

Spot WTI Crude \$US/B	Edmonton Light \$US/B	Spot Henry Hub \$US/MMBtu	Spot AECO \$Cdn/GJ	Spot AECO Basis \$US/MMBtu	Currency \$US/\$Cdn
<b>51.50</b> ↓	<b>47.27</b> ↑	<b>3.75</b> ↑	<b>3.80</b> ↑	<b>0.71</b> ↓	<b>0.7588</b> ↑

### Chart Watch

- 2** E&Ps have surged since OPEC's meeting
- 7** WTI climbed to a 17 month high on Monday
- 11** Trader long positions rose post OPEC meeting
- 17** Crude imports from Canada hit a record high
- 25** Cold weather has boosted natural gas prices

### On the Right Side of History, at Last

By Jackie Forrest

Western Canada is in a deep freeze. The US Midwest is buried under snow. An Arctic blast is expected to hit the Eastern and Central United States in the next week. The frigid weather is causing people to crank-up furnaces and heaters across the continent. Power consumption is surging too. In Alberta, power use hit a new all-time high for peak winter load last week.

The only ones reveling in these freezing temperatures are North America's natural gas producers.

Last Friday, the intense weather-driven demand for natural gas combined with expectations of ongoing freezing conditions pushed benchmark US prices at Henry Hub to a level not seen in almost two years, \$US 3.75/MMBtu. Prices have weakened slightly since Friday's high, as newly updated weather outlooks are now predicting a greater chance of warmer temperatures before the Christmas holidays.

Over the past few years, weak natural gas prices

have been the result of a prolonged supply glut. The initial cause was a "polar vortex" that gripped the continent in the winter of 2013/14. Back then, a lengthy cold snap set low temperature records on the East Coast, boosting natural gas consumption, and spiking prices to over \$US 5.00/MMBtu in early 2014. In turn, the high prices resulted in more drilling, pipelines and a gush of new natural gas supply. Associated gas from robust oil drilling amplified the surplus. Even industry veterans were surprised when year-over-year American production grew by 7 Bcf/d or 10% over the course of 2014.

The hangover from the 2014 supply binge extended into 2015, when natural gas markets continued to be oversupplied. The situation only got worse when the exceptionally warm "El Niño" winter of 2015/16 sapped demand, causing prices to sink under \$US 2.00/MMBtu.

This recent history illustrates how weather drives unpredictable price volatility in natural gas markets. The relationship between weather and price has grown stronger over the past 15 years, as the amount of weather related demand has increased by more than 8 Bcf/d over that time frame (see past blog "[Weathering Volatility in Natural Gas Markets](#)").

Assuming that Old Man Winter continues to linger into January and February (a critical, yet still uncertain assumption), price could once again spike above \$US 5.00/MMBtu as it did in 2014; especially when you consider the underlying supply fundamentals are weaker today, compared with back then.

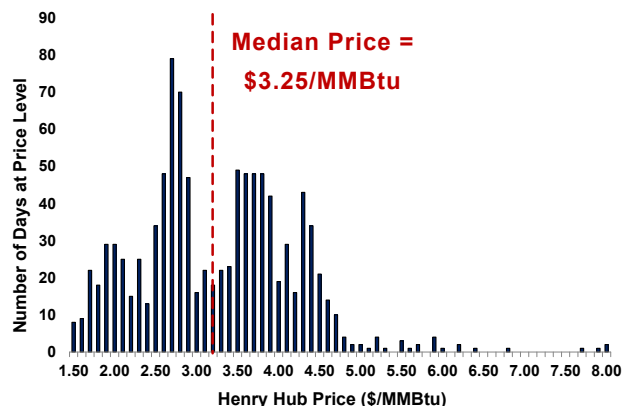
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As a result of low prices inflicted over the past few years, natural gas field activity has slowed to a snail's pace. The number of US rigs targeting gas is only one-third the level of 2014. If prices strengthen this winter, it could take some time for supply to respond, being that it has to ramp up from this low level. A shortage of new takeaway pipeline capacity from the prolific Appalachia region this winter may be another constraint. Combine this with the fact that, as a result of dwindling US oil production, associated gas is meaningfully declining.

While the current price boost is welcome news for natural gas producers, history has shown that North America's low cost, abundant shale gas resource has a way of mercilessly capping the price upside. Figure 1 shows a histogram of daily natural gas prices at Louisiana's Henry Hub going back to 2013. While there are some outliers, prices have mostly yo-yoed between \$US 1.50 and \$US 5.00/MMBtu, with a median at \$US 3.25/MMBtu. Only one-third of the data points are over Friday's \$US 3.75/MMBtu high mark.

There are two main forces that keep price oscillating equally on either side of this median. On the demand side, the weather swings back and forth on either side of normal. In other words, predicting

**Figure 1: Henry Hub Price Histogram**  
Daily Spot Prices; 2013 to Current



Source: Bloomberg, ARC Financial Corp.

gas demand is about as forgiving as predicting long-term weather. On the supply side, plentiful resource and new production techniques have created a system that can turn on and off supply within a season, depending on the commodity price, that is largely dictated by the weather.

Figure 1 illustrates why, if higher prices make an appearance this winter, that producers should enjoy them while they last. Post the shale gas era, history shows they do not persist for very long.

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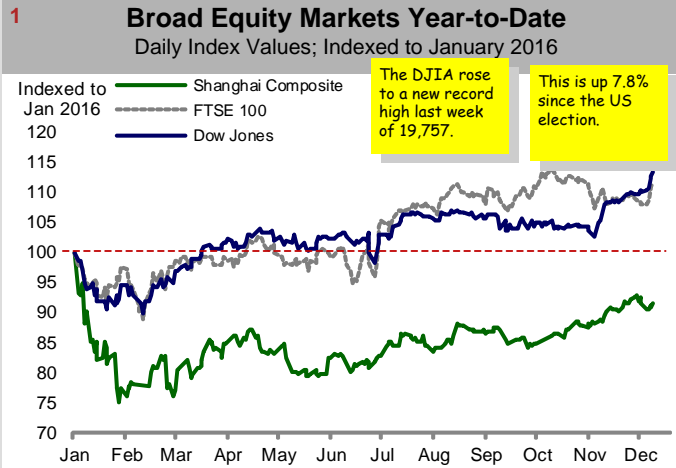
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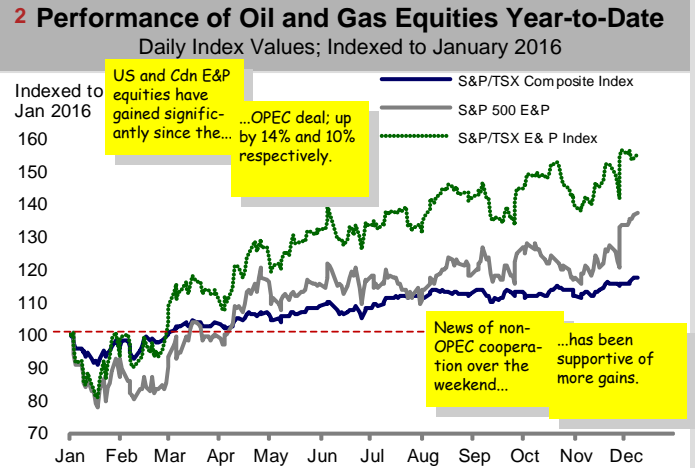
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**Market Indicators**



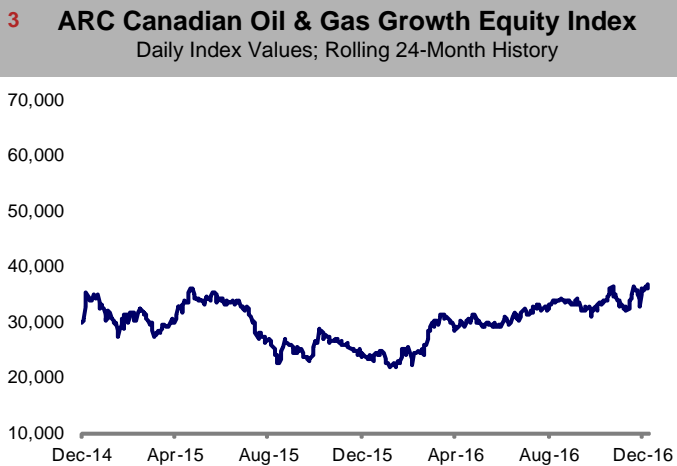
Broad market indices are one of many vital signs measuring the health of the economy. Energy demand is a function of economic health.

Source: Bloomberg



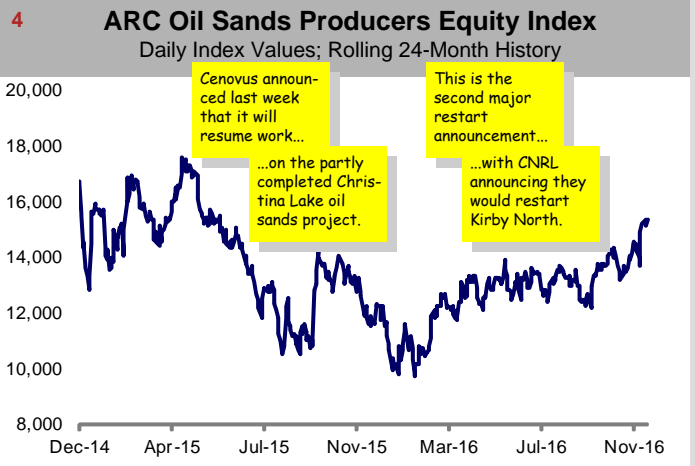
Performance of Canadian and US oil & gas equities are compared against the broader market.

Source: Bloomberg



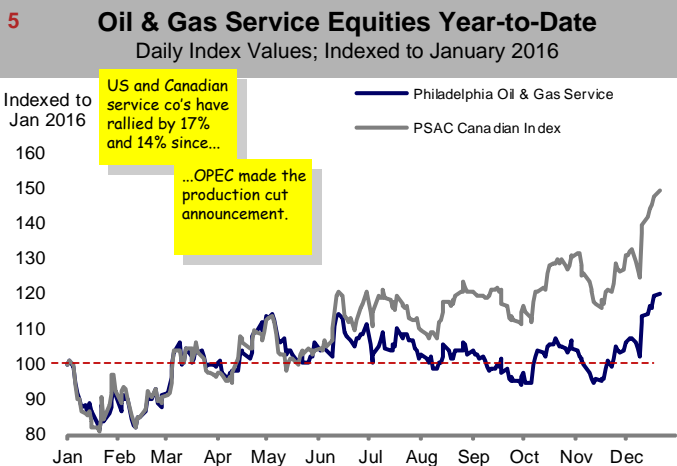
The ARC CDN Oil & Gas Growth Index measures the performance of junior oil and gas producers that are not included in larger exchange indices.

Source: Bloomberg, ARC Financial Corp.



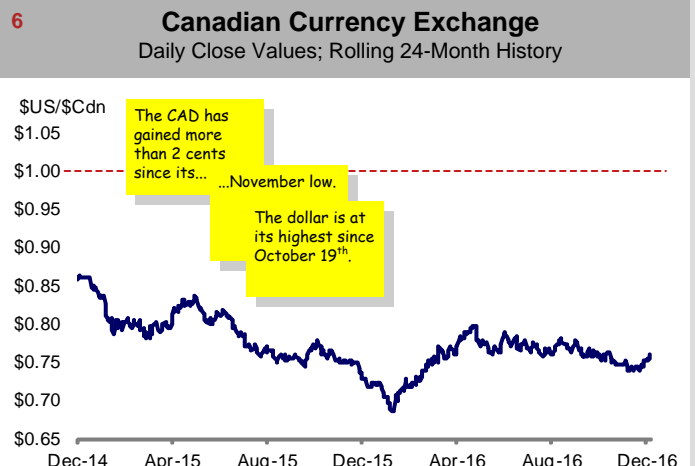
The ARC Oil Sands Index measures the performance of six oil sands producers.

Source: Bloomberg, ARC Financial Corp.



The performance of Canadian oil and gas service equities are plotted in tandem with the corresponding US index.

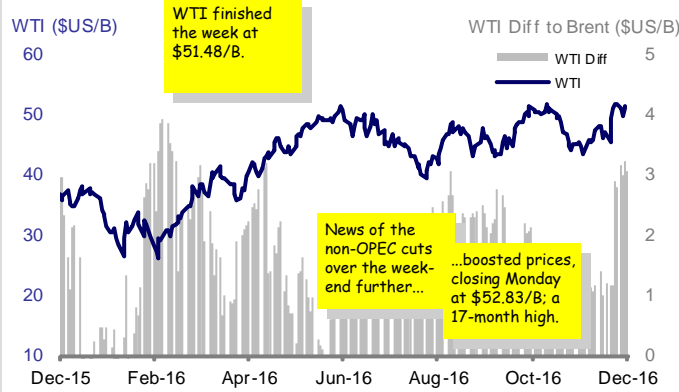
Source: Bloomberg, Petroleum Services Association of Canada



Much of Canada's oil and gas production is sold in US dollars. As such, the exchange rate significantly impacts corporate revenues and profits.

Source: Bloomberg

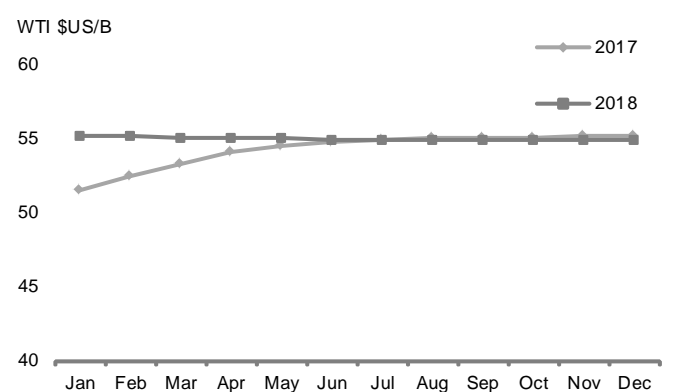
**7 WTI Crude Oil Price and Differential to Brent**  
Near-Month WTI and Brent Differential; Rolling 12-Month History



North American crude oil prices can sometimes disconnect from global prices depending on regional supply and demand dynamics.

Source: Bloomberg

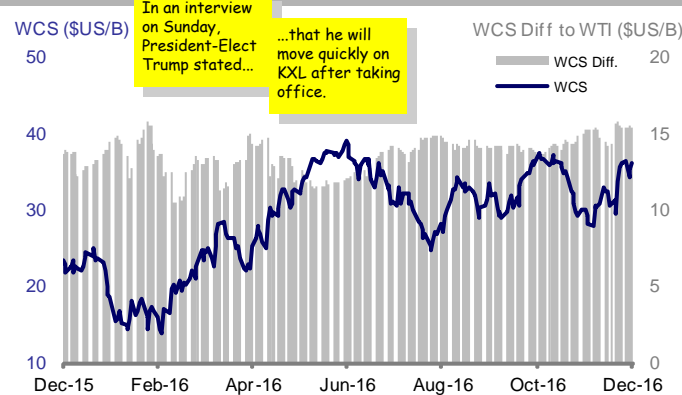
**8 US Crude Oil Futures**  
West Texas Intermediate (WTI) 2017 to 2018



Forward prices for WTI are plotted against months in the calendar year. Years are distinguished by color and symbol coding.

Source: Bloomberg

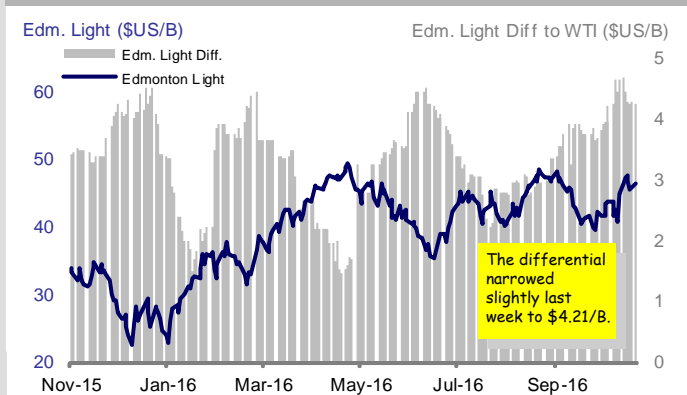
**9 Canadian Heavy Oil Price Differential to WTI**  
Western Canadian Select (WCS) Differential; Rolling 12-Month History



Canadian heavy crude oil differentials are becoming less volatile with growing access to new markets via pipeline and rail.

Source: Bloomberg

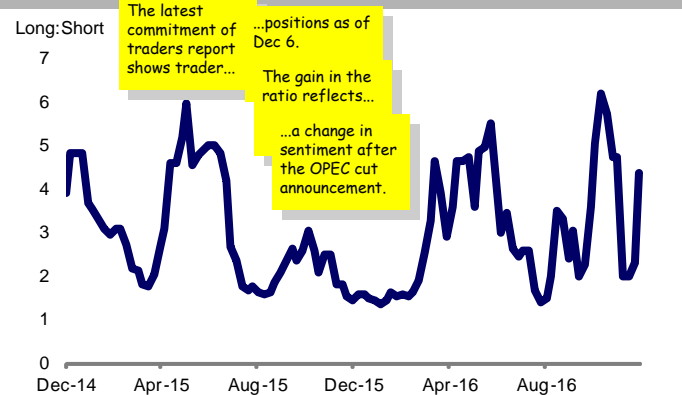
**10 Canadian Light Crude Oil Price Differential to WTI**  
WTI and Edmonton Light differential; Rolling 12-Month History



The differential should reflect the transportation cost from Alberta to Cushing. Greater discounts can result from infrastructure or refinery outages.

Source: Bloomberg

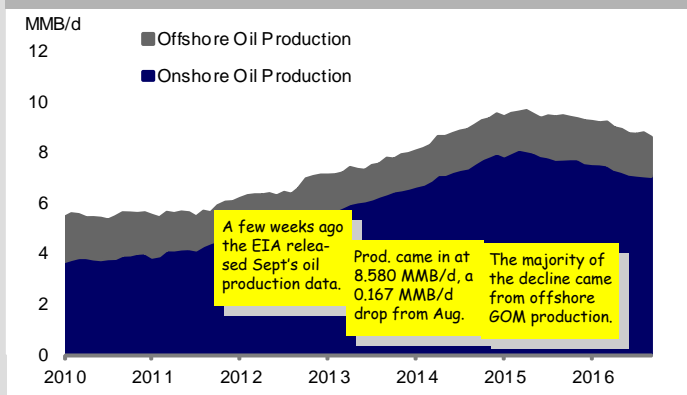
**11 Ratio of Long to Short Contracts - WTI**  
Managed Money - Futures and Options



This represents the relative bullishness of money managers on the price of oil in the United States.

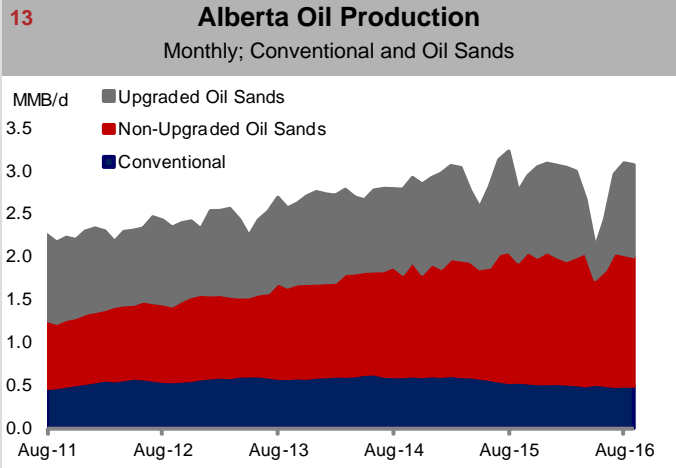
Source: Bloomberg, U.S. Commodity Futures Trading Commission

**12 Total US Oil Production**  
Monthly; 2010 to Present



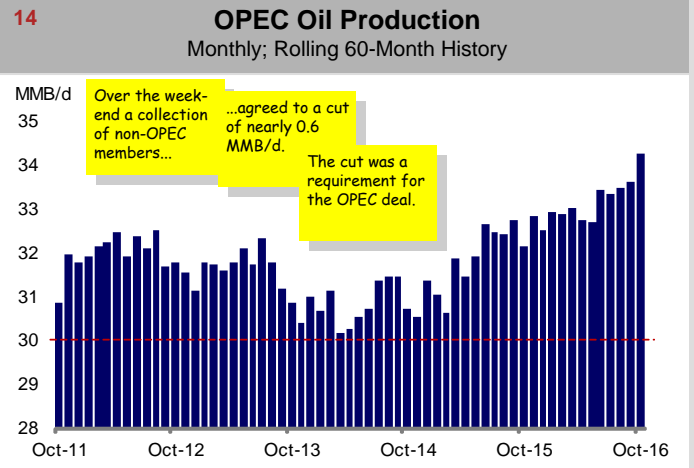
The advancement of drilling and completion methods boosted US crude oil production, prior to the downturn in prices.

Source: Bloomberg, U.S. Energy Information Administration



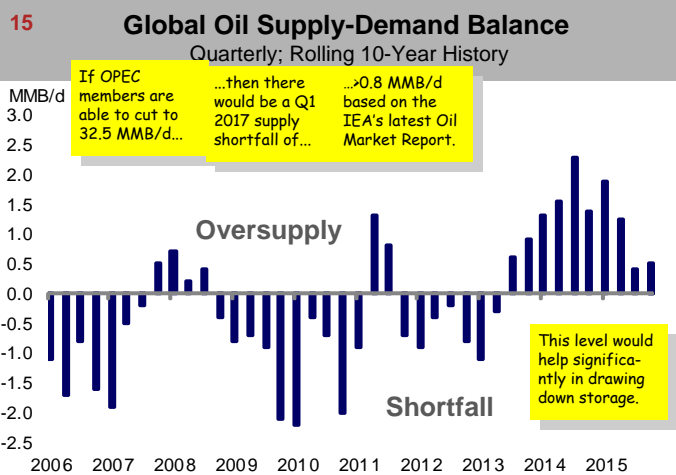
Most of Canada's oil production comes from Alberta; split between oil sands and conventional production.

Source: Alberta Energy Regulator



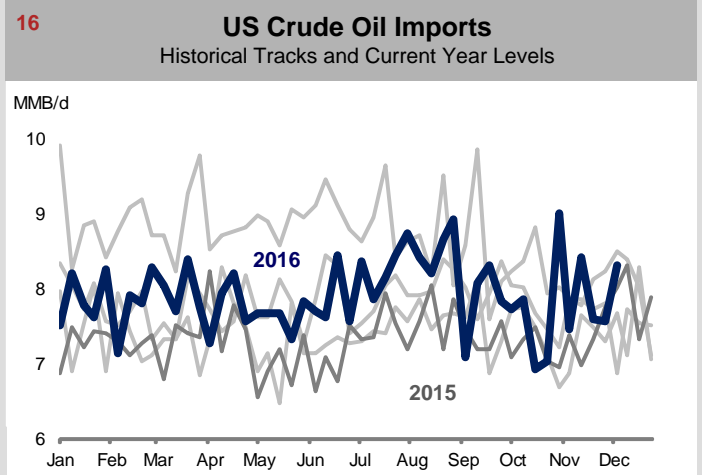
OPEC's production levels relative to its sustainable and spare capacity influences global crude prices.

Source: Petroleum Intelligence Weekly



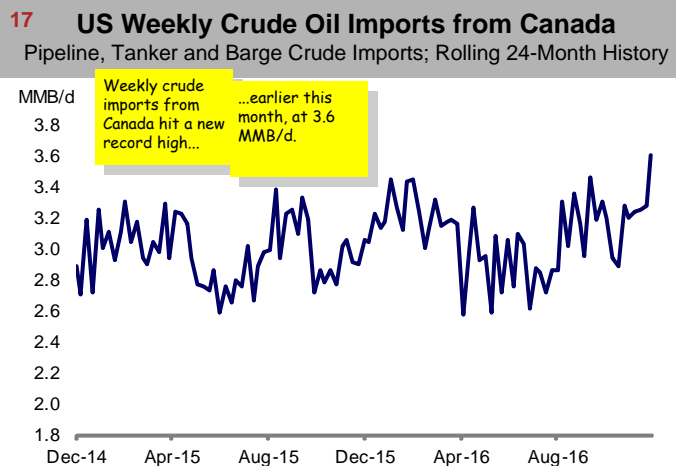
Negative numbers indicate a global crude shortfall, while positive numbers indicate an oversupply.

Source: International Energy Agency



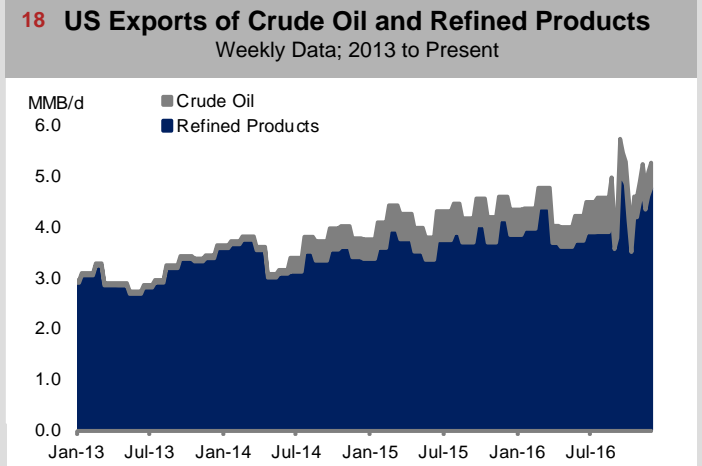
Prior to the downturn, growing domestic supply was displacing crude oil imports. Crude oil imports for the current year are in blue.

Source: U.S. Energy Information Administration



Crude oil imports from Canada are taking market share from overseas imports.

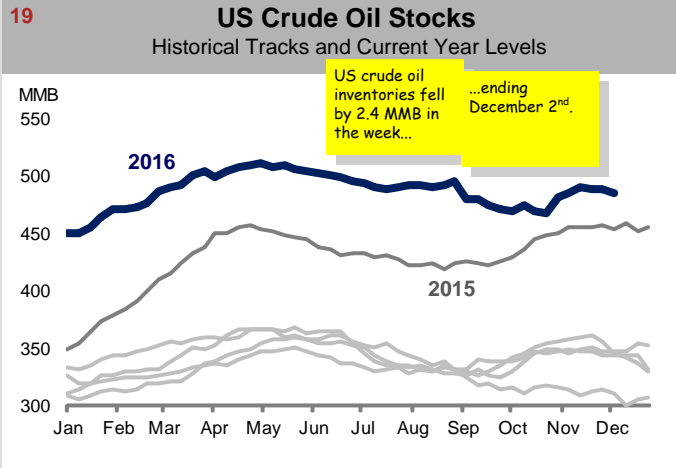
Source: U.S. Energy Information Administration



The US exports more refined products than crude oil. If/when tight oil growth resumes, most export growth should come from crude oil exports.

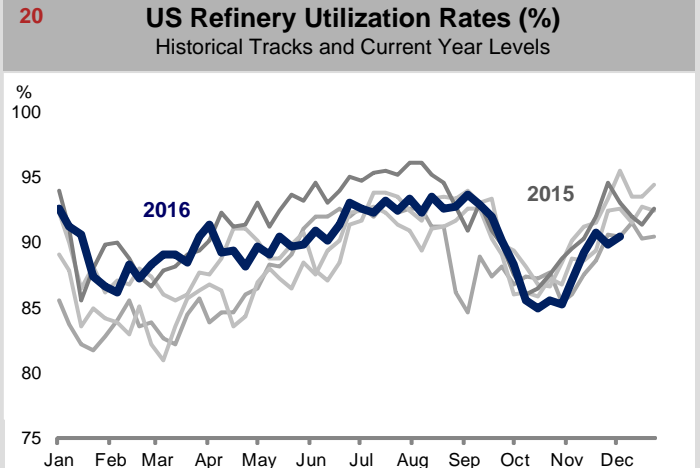
Source: U.S. Energy Information Administration

**Crude Oil**



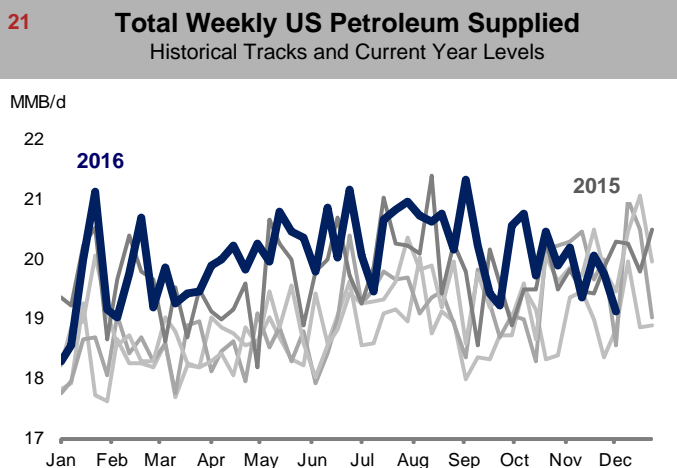
US crude oil stock levels can affect crude oil prices. Stock levels for the current year are represented by the blue line.

Source: U.S. Energy Information Administration



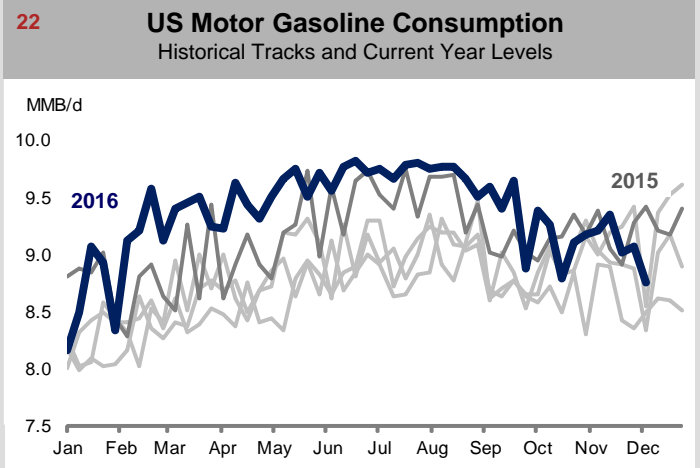
Refinery utilization rates change the supply of refined products, impacting price. Utilization for the current year is blue.

Source: U.S. Energy Information Administration



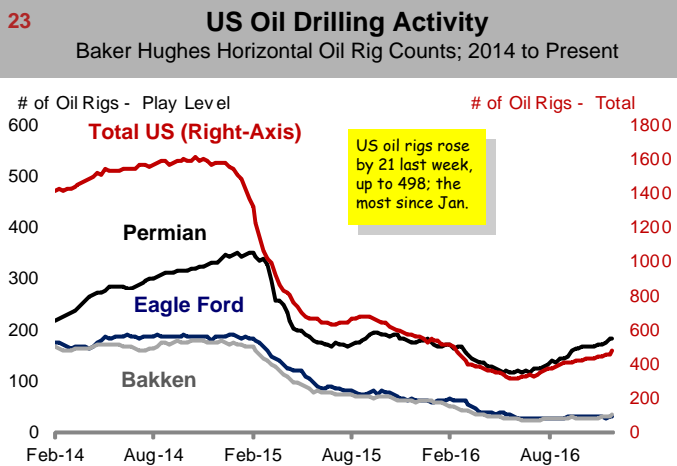
Petroleum supplied represents the total consumption of petroleum products in the US. Consumption for the current year is in blue.

Source: U.S. Energy Information Administration



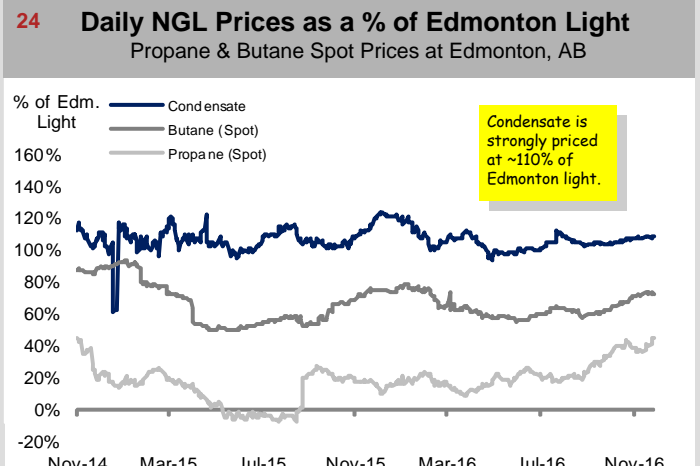
Gasoline consumption accounts for almost half of all oil use in the US. Gasoline consumption for the current year is represented by the blue line.

Source: U.S. Energy Information Administration



Tracking US oil drilling by major play provides insight into the composition of US oil supply and growth trends.

Source: Baker Hughes



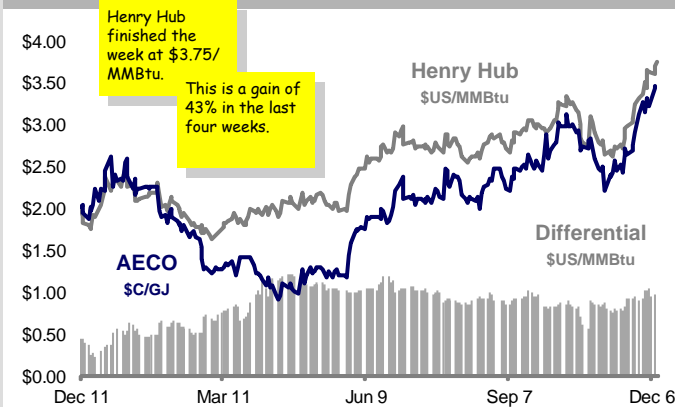
Natural gas liquids have become critical contributors to producer's cash flow. Prices are influenced by the price of oil as well as local supply and demand.

Source: Bloomberg, ARC Financial Corp.



**Natural Gas**

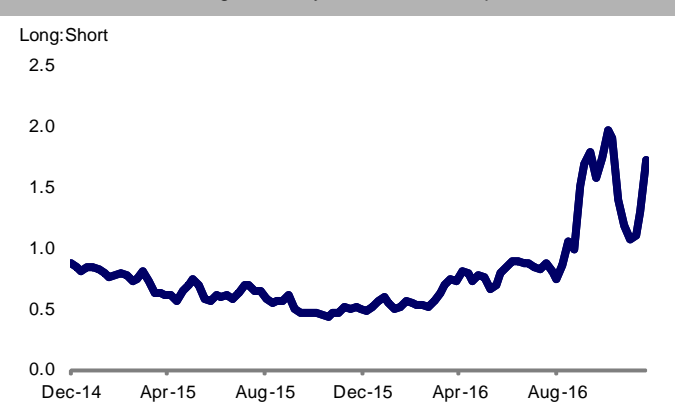
**25 Near-Month North American Natural Gas Prices**  
Daily Prices; Rolling 12-Month History



Near-month prices at AECO track Henry Hub prices, the exchange rate and the cost of transportation. Local factors can also affect price.

Source: Bloomberg

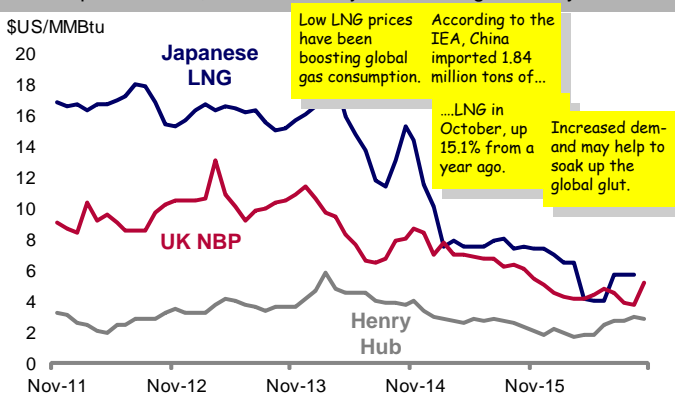
**27 Ratio of Long to Short Contracts – Henry Hub**  
Managed Money – Futures and Options



This represents the relative bullishness of money managers on the price of natural gas in the United States.

Source: U.S. Commodity Futures Trading Commission

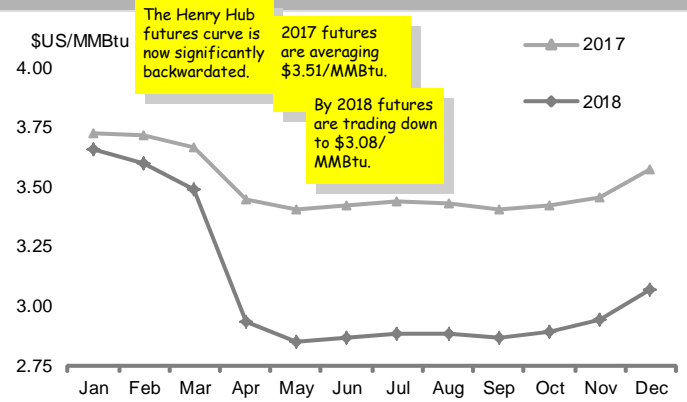
**29 Global Natural Gas Prices**  
Japanese LNG, UK NBP, Henry Hub; Average Monthly Prices



International natural gas prices strongly impact the economics of proposed LNG projects.

Source: Bloomberg, Japanese Ministry of Economy, Trade and Industry

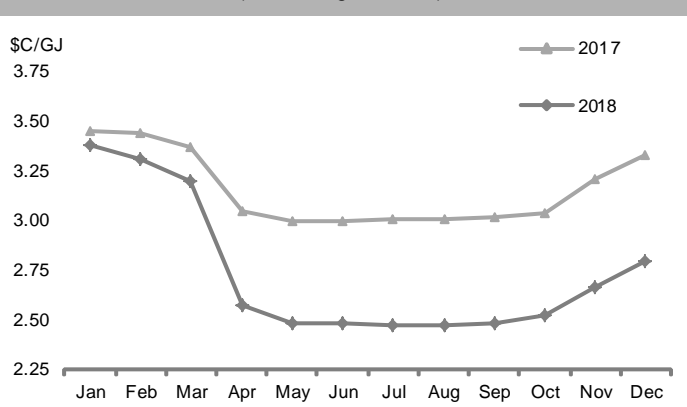
**26 US Natural Gas Futures**  
Nymex (Henry Hub) 2017 to 2018



Forward contract prices are plotted against months in the calendar year. Years are distinguished by color and symbol coding.

Source: Bloomberg

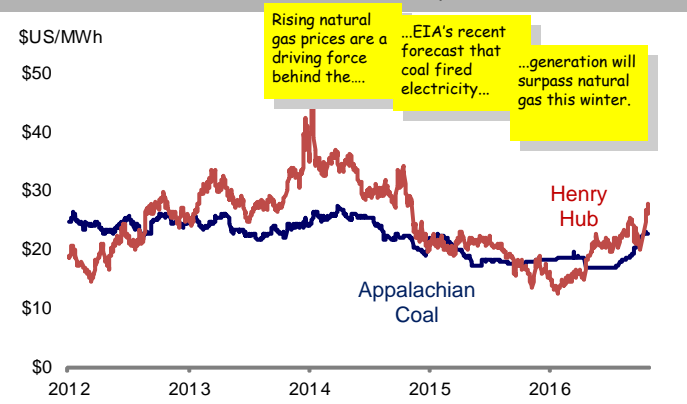
**28 Canadian Natural Gas Futures**  
AECO Hub (Bloomberg Estimate) 2017 to 2018



AECO forward prices mimic Henry Hub futures plus a differential

Source: Bloomberg

**30 US Coal and Natural Gas Power Generation Cost**  
Converted to a \$/MWh Equivalent



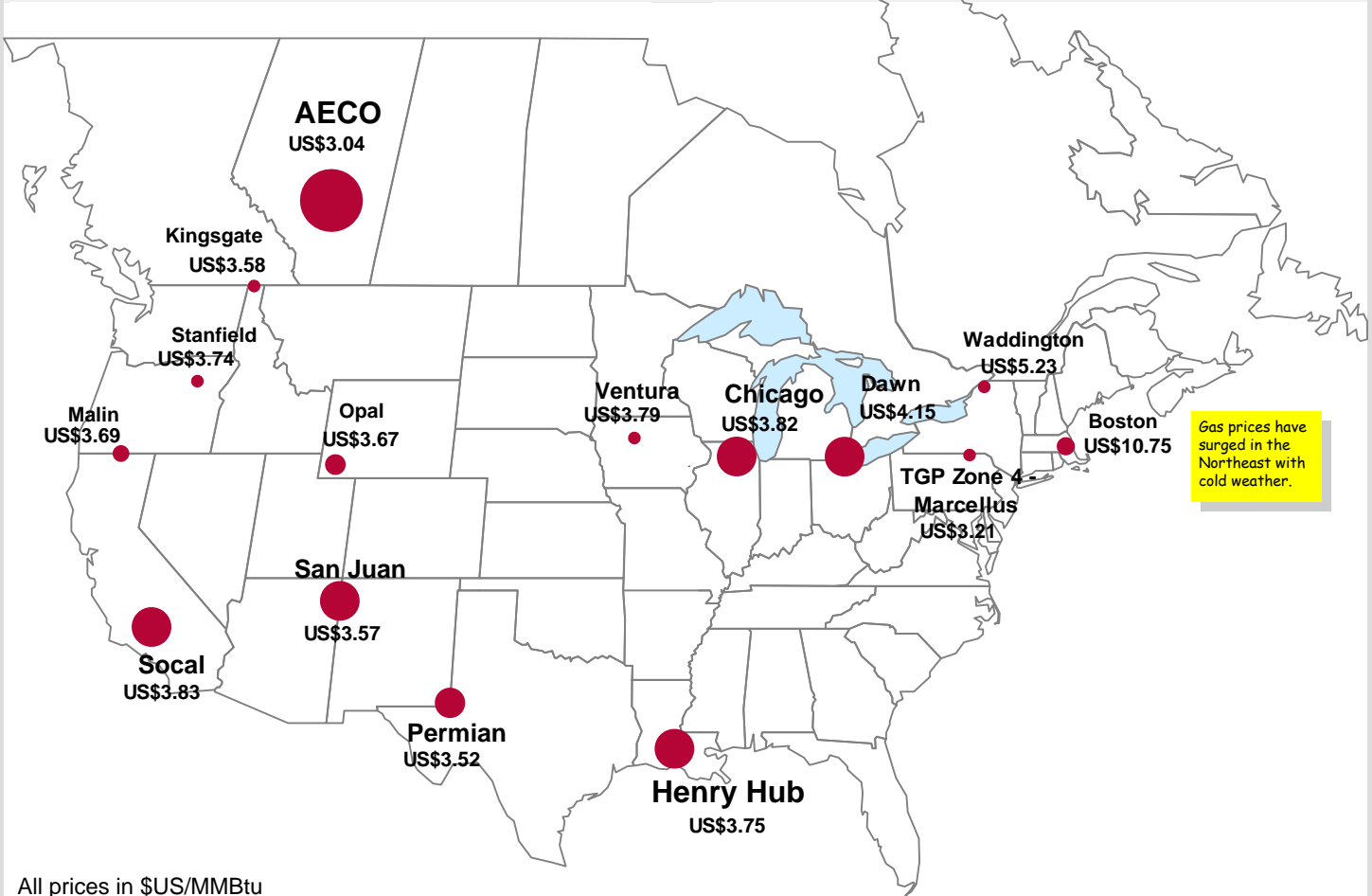
This graph illustrates when it may be economic to begin coal-gas switching in power generation. Average power plant efficiencies are assumed.

Source: Bloomberg

**Natural Gas**

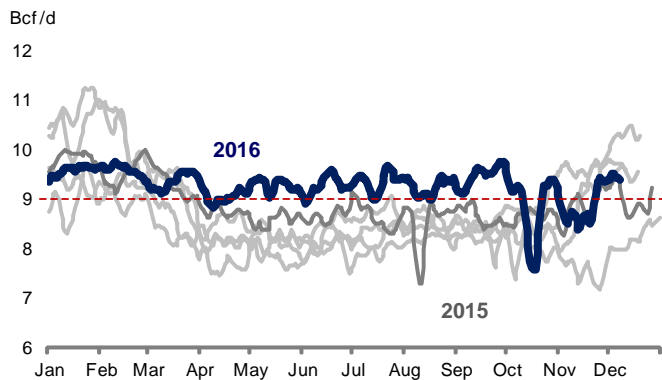
31

**Closing Spot Prices at North American Natural Gas Hubs**  
Superimposed on Relative Physical Volumes Traded



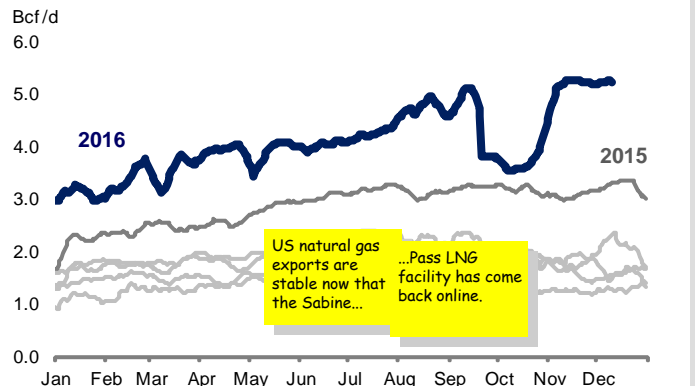
North America has an integrated natural gas market. Prices are determined by regional supply and demand, and pipeline flows.  
Source: Bloomberg

**32 Pipeline Flows Out of Western Canada**  
Daily; Historical Tracks and Current Year Levels



The ability of gas producers to move gas out of the WCSB to eastern markets and the US is a major factor in local natural gas prices.  
Source: Various Pipeline Companies

**33 US Natural Gas Exports – Excluding Canada**  
Daily; Historical Tracks and Current Year Levels



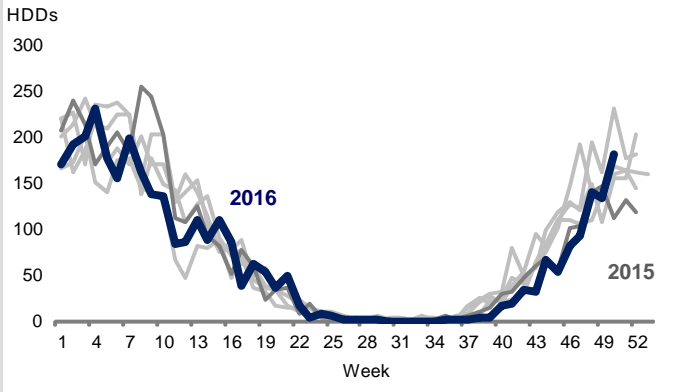
Between exports to Mexico and LNG shipments, the US is growing as a natural gas exporter. Robust US supply growth has driven this trend.  
Source: Bentek



ARC energy charts

Natural Gas

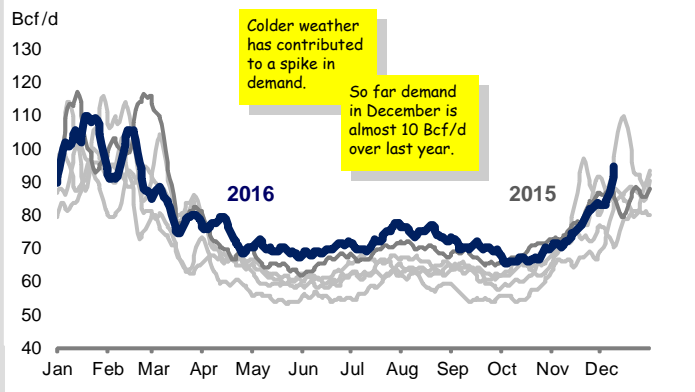
**34 US Weekly Heating Degree Days**  
Weekly: Historical Tracks and Current Year Levels



Weekly natural gas demand is directly tied to the weather. The current year is in dark blue.

Source: National Oceanic and Atmospheric Administration

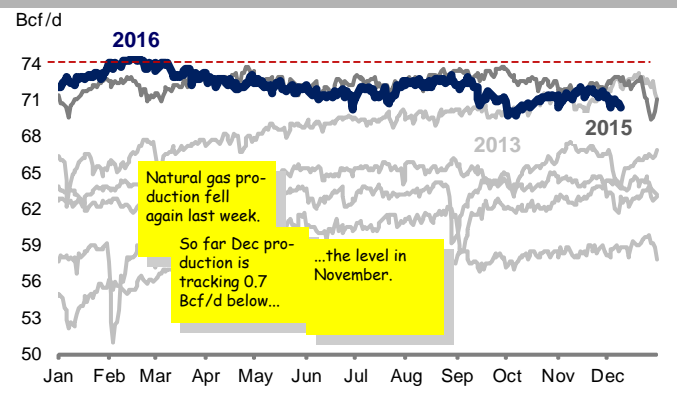
**35 US Total Natural Gas Demand**  
Daily: Historical Tracks and Current Year Levels



Total US demand fluctuates between 60 Bcf/d in the summer and over 100 Bcf/d in the winter. Weather is the most important driver of consumption.

Source: Bentek

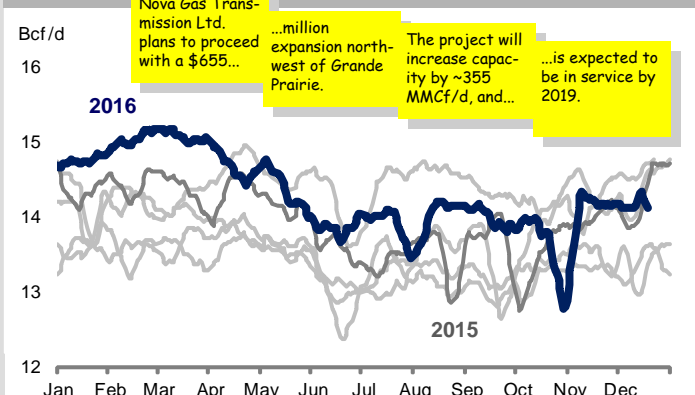
**36 Total US Dry Natural Gas Production**  
Historical Tracks and Current Year Levels



US production started ramping up in late 2007 and continues to grow year over year.

Source: Bentek

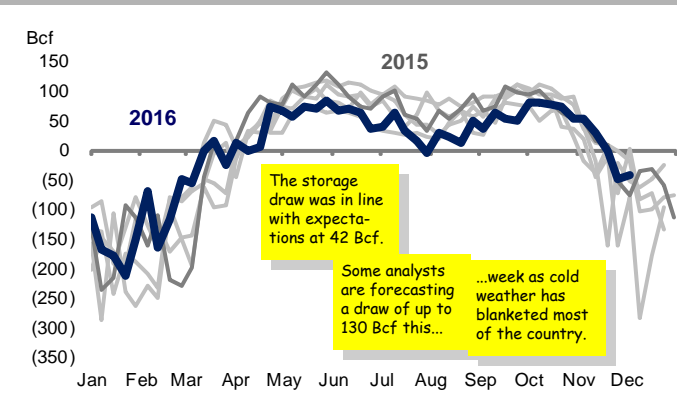
**37 Daily Western Canadian Production**  
Estimated Using Major Pipeline Receipts



This includes receipts on the TCPL, Alliance, WestCoast and TransGas pipelines.

Source: Various Pipeline Companies

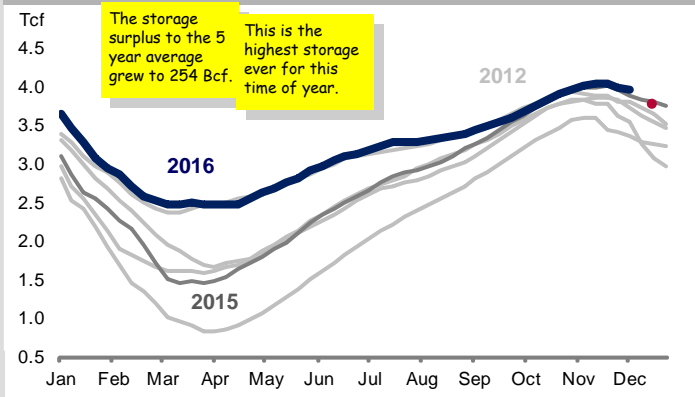
**38 Weekly US Natural Gas Storage Net Change**  
Weekly Injection or (Withdrawals); 2009 to Current



Weekly gas storage reports provide a snapshot of supply and demand. Current year changes are represented by the blue line.

Source: U.S. Energy Information Administration

**39 Total Working Natural Gas in US Storage**  
Historical Tracks and Current Year Levels



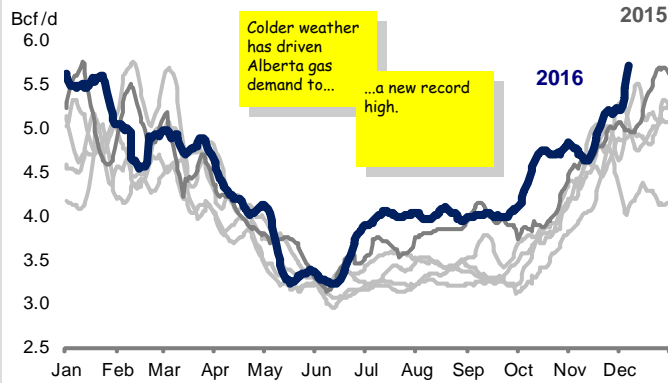
The EIA reports changes in US natural gas inventories held in underground storage facilities on a weekly basis.

Source: U.S. Energy Information Administration

ARC energy charts

Natural Gas and Other Indicators

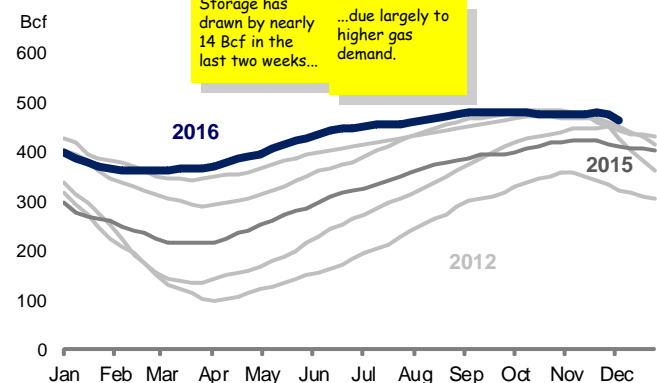
**40 Alberta Natural Gas Demand**  
TransCanada Intra-AB Deliveries; Current Year and Historical Tracks



Alberta natural gas demand has grown steadily in recent years, largely driven by new oil sands projects coming on line.

Source: TransCanada Pipelines

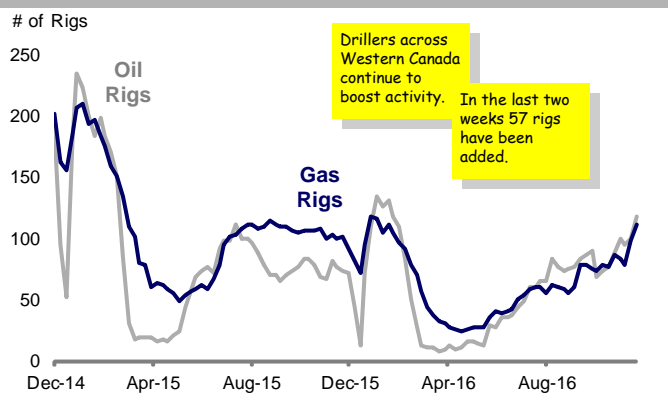
**41 Western Canadian Natural Gas Storage Levels**  
Weekly; Current Year and Historic Tracks



Canada's natural gas storage level provides a good metric if the country is well stocked. Abnormally high or low storage can affect the basis.

Source: Bloomberg

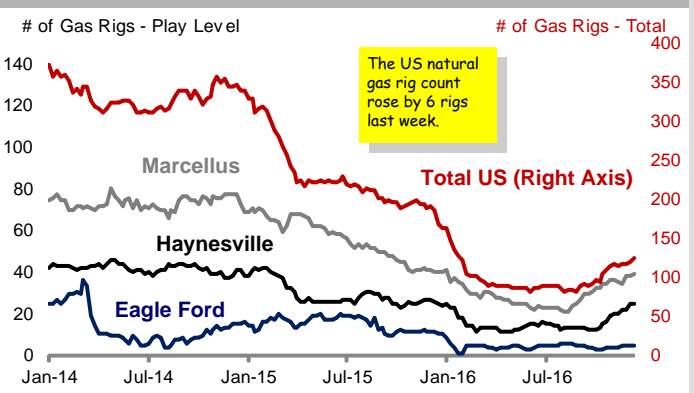
**42 Weekly Canadian Oil and Gas Drilling Activity**  
Baker Hughes Average Rig Counts; Rolling 24-Month History



Unlike US drilling activity, Canadian rigs are dispatched seasonally. Capital allocation by operators is driven by views of future oil and gas prices.

Source: Baker Hughes

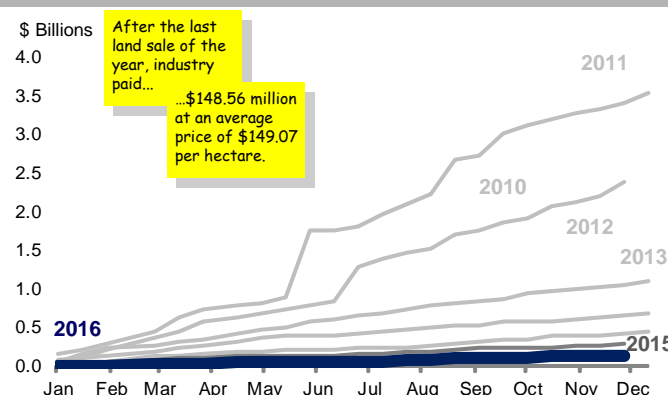
**43 US Gas Drilling Activity**  
Baker Hughes Horizontal Gas Rig Counts; 2014 to Present



Tracking US gas drilling by major play provides insight into the composition of US gas supply and growth trends.

Source: Baker Hughes

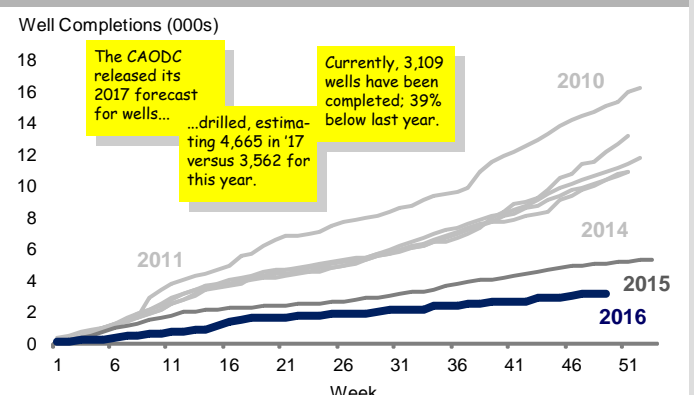
**44 Alberta Crown Land Sales – Excluding Oil Sands**  
Year-over-Year; Cumulative



Land prices are an important component of F&D costs. In Alberta, sales of petroleum and natural gas rights are held every two weeks.

Source: Alberta Department of Energy

**45 Canadian Cumulative Well Completions**  
Current Year vs Years Prior

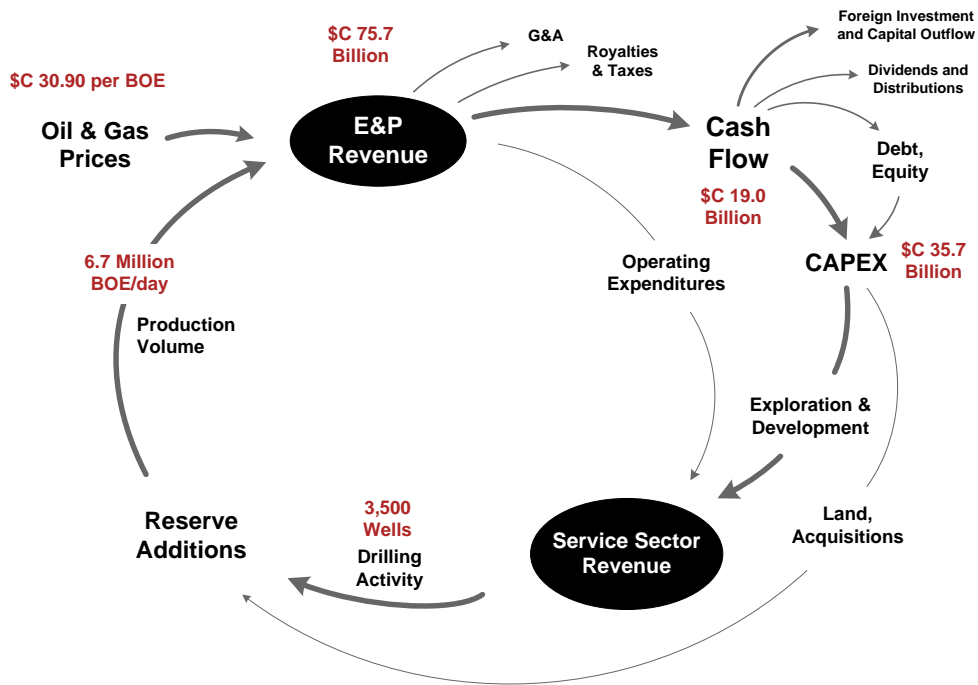


Relative year-over-year drilling activity is highlighted in this chart. Cumulative well completions for the current year are shown in blue.

Source: Daily Oil Bulletin/JWN

**Canadian Industry Metrics**

**Estimated Capital Flow in the Canadian Oil and Gas Economy for 2016**  
Industry Revenue, Cash Flow, Reinvestment, Drilling Activity and Production



46

**Canadian Industry Statistics: Historical Data and Forecast**

**Canadian Industry Metrics**

	Price			Production Volume				Capital Inflow		Reinvestment			Drilling		Well Split	
	Average Price	Edmonton Par	AECO	Conv. Liquids	Bitumen + Synthetic	Natural Gas	Total Volume	Total Revenue	After-tax Cash Flow	Conv. Oil and Gas	Oilsands	Reinvest Ratio	Wells Compl.	Avg Rig Utiliz.	Oil Wells	Gas Wells
	\$/BOE	\$/B	\$/GJ	Average MBOE/d	Average MBOE/d	MBOE/d (@ 6:1)	MBOE/d (@ 6:1)	\$/ millions	\$/ millions	\$/ millions	\$/ millions	x:1	# / Year	%	%	%
2002	27.71	40.21	3.89	2,102	741	2,886	5,729	57,939	29,433	18,107	6,746	0.84	14,459	45%	27%	63%
2003	35.95	43.40	6.31	2,085	863	2,800	5,738	75,298	37,644	23,855	5,048	0.77	19,851	62%	23%	70%
2004	39.79	52.86	6.24	2,089	993	2,827	5,865	85,179	43,959	26,828	6,183	0.75	21,593	63%	21%	72%
2005	51.53	69.19	8.36	2,044	990	2,840	5,837	107,455	56,442	34,815	10,437	0.81	21,925	68%	22%	70%
2006	46.98	73.27	6.20	2,042	1,126	2,850	5,941	103,294	54,171	38,345	14,337	1.00	22,127	65%	22%	71%
2007	49.28	77.01	6.12	2,077	1,199	2,810	6,070	109,274	54,985	31,184	18,065	0.88	19,144	38%	28%	66%
2008	68.22	102.66	7.75	1,994	1,207	2,700	5,864	145,425	83,255	36,293	18,113	0.65	16,877	41%	36%	56%
2009	42.26	66.42	3.79	1,840	1,331	2,514	5,683	89,057	36,680	22,335	11,227	0.91	8,368	25%	41%	51%
2010	48.41	77.55	3.79	1,830	1,403	2,434	5,668	101,056	43,569	35,666	17,195	1.16	12,119	40%	56%	40%
2011	55.32	95.24	3.44	1,873	1,482	2,386	5,740	115,890	53,448	40,139	22,491	1.10	12,827	52%	69%	31%
2012	50.60	86.38	2.27	1,905	1,743	2,327	5,975	111,389	48,908	39,733	27,199	1.37	11,067	44%	83%	17%
2013	55.95	93.47	3.02	2,023	1,940	2,343	6,306	128,787	54,711	43,165	30,809	1.35	11,071	42%	84%	16%
2014	61.20	95.07	4.23	2,086	2,163	2,445	6,694	149,530	71,846	46,872	33,868	1.12	11,226	45%	78%	22%
2015	35.34	57.63	2.56	1,983	2,373	2,479	6,835	88,170	24,775	30,551	22,948	2.16	5,394	24%	69%	31%
2016e	30.90	51.51	2.04	1,904	2,393	2,411	6,708	75,666	19,049	19,469	16,209	1.87	3,500	16%	55%	45%