4Q	2015	1Q	2Q	3Q	4Q	16-F	1Q	2Q	3Q	4Q	17-F
DEMAND															
US	19.4	19.5	19.8	19.4	19.5	19.5	19.4	19.9	19.6	19.6	19.8	19.6	20.1	19.7	19.8
Europe	13.5	13.6	14.2	13.7	13.7	13.6	14.0	14.5	13.7	13.9	13.6	13.7	14.4	13.7	13.8
Other OECD	<u>13.7</u>	<u>12.5</u>	<u>12.9</u>	<u>13.3</u>	<u>13.1</u>	<u>13.6</u>	<u>12.6</u>	<u>12.9</u>	<u>13.3</u>	<u>13.1</u>	<u>13.6</u>	<u>12.6</u>	<u>12.9</u>	<u>13.3</u>	<u>13.1</u>
Total OECD	46.6	45.6	46.9	46.4	46.4	46.7	46.0	47.2	46.6	46.6	47.0	46.0	47.4	46.7	46.8
FSU	4.4	4.7	4.8	4.7	4.6	4.6	4.6	4.9	4.7	4.7	4.7	4.6	5.0	4.8	4.7
China	11.3	11.6	11.6	11.7	11.5	11.7	12.1	11.7	12.1	11.9	12.1	12.4	12.1	12.5	12.3
East Europe	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Other Non-OECD	<u>31.4</u>	<u>33.0</u>	<u>32.4</u>	<u>33.5</u>	<u>32.6</u>	<u>32.5</u>	<u>32.3</u>	<u>33.5</u>	<u>34.5</u>	<u>33.2</u>	<u>33.4</u>	<u>33.5</u>	<u>34.4</u>	<u>35.5</u>	<u>34.2</u>
Total Non-OECD	47.8	49.9	49.5	50.6	49.4	49.5	49.6	49.9	52.1	50.5	50.8	51.2	52.2	53.5	51.9
Total World	94.4	95.5	96.4	97.0	95.8	96.2	95.6	97.2	98.7	97.1	97.8	97.2	99.5	100.2	98.7
SUPPLY															
US	12.8	13.0	13.1	13.0	13.0	12.7	12.6	12.3	12.4	12.5	12.4	12.4	12.5	12.6	12.5
Canada	4.6	4.0	4.4	4.5	4.4	4.6	3.9	4.6	4.6	4.4	4.6	4.4	4.6	4.6	4.6
UK	0.9	1.0	0.9	1.0	1.0	1.1	1.1	1.0	0.9	1.0	1.0	0.9	0.8	0.9	0.9
Norway	1.9	1.9	1.9	2.0	1.9	2.0	1.9	1.9	2.0	2.0	1.9	1.8	1.8	1.9	1.9
Mexico	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.5	2.4	2.4	2.4	2.4	2.4
FSU	14.1	14.0	13.9	14.1	14.0	14.3	14.0	14.0	14.5	14.2	14.5	14.3	14.4	14.4	14.4
China	4.3	4.4	4.3	4.3	4.3	4.2	4.1	4.0	3.8	4.0	4.0	4.0	4.0	4.0	4.0
Other	13.8	14.2	14.3	14.2	14.1	13.4	13.8	14.4	14.1	13.9	13.0	13.8	14.2	14.1	13.8
Refinery Gain	<u>2.2</u>	<u>2.2</u>	<u>2.2</u>	<u>2.2</u>	<u>2.2</u>	<u>2.3</u>	<u>2.3</u>	<u>2.3</u>	<u>2.3</u>	<u>2.3</u>	<u>2.3</u>	<u>2.3</u>	<u>2.3</u>	<u>2.4</u>	<u>2.3</u>
Total Non-OPEC	57.3	57.4	57.8	58.0	57.6	57.1	56.1	56.8	57.0	56.8	56.1	56.4	57.0	57.2	56.7
Saudi Arabia (incl NZ)	9.8	10.3	10.3	10.2	10.1	10.2	10.3	10.6							
Iran	2.8	2.8	2.9	2.9	2.8	3.1	3.6	3.7							
Iraq	3.5	3.9	4.3	4.3	4.0	4.3	4.3	4.4							
Kuwait (incl NZ)	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.9							
UAE	2.9	2.9	2.9	2.9	2.9	2.8	3.0	3.1							
Qatar	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.6							
Venezuela	2.5	2.5	2.5	2.4	2.5	2.4	2.3	2.2							
Nigeria	1.9	1.8	1.9	1.9	1.9	1.8	1.5	1.4							
Libya	0.4	0.5	0.4	0.4	0.4	0.4	0.3	0.3							
Ecuador	0.5	0.5	0.5	0.5	0.4	0.5	0.6	0.6							
Algeria	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1							
Angola	1.8	1.8	1.8	1.7	1.8	1.8	1.7	1.7							
Indonesia	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7							
Gabon	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2							
Total OPEC Crude	31.5	32.5	32.7	32.7	32.2	32.8	33.1	33.6	33.8	33.3	33.0	33.0	33.0	33.0	33.0
Condensates & NGLs	<u>6.5</u>	<u>6.6</u>	<u>6.7</u>	<u>6.8</u>	<u>6.7</u>	<u>6.7</u>	<u>6.8</u>	<u>6.9</u>	<u>6.9</u>	<u>6.8</u>	<u>7.0</u>	<u>7.0</u>	<u>7.0</u>	<u>7.0</u>	<u>7.0</u>
Total OPEC Supply	38.0	39.1	39.5	39.5	38.9	39.6	39.9	40.5	40.7	40.1	40.0	40.0	40.0	40.0	40.0
	95.3	96.5	97.2	97.5	96.5	96.7	96.0	97.3	97.7	96.9	96.0	96.4	97.0	97.1	96.6
Inventory Change	1.0	1.0	0.8	0.5	0.8	0.5	0.4	0.1	-1.0	-0.0	-1.8	-0.9	-2.6	-3.0	-2.1
% Change in Demand															
US	3.1%	3.7%	2.7%	-0.5%	2.3%	0.2%	-0.2%	0.4%	0.7%	0.3%	1.7%	0.9%	0.9%	0.9%	1.1%
Europe	3.1%	1.1%	2.3%	1.9%	2.1%	1.4%	2.7%	1.8%	0.0%	1.5%	-0.5%	-1.5%	-0.5%	-0.5%	-0.8%
Other OECD	<u>-1.4%</u>	<u>-0.8%</u>	<u>0.9%</u>	<u>-0.6%</u>	<u>-0.5%</u>	<u>-1.0%</u>	<u>0.7%</u>	<u>0.1%</u>	<u>0.1%</u>	<u>-0.0%</u>	<u>0.1%</u>	<u>0.1%</u>	<u>0.1%</u>	<u>0.1%</u>	<u>0.1%</u>
Total OECD	1.8%	1.7%	2.1%	0.2%	1.4%	0.2%	0.9%	0.7%	0.3%	0.5%	0.6%	-0.0%	0.3%	0.3%	0.3%
FSU	-5.6%	-4.3%	-6.4%	-6.1%	-5.6%	5.9%	-1.7%	2.5%	0.1%	1.6%	0.5%	0.5%	0.5%	0.5%	0.5%
China	7.3%	8.1%	9.1%	4.8%	7.3%	3.2%	4.1%	1.4%	3.9%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
E. Europe	4.6%	3.0%	2.9%	4.4%	3.7%	2.9%	4.3%	0.0%	0.0%	1.8%	0.1%	0.1%	0.1%	0.1%	0.1%
Other Non-OECD	<u>3.3%</u>	<u>5.0%</u>	<u>3.5%</u>	<u>2.8%</u>	<u>3.6%</u>	<u>3.6%</u>	<u>-2.2%</u>	<u>3.2%</u>	<u>3.2%</u>	<u>1.9%</u>	<u>2.8%</u>	<u>3.9%</u>	<u>2.8%</u>	<u>2.8%</u>	<u>3.1%</u>
Total Non-OECD	3.3%	4.7%	3.7%	2.3%	3.5%	3.7%	-0.6%	0.8%	3.0%	2.2%	2.6%	3.3%	4.5%	2.6%	2.8%
Total World	2.5%	3.3%	2.9%	1.3%	2.5%	2.0%	0.1%	0.8%	1.7%	1.4%	1.6%	1.7%	2.4%	1.5%	1.6%

This is our updated oil balance model and it accounts for all recent revisions to historical data. Our model continues to show that the global oil balance went into deficit during 3Q 2016, which counters the current consensus being worked down sharply portending significant upward oil price pressure. OPEC's planned cut is specifically aimed at eliminating the storage surplus and consequently lifting oil income levels. We expect it will work in spades.

