January 3, 2017

energyresearch institute

ARC Energy Charts

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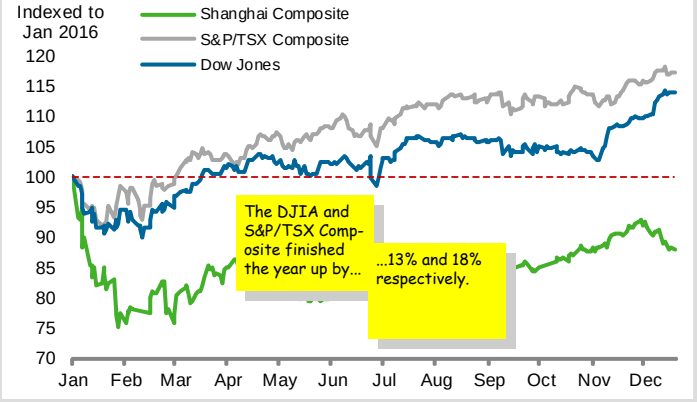
Chart Watch

10	US oil production increased by 232 MB/d in Oct
17	US crude oil stocks rose by 0.6 MMB last week
21	US oil rigs are up 66% from the May low
36	US gas storage drew by 237 Bcf last week
37	US gas storage is now below the 5-year average

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
53.72 ↑	50.48 ↑	3.68 ↑	3.36 ↑	1.04 ↓	0.7445 ↑

1 Broad Equity Markets Year-to-Date

Daily Index Values; Indexed to January 2016

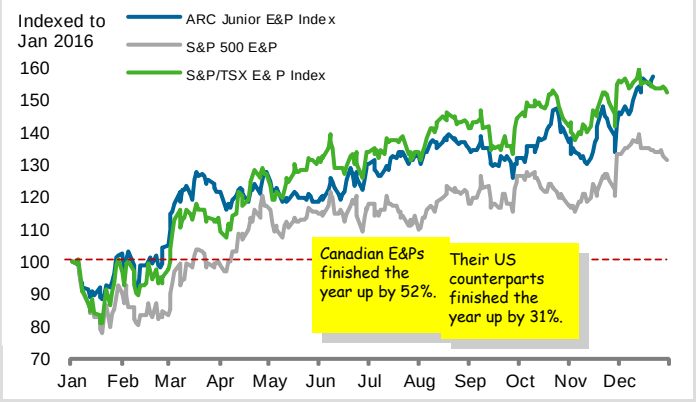


Broad market indices are one the many vital signs measuring the health of the economy. Energy demand is a function of economic health.

Source: Bloomberg, ARC Financial Corp.

2 Performance of Oil and Gas Equities Year-to-Date

Daily Index Values; Indexed to January 2016

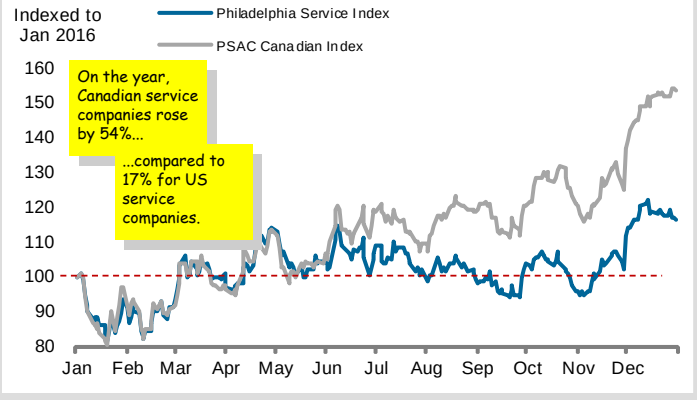


Performance of Canadian and US oil & gas equities are compared against each other.

Source: Bloomberg, ARC Financial Corp.

3 Oil & Gas Service Equities Year-to-Date

Daily Index Values; Indexed to January 2016

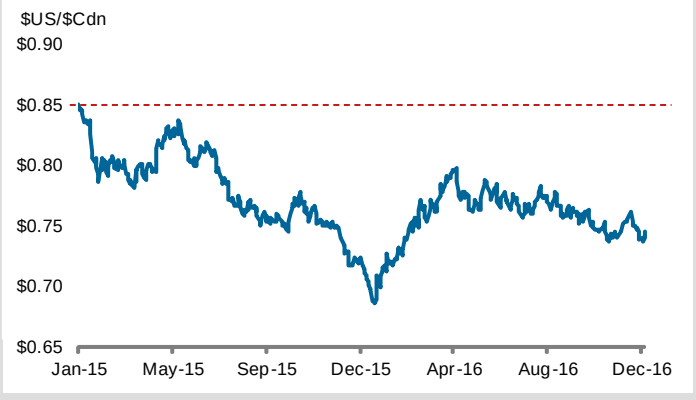


The performance of Canadian oil and gas service equities are plotted in tandem with the corresponding US index.

Source: Bloomberg, Petroleum Services Association of Canada

4 Canadian Currency Exchange

Daily Close Values; Rolling 24-Month History



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

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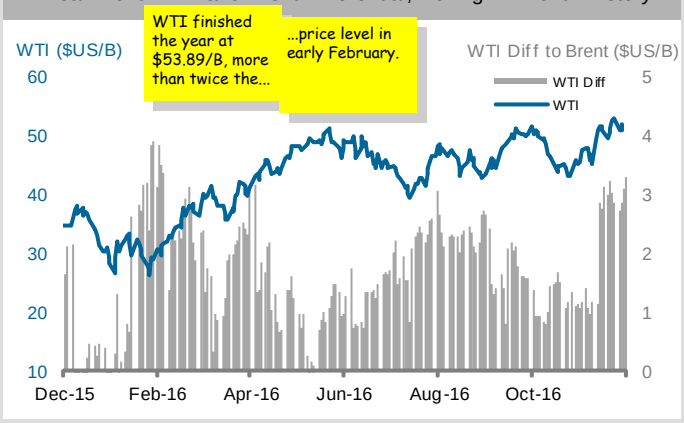
5 WTI Crude Oil Price and Differential to Brent

Near-Month WTI and Brent Differential; Rolling 12-Month History

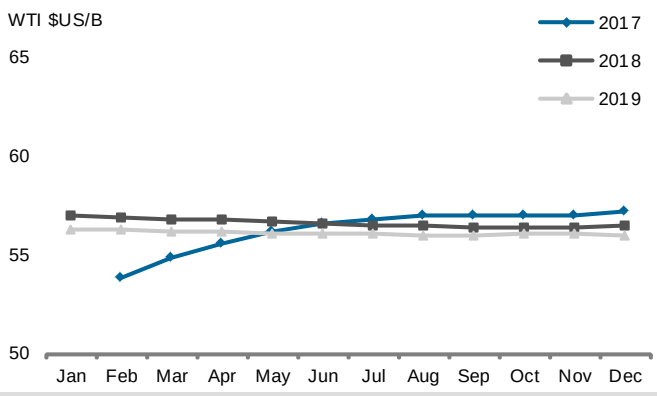


North American crude oil prices can sometimes disconnect from global prices depending on regional supply and demand dynamics.

Source: Bloomberg

6 US Crude Oil Futures

West Texas Intermediate (WTI) 2016 to 2018

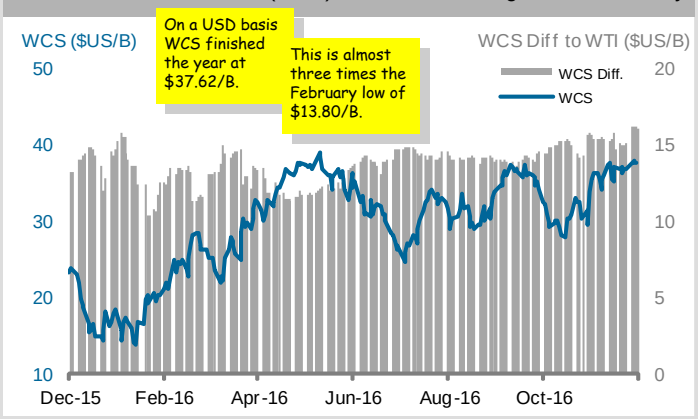


Forward prices for WTI are plotted against months in the calendar year. Years are distinguished by color and symbol coding.

Source: Bloomberg

7 Canadian Heavy Oil Price Differential to WTI

Western Canadian Select (WCS) Differential; Rolling 12-Month History

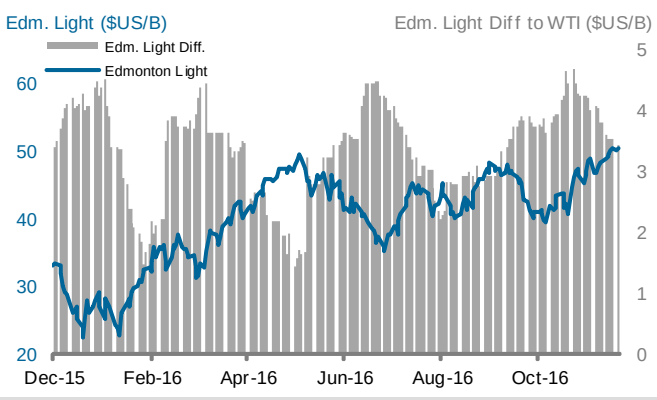


Canadian heavy crude oil differentials are becoming less volatile with growing access to new markets via pipeline and rail.

Source: Bloomberg

8 Canadian Light Crude Oil Price Differential to WTI

WTI and Edmonton Light differential; Rolling 12-Month History

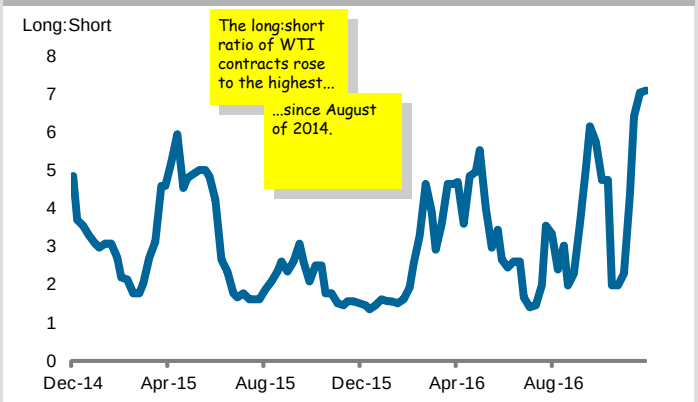


The differential should reflect the transportation cost from Alberta to Cushing. Greater discounts can result from infrastructure or refinery outages.

Source: Bloomberg

9 Ratio of Long to Short Contracts - WTI

Managed Money - Futures and Options

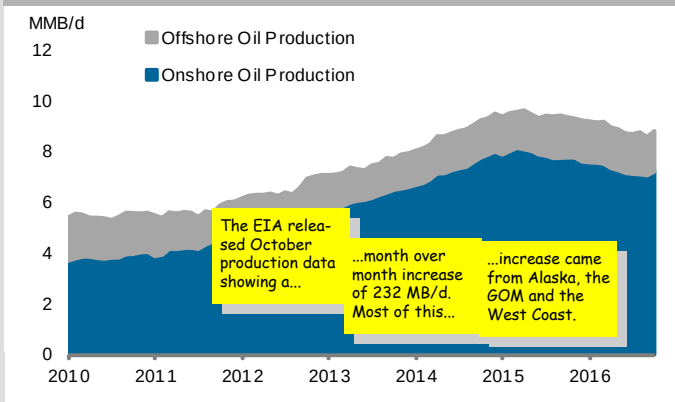


This represents the relative bullishness of money managers on the price of oil in the United States.

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

10 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

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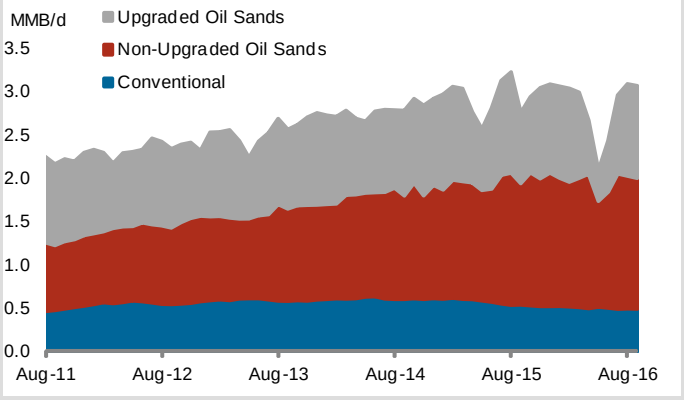
11 Alberta Oil Production

Monthly; Conventional and Oil Sands

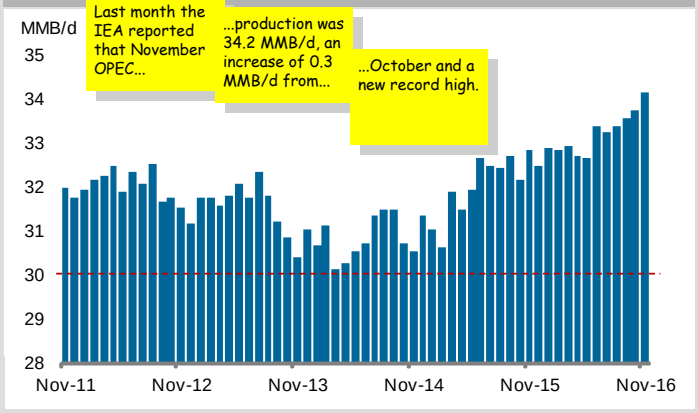


Most of Canada's oil production comes from Alberta; split between oil sands and conventional production.

Source: Alberta Energy Regulator

12 OPEC Oil Production

Monthly; Rolling 60-Month History

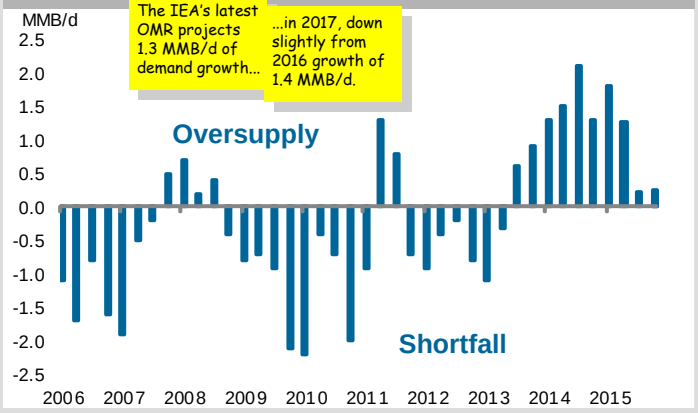


OPEC's production levels relative to its sustainable and spare capacity influences global crude prices.

Source: Petroleum Intelligence Weekly

13 Global Oil Supply-Demand Balance

Quarterly; Rolling 10-Year History

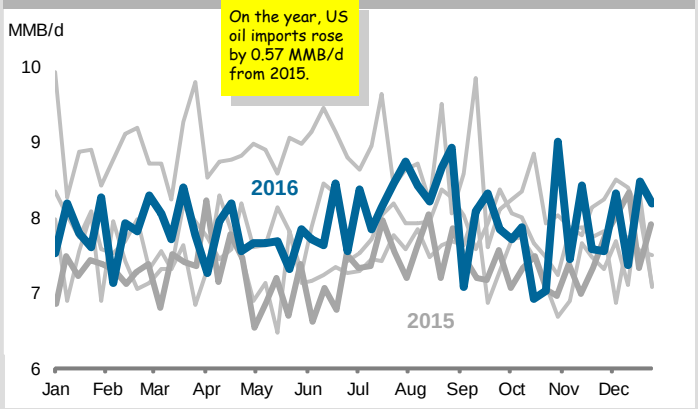


Negative numbers indicate a global crude shortfall, while positive numbers indicate an oversupply.

Source: International Energy Agency

14 US Crude Oil Imports

Historical Tracks and Current Year Levels

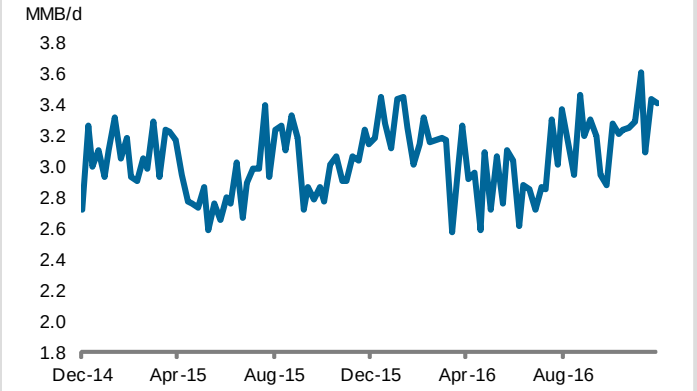


Prior to the downturn, growing domestic supply was displacing crude oil imports. Crude oil imports for the current year are in blue.

Source: U.S. Energy Information Administration

15 US Weekly Crude Oil Imports from Canada

Pipeline, Tanker and Barge Crude Imports; Rolling 24-Month History

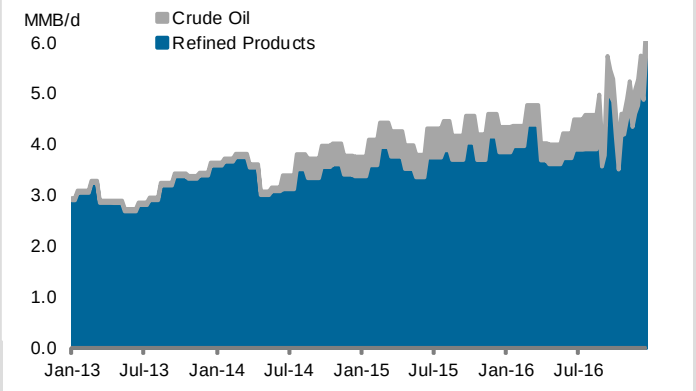


Crude oil imports from Canada are taking market share from overseas imports.

Source: U.S. Energy Information Administration

16 US Exports of Crude Oil and Refined Products

Weekly Data; 2013 to Present



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

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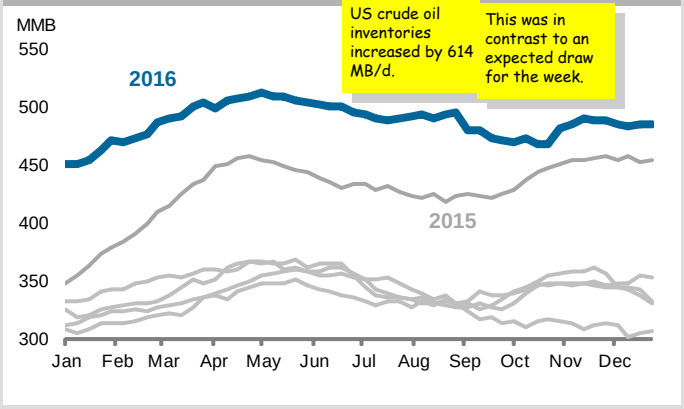
17 US Crude Oil Stocks

Historical Tracks and Current Year Levels

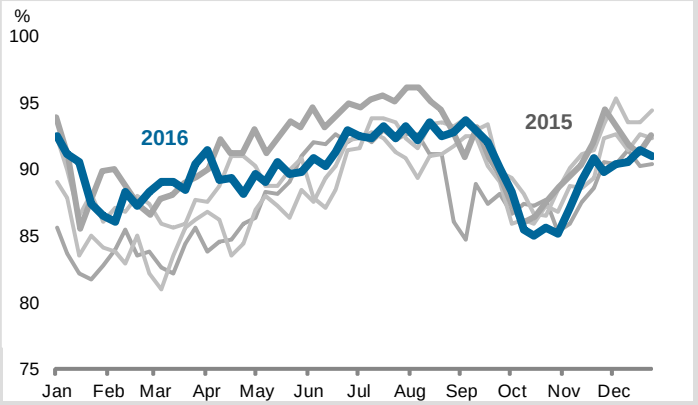


US crude oil stock levels can affect crude oil prices. Stock levels for the current year are represented by the blue line.

Source: U.S. Energy Information Administration

18 US Refinery Utilization Rates (%)

Historical Tracks and Current Year Levels

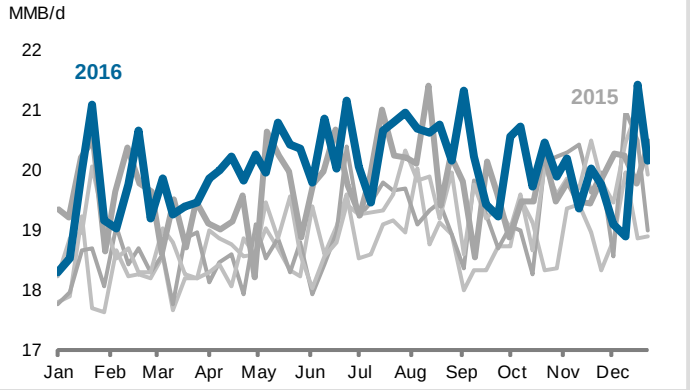


Refinery utilization rates change the supply of refined products, impacting price. Utilization for the current year is blue.

Source: U.S. Energy Information Administration

19 Total Weekly US Petroleum Supplied

Historical Tracks and Current Year Levels

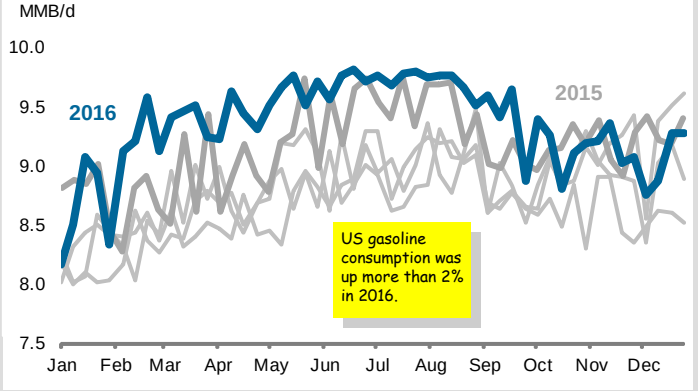


Petroleum supplied represents the total consumption of petroleum products in the US. Consumption for the current year is in blue.

Source: U.S. Energy Information Administration

20 US Motor Gasoline Consumption

Historical Tracks and Current Year Levels

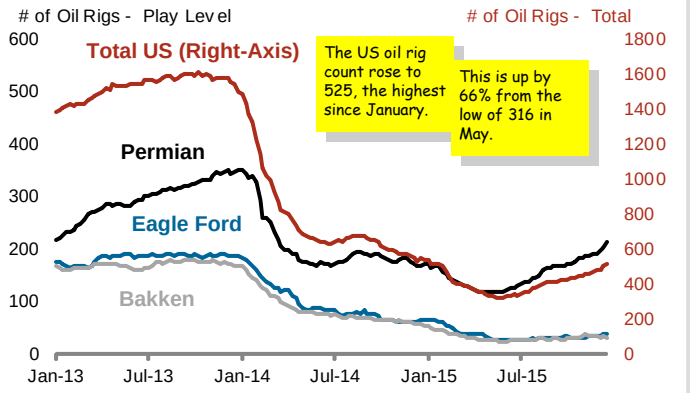


Gasoline consumption accounts for almost half of all oil use in the US. Gasoline consumption for the current year is represented by the blue line.

Source: U.S. Energy Information Administration

21 US Oil Drilling Activity

Baker Hughes Horizontal Oil Rig Counts; 2014 to Present

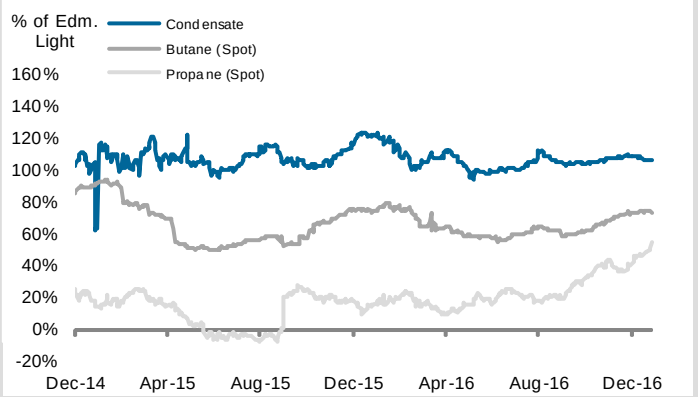


Tracking US oil drilling by major play provides insight into the composition of US oil supply and growth trends.

Source: Baker Hughes

22 Daily NGL Prices as a % of Edmonton Light

Propane & Butane Spot Prices at Edmonton, AB



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.

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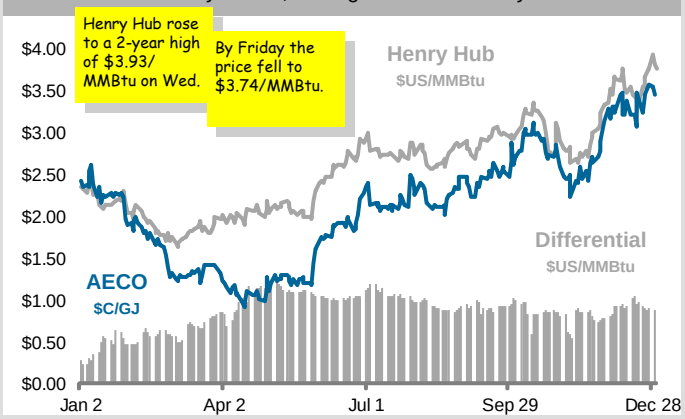
23 Near-Month North American Natural Gas Prices

Daily Prices; Rolling 12-Month History

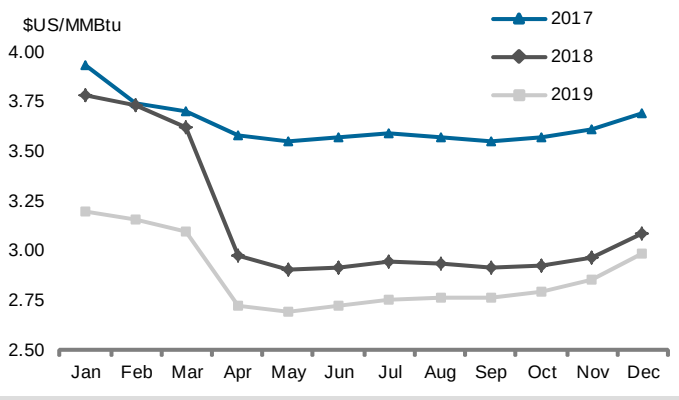


Near-month prices at AECO track Henry Hub prices, the exchange rate and the cost of transportation. Local factors can also affect price.

Source: Bloomberg

24 US Natural Gas Futures

Nymex (Henry Hub) 2016 to 2018

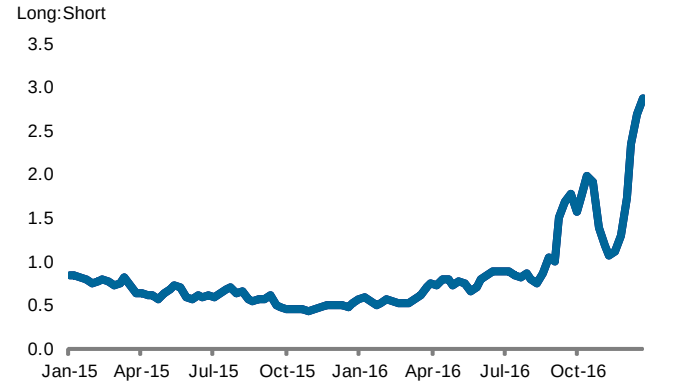


Forward contract prices are plotted against months in the calendar year. Years are distinguished by color and symbol coding.

Source: Bloomberg

25 Ratio of Long to Short Contracts – Henry Hub

Managed Money – Futures and Options

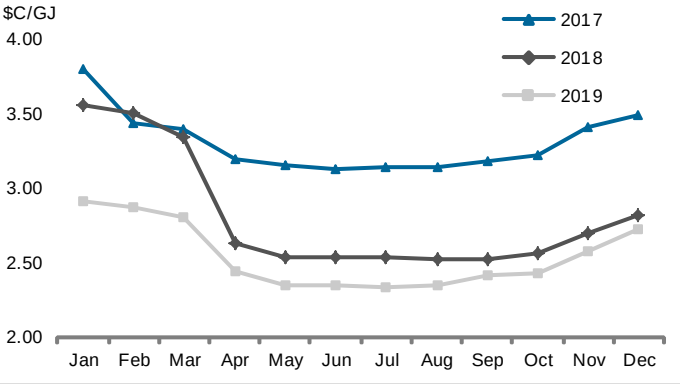


This represents the relative bullishness of money managers on the price of natural gas in the United States.

Source: U.S. Commodity Futures Trading Commission

26 Canadian Natural Gas Futures

AECO Hub (Bloomberg Estimate) 2016 to 2018

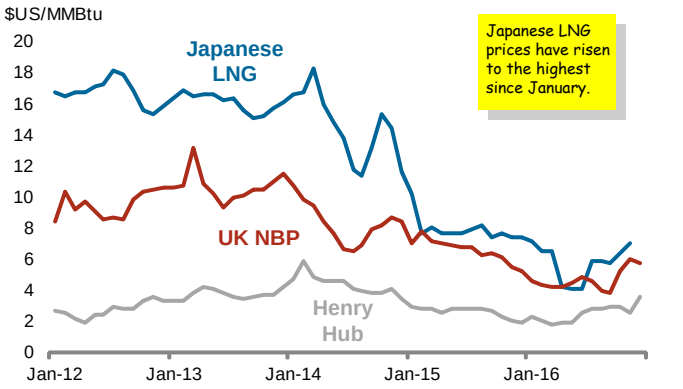


AECO forward prices mimic Henry Hub futures plus a differential

Source: Bloomberg

27 Global Natural Gas Prices

Japanese LNG, UK NBP, Henry Hub; Average Monthly Prices

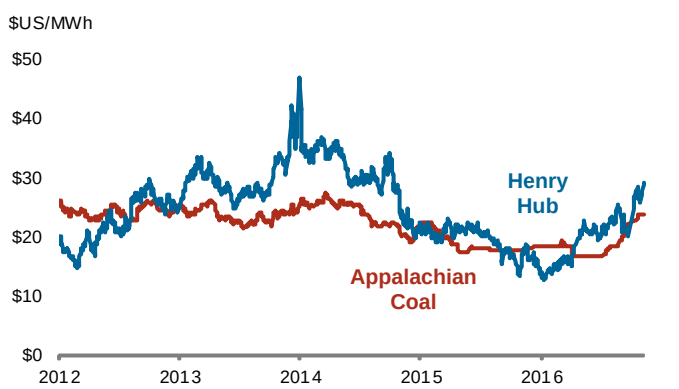


International natural gas prices strongly impact the economics of proposed LNG projects.

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

28 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

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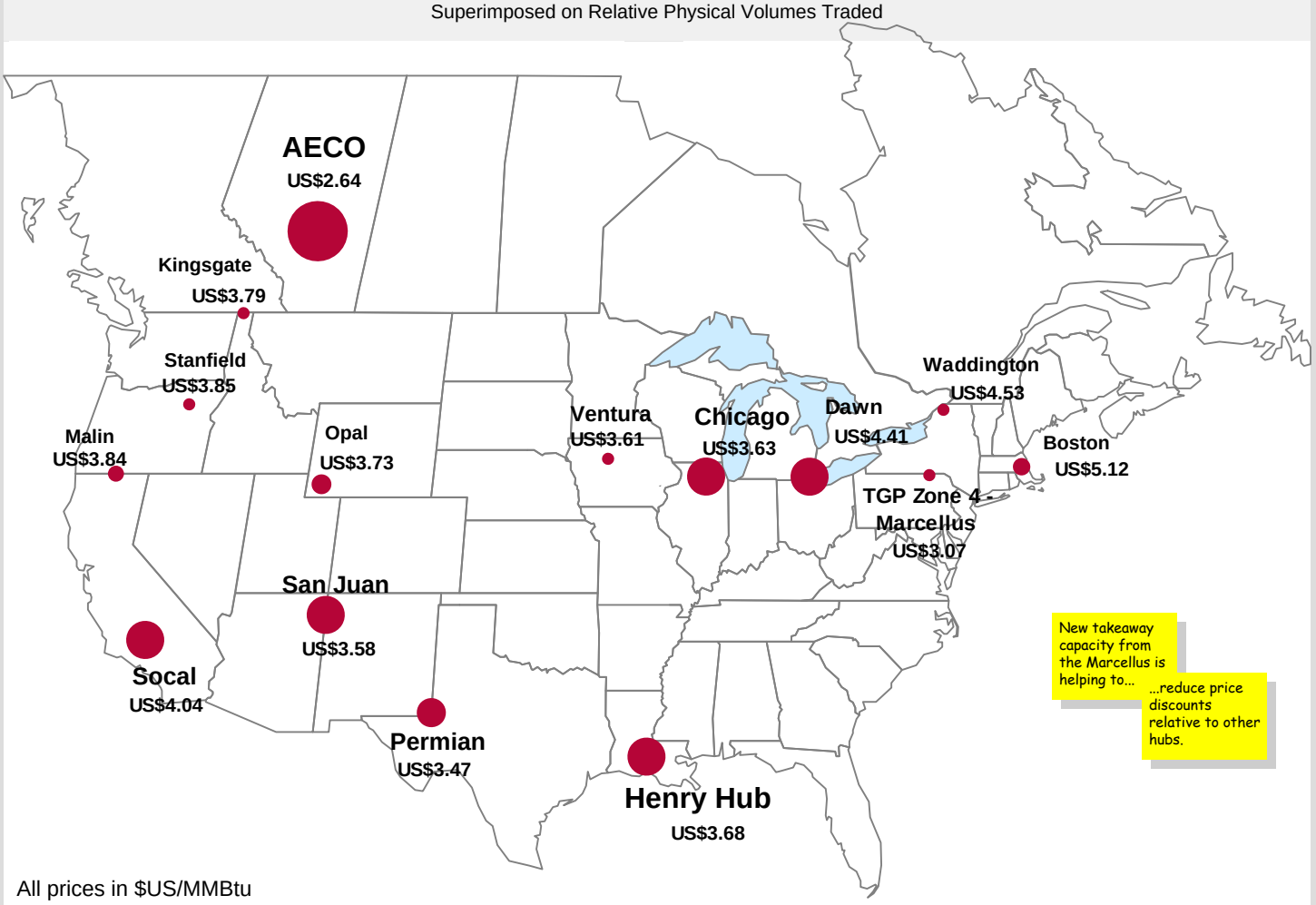
29

Closing Spot Prices at North American Natural Gas Hubs

Superimposed on Relative Physical Volumes Traded



All prices in $US/MMBtu

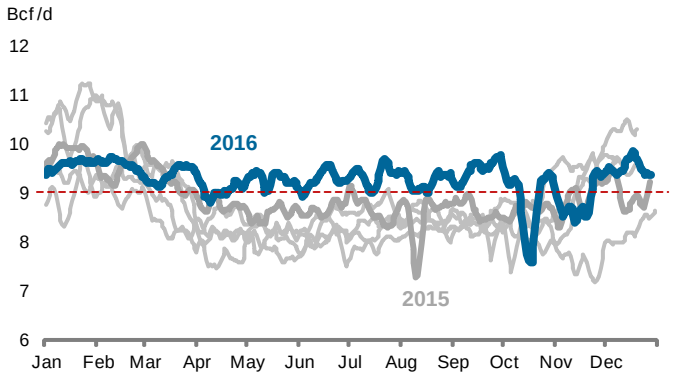
North America has an integrated natural gas market. Prices are determined by regional supply and demand, and pipeline flows.

Source: Bloomberg

30

Pipeline Flows Out of Western Canada

Daily; Historical Tracks and Current Year Levels



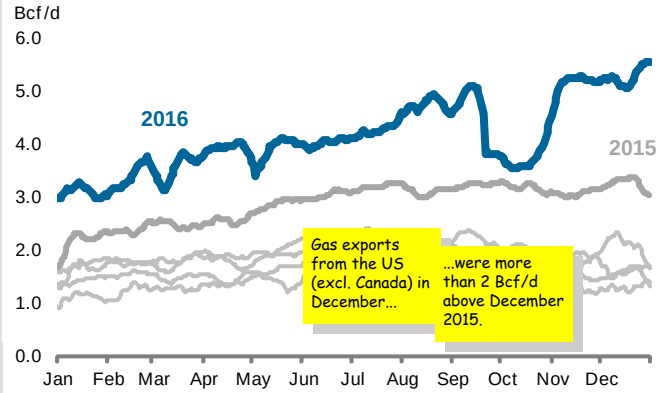
The ability of gas producers to move gas out of the WCSB to eastern markets and the US is a major factor in local natural gas prices.

Source: Various Pipeline Companies

31

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

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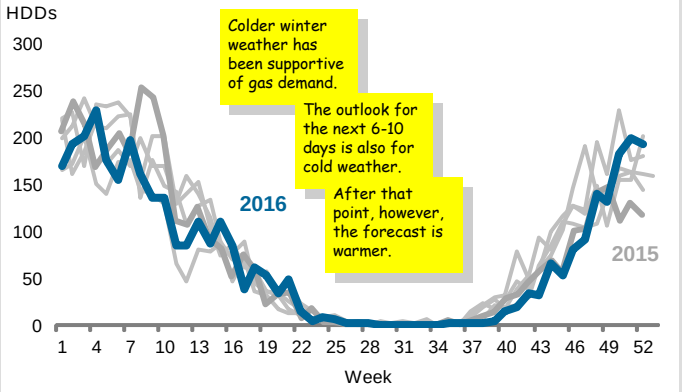
32 US Weekly Heating Degree Days

Source: NOAA

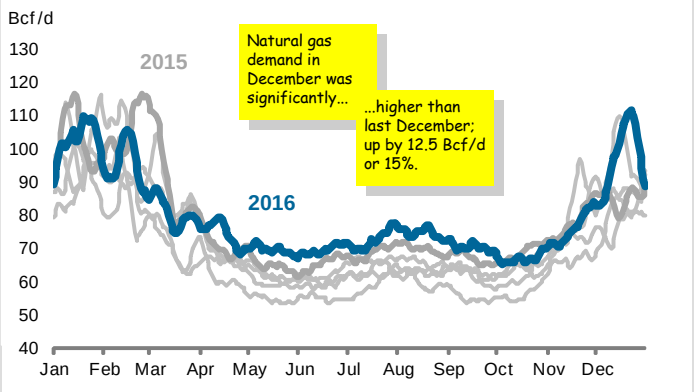


Weekly natural gas demand is directly tied to the weather. The current year is in dark blue.

Source: National Oceanic and Atmospheric Administration

33 US Total Natural Gas Demand

Daily; Historical Tracks and Current Year Levels

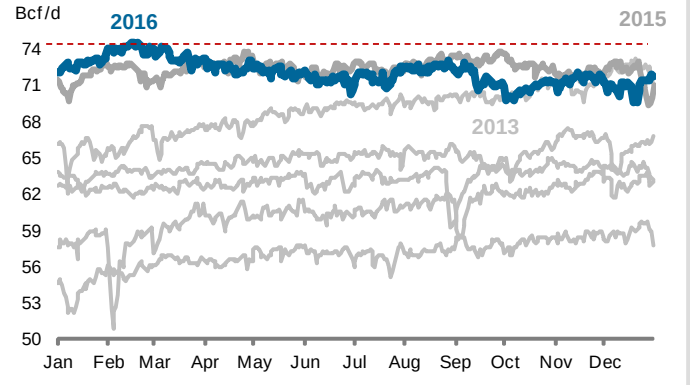


Total US demand fluctuates between 60 Bcf/d in the summer and over 100 Bcf/d in the winter. Weather is the most important driver of consumption.

Source: Bentek

34 Total US Dry Natural Gas Production

Historical Tracks and Current Year Levels

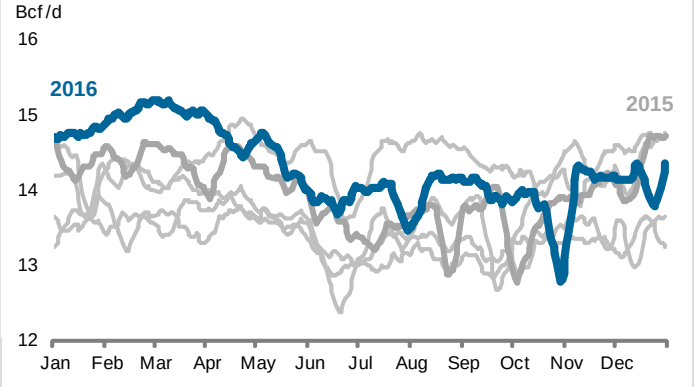


US production started ramping up in late 2007 and continues to grow year over year.

Source: Bentek

35 Daily Western Canadian Production

Estimated Using Major Pipeline Receipts

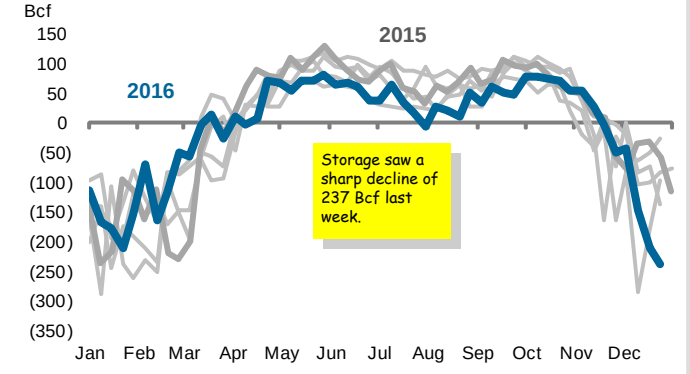


This includes receipts on the TCPL, Alliance, WestCoast and TransGas pipelines.

Source: Various Pipeline Companies

36 Weekly US Natural Gas Storage Net Change

Weekly Injection or (Withdrawals); 2009 to Current

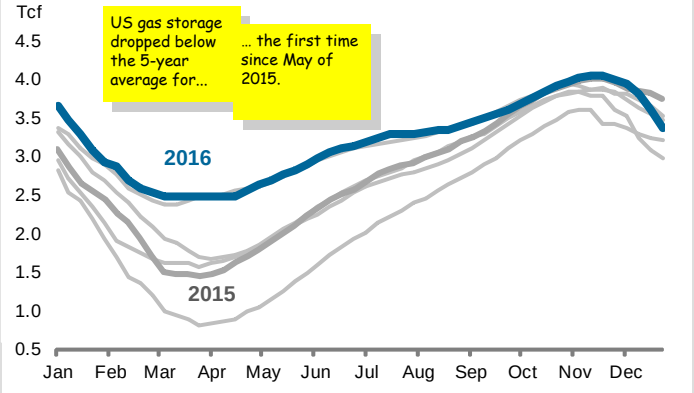


Weekly gas storage reports provide a snapshot of supply and demand. Current year changes are represented by the blue line.

Source: U.S. Energy Information Administration

37 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

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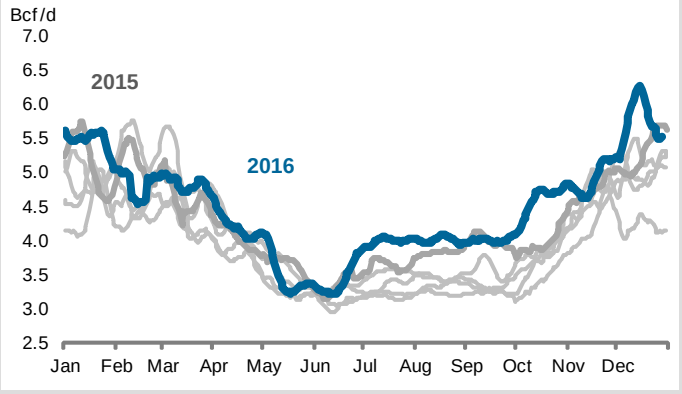
38 Alberta Natural Gas Demand

TransCanada Intra-AB Deliveries; Current Year and Historical Tracks

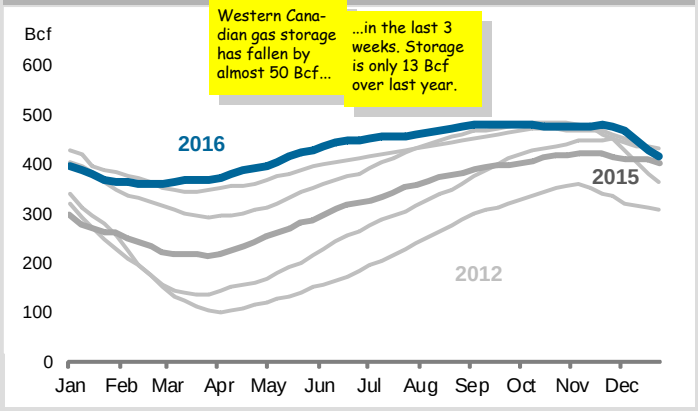


Alberta natural gas demand has grown steadily in recent years, largely driven by new oil sands projects coming on line.

Source: TransCanada Pipelines

39 Western Canadian Natural Gas Storage Levels

Weekly; Current Year and Historic Tracks

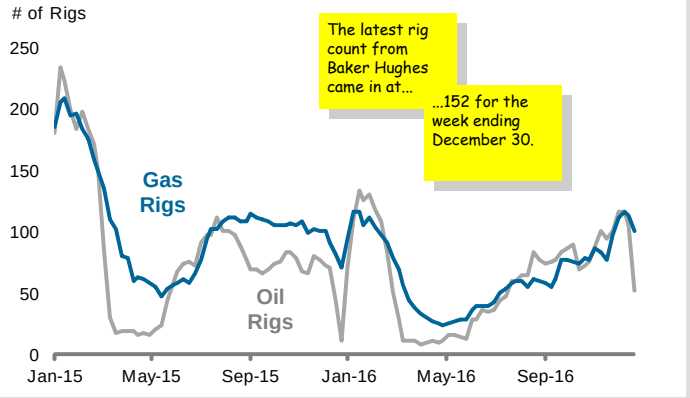


Canada's natural gas storage level provides a good metric if the country is well stocked. Abnormally high or low storage can affect the basis.

Source: Bloomberg

40 Weekly Canadian Oil and Gas Drilling Activity

Baker Hughes Average Rig Counts; Rolling 24-Month History

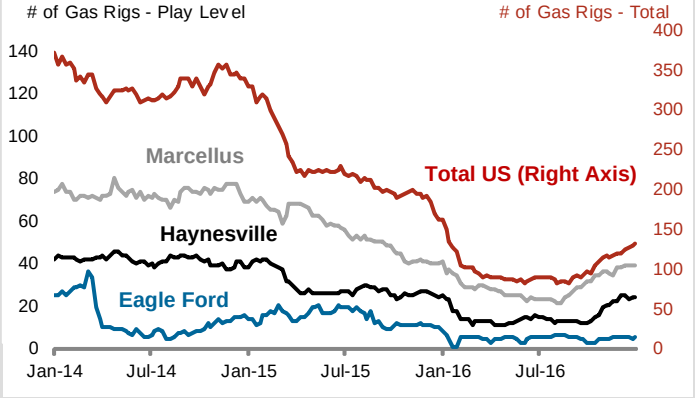


Unlike US drilling activity, Canadian rigs are dispatched seasonally. Capital allocation by operators is driven by views of future oil and gas prices.

Source: Baker Hughes

41 US Gas Drilling Activity

Baker Hughes Horizontal Gas Rig Counts; 2014 to Present

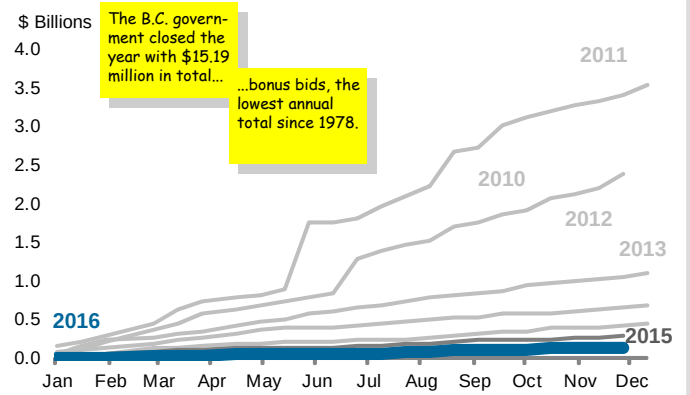


Tracking US gas drilling by major play provides insight into the composition of US gas supply and growth trends.

Source: Baker Hughes

42 Alberta Crown Land Sales – Excluding Oil Sands

Year-over-Year; Cumulative

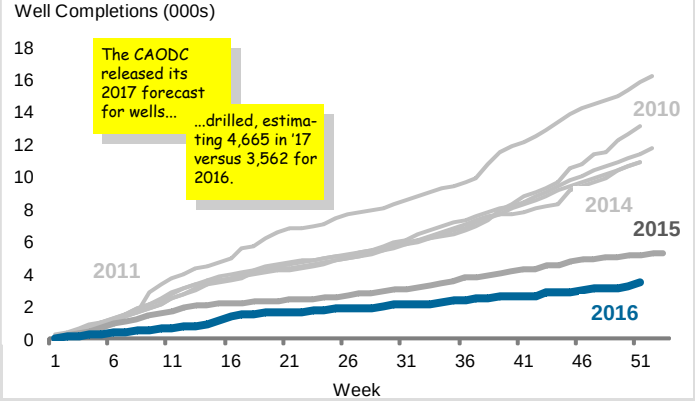


Land prices are an important component of F&D costs. In Alberta, sales of petroleum and natural gas rights are held every two weeks.

Source: Alberta Department of Energy

43 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

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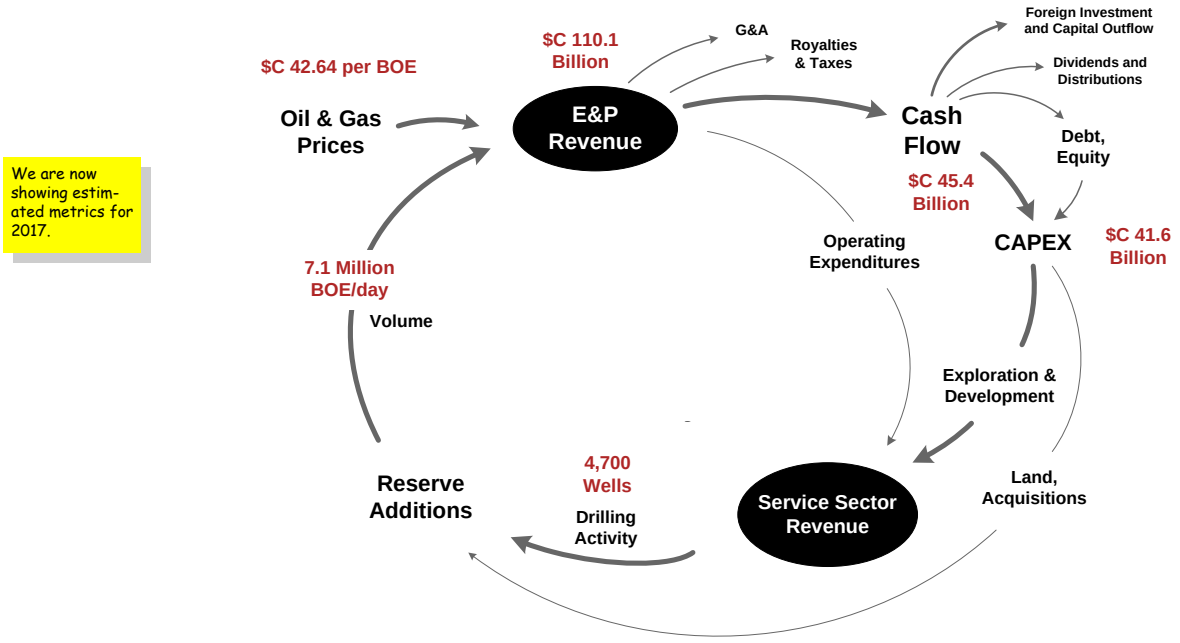
Estimated Capital Flow in the Canadian Oil and Gas Economy for 2017

Industry Revenue, Cash Flow, Reinvestment, Drilling Activity and Production



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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	$C/B	$C/GJ	Average MBOE/d	Average MBOE/d	MBOE/d (@ 6:1)	MBOE/d (@ 6:1)	$C millions	$C millions	$C millions	$C millions	x:1	# / Year	%	%	%
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	24,109	30,551	22,948	2.22	5,394	24%	69%	31%
2016e	31.32	52.62	2.04	1,921	2,393	2,495	6,809	77,844	20,386	20,527	16,209	1.80	3,500	17%	60%	40%
2017e	42.64	68.19	3.25	1,868	2,655	2,548	7,070	110,052	45,351	28,315	13,242	0.92	4,700	24%	60%	40%

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