Chad Bourne – Engineer
Katherine McKenna – Engineer

Karthik Revana – Engineer
Ryan Long – Geotech

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WEEKLY INDUSTRY UPDATE

COVERING THE WEEK OF OCTOBER 1 – OCTOBER 8, 2018

INDUSTRY METRICS – QUICK SNAPSHOT

	Current	Last Week	WoW Change	% Change
Crude Oil Near-Month Price ($/bbl)	$74.34	$73.25	$1.09	1.49%
Natural Gas Near-Month Price ($/MMbtu)	$3.14	$3.01	$0.13	4.32%
Weekly Upstream-Deal Transaction Value ($MM)	$32	$537	($505)	(94.04%)
Weekly Number of Upstream-Deal Transactions	1	7	(6)	(85.71%)
Current Total US Rig Count	1,052	1,054	(2)	(0.19%)
US Field Crude Oil Production (MMbbl/day)	11.1	11.1	-	0.00%
US Field Dry Natural Gas Production (Bcf/day)	84.2	84.4	(0.2)	(0.24%)
Commercial Crude Oil Stocks - Excluding SPR (MMbbl)	404.0	396.0	8.0	2.02%
Natural Gas Stocks - Working Gas Underground Storage (Bcf)	2,866	2,768	98	3.54%
Total Drilled But Uncompleted Wells (DUC)	8,269	8,031	238	2.96%

FRIDAY'S MARKET CLOSE

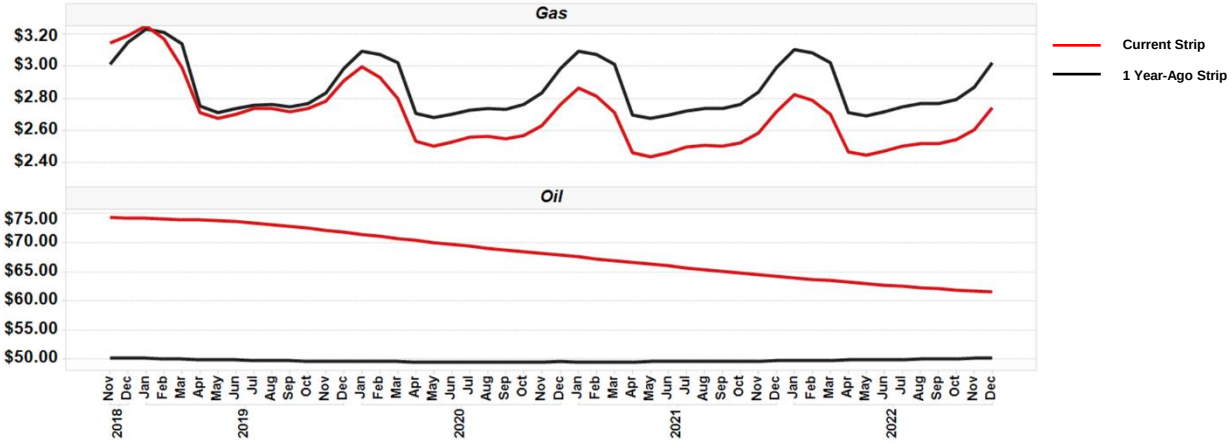
NYMEX WTI CRUDE OIL FUTURES as of OCTOBER 5, 2018 CLOSE ($/bbl)

Period	Current	WoW Change	Last Week	1 Yr Ago
2018	$ 74.30	$ 1.14	$ 73.16	$ 50.24
2019	$ 73.25	$ 1.74	$ 71.51	$ 49.88
2020	$ 69.59	$ 2.18	$ 67.41	$ 49.55
2021	$ 65.86	$ 2.12	$ 63.74	$ 49.62
2022	$ 62.69	$ 1.82	$ 60.87	$ 49.98

NYMEX HH NAT GAS FUTURES as of OCTOBER 5, 2018 CLOSE ($/MMBtu)

Period	Current	WoW Change	Last Week	1 Yr Ago
2018	$ 3.17	$ 0.12	$ 3.05	$ 3.01
2019	$ 2.84	$ 0.06	$ 2.78	$ 2.89
2020	$ 2.66	$ 0.02	$ 2.64	$ 2.84
2021	$ 2.59	$ -	$ 2.59	$ 2.84
2022	$ 2.59	$ -	$ 2.59	$ 2.86

NYMEX 5 YEAR FUTURES STRIP PRICING



**Source – CME Group / Baker Hughes North America Rotary Rig Count / Energy Information Administration, United States (EIA)*

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RIG ACTIVITY BY US REGION

Major Basin Variances	This Week	+/-	Last Week	+/-	Year Ago
Ardmore Woodford	3	0	3	1	2
Arkoma Woodford	7	0	7	-4	11
Barnett	2	0	2	-6	8
Cana Woodford	66	-1	67	6	60
DJ-Niobrara	27	-1	28	1	26
Eagle Ford	78	-1	79	9	69
Granite Wash	13	0	13	0	13
Haynesville	50	0	50	6	44
Marcellus	56	1	55	11	45
Mississippian	7	3	4	3	4
Permian	485	-1	486	102	383
Utica	20	0	20	-10	30
Williston	52	-1	53	2	50
LAND (INC OTHERS)	1,026	-3	1,029	113	913
INLAND WATERS	3	-2	5	2	1
OFFSHORE	23	3	20	1	22
US TOTAL	1,052	-2	1,054	116	936

U.S. Breakout Information	This Week	+/-	Last Week	+/-	Year Ago
Oil	861	-2	863	113	748
Gas	189	0	189	2	187
Miscellaneous	2	0	2	1	1
Directional	66	-3	69	-13	79
Horizontal	919	-3	922	127	792
Vertical	67	4	63	2	65

Source – Baker Hughes North America Rotary Rig Count

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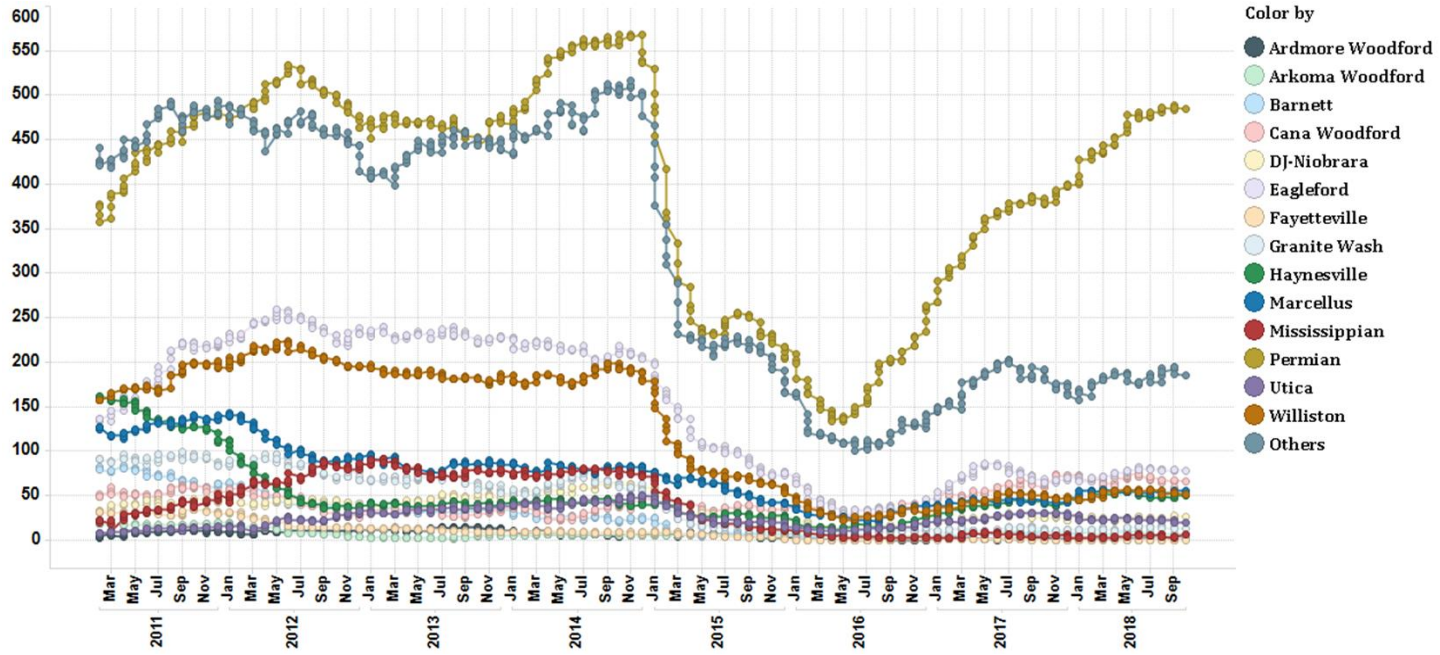
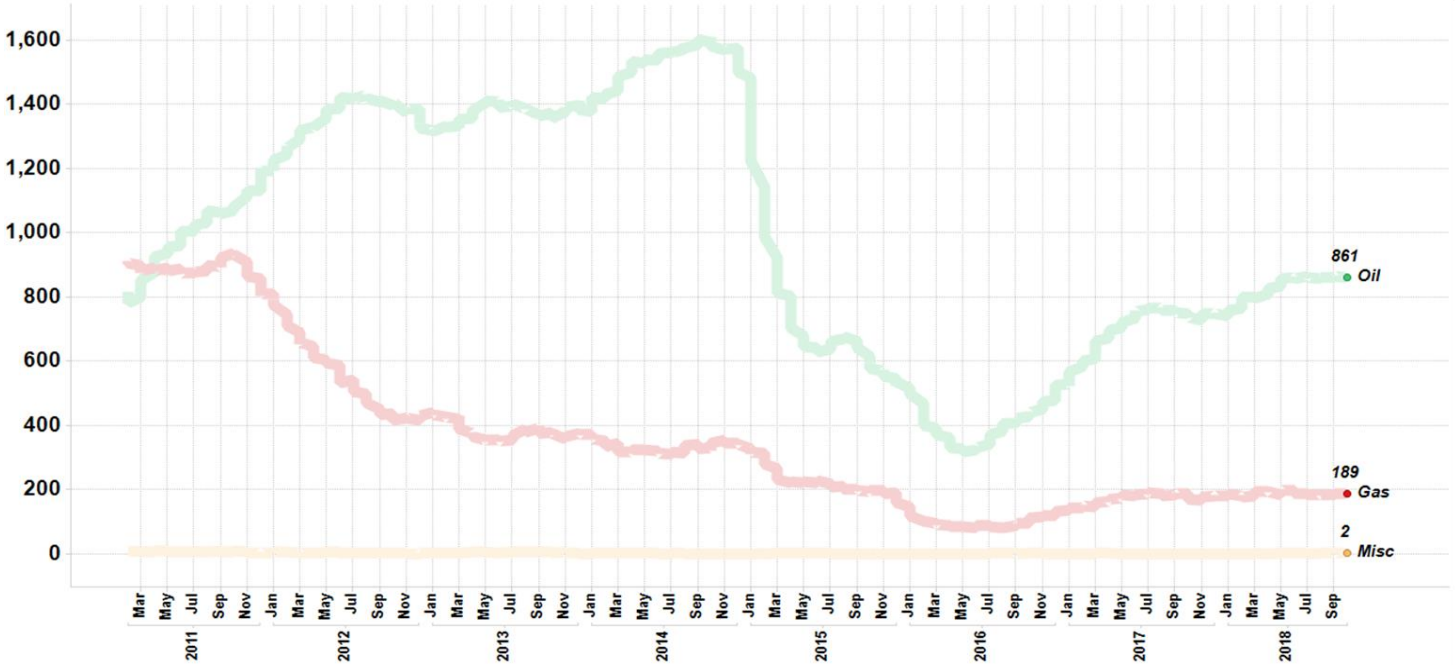
TOTAL US RIG COUNT BY US REGION



US RIG COUNT BY PRODUCT



Source – Baker Hughes North America Rotary Rig Count

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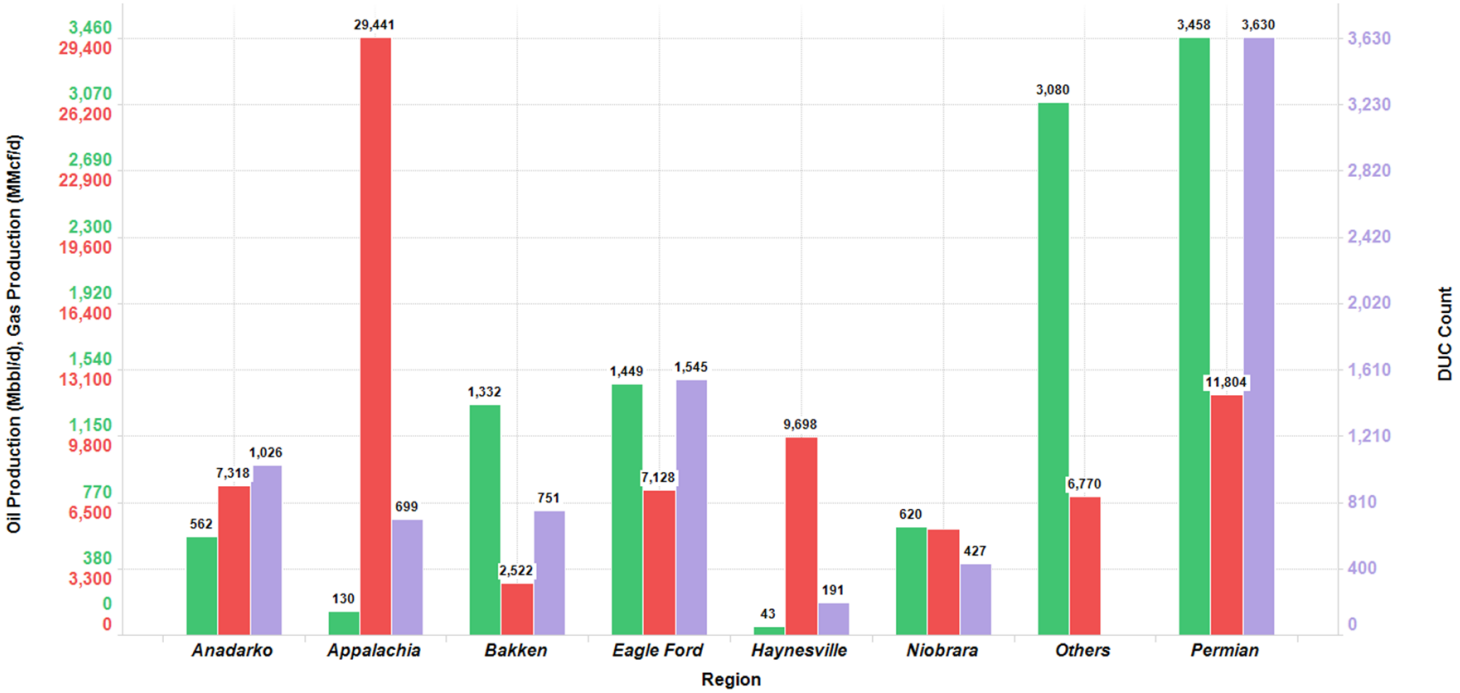
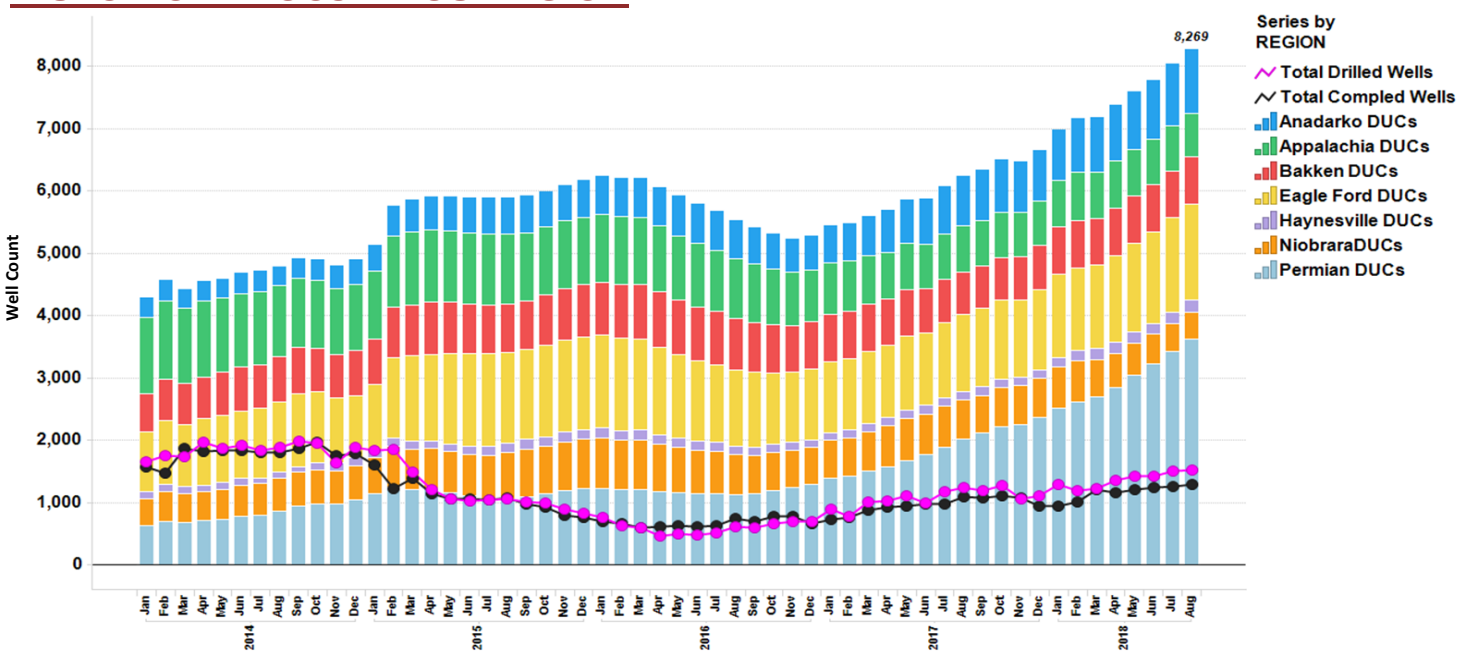
PRODUCTION & DUCs BY US REGION (1)



(1) 'Others' Region (includes Federal Offshore) is the difference between total daily US crude oil and natural gas production and the summation of the major US shale regions production

HISTORICAL DUCs BY US REGION



**Source – Energy Information Administration, United States (EIA)*

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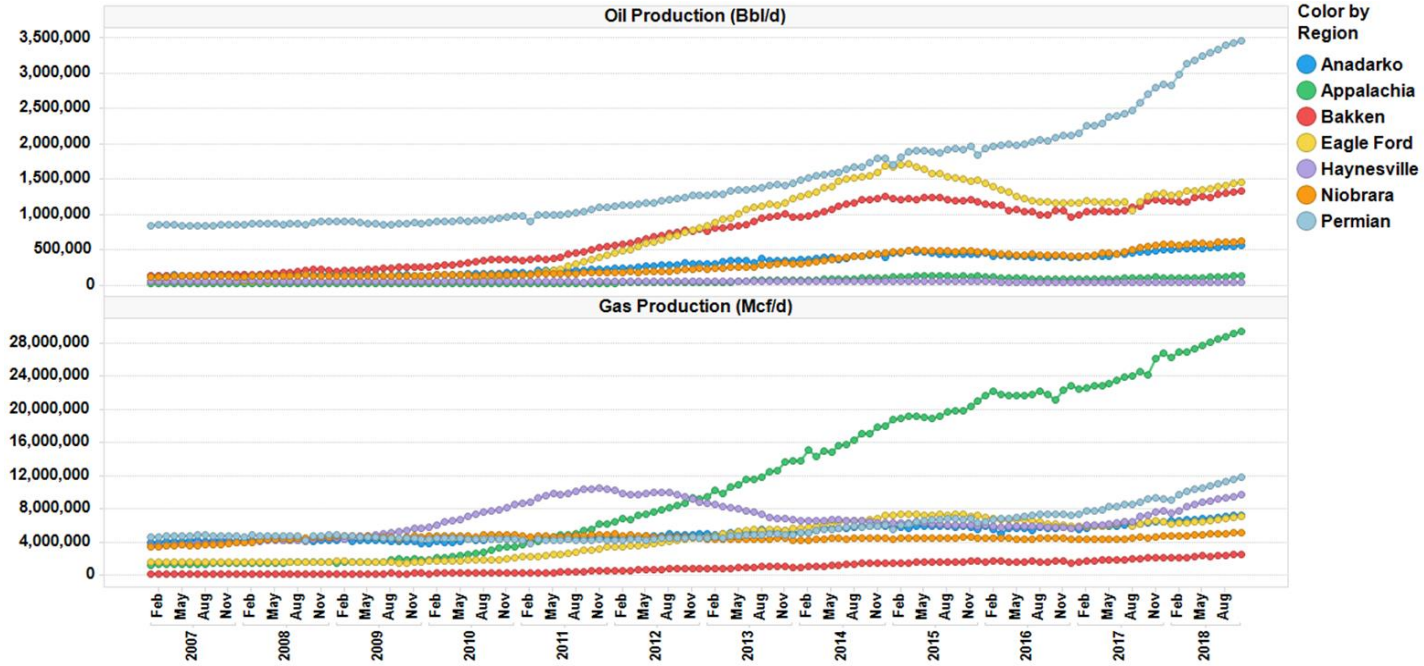
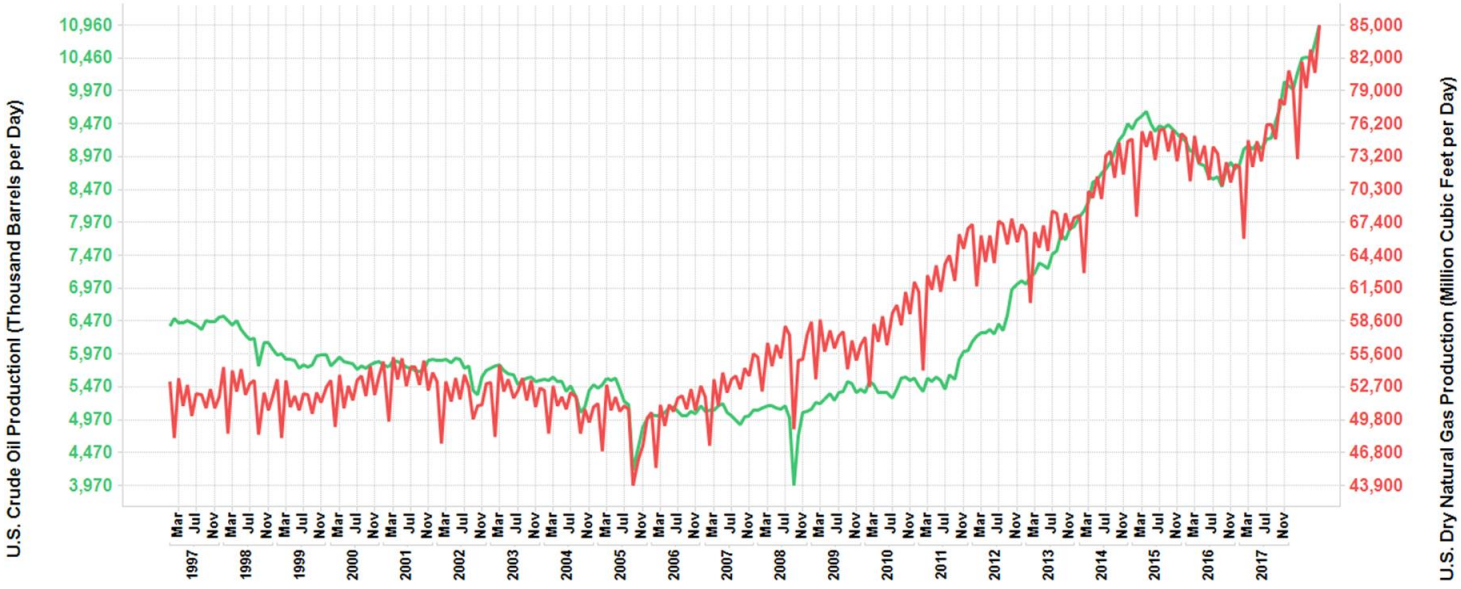
HISTORICAL PRODUCTION BY US REGION



US DAILY CRUDE (MBBL) AND DRY NATURAL GAS PRODUCTION (MMCF) (2)



(2) Official historical monthly field production (average per day units) for crude oil and dry natural gas per EIA as of 9/28/2018, assuming an average of 30.44 days in a month

**Source – Energy Information Administration, United States (EIA)*

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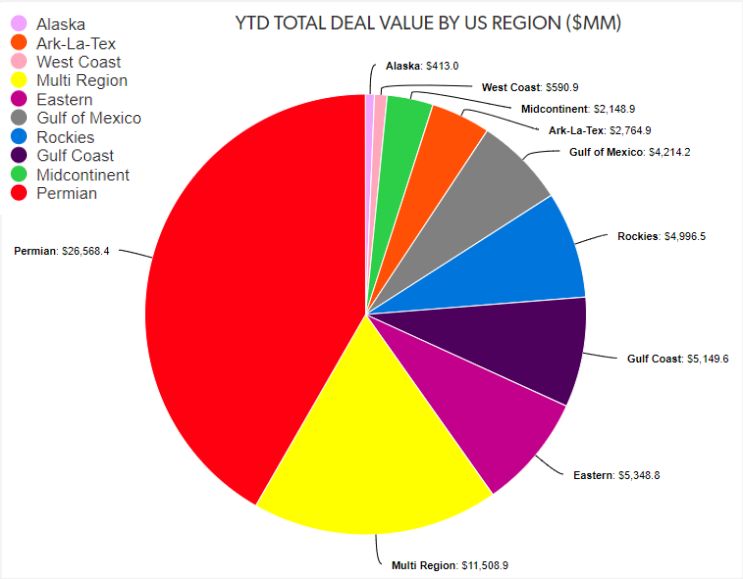
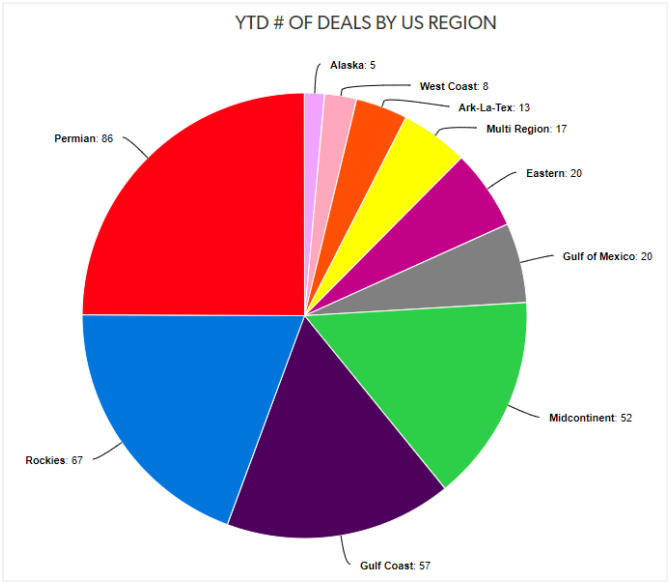
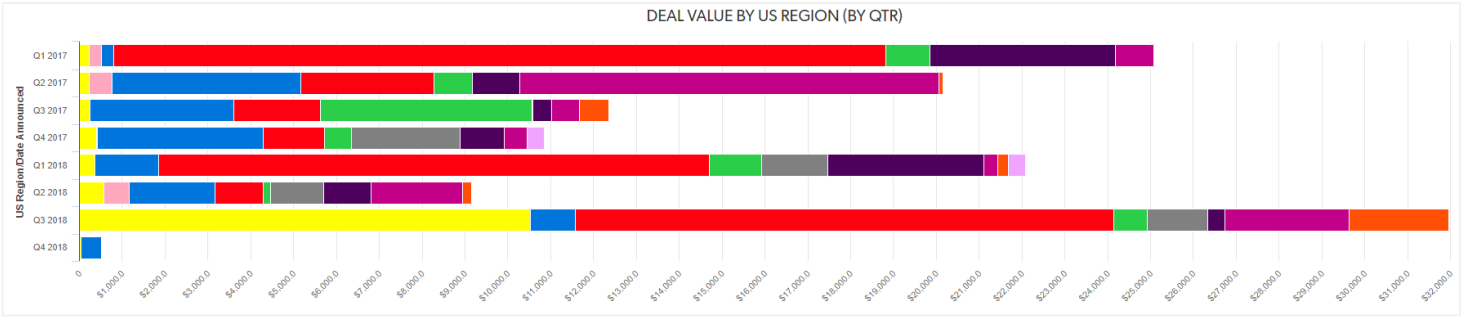
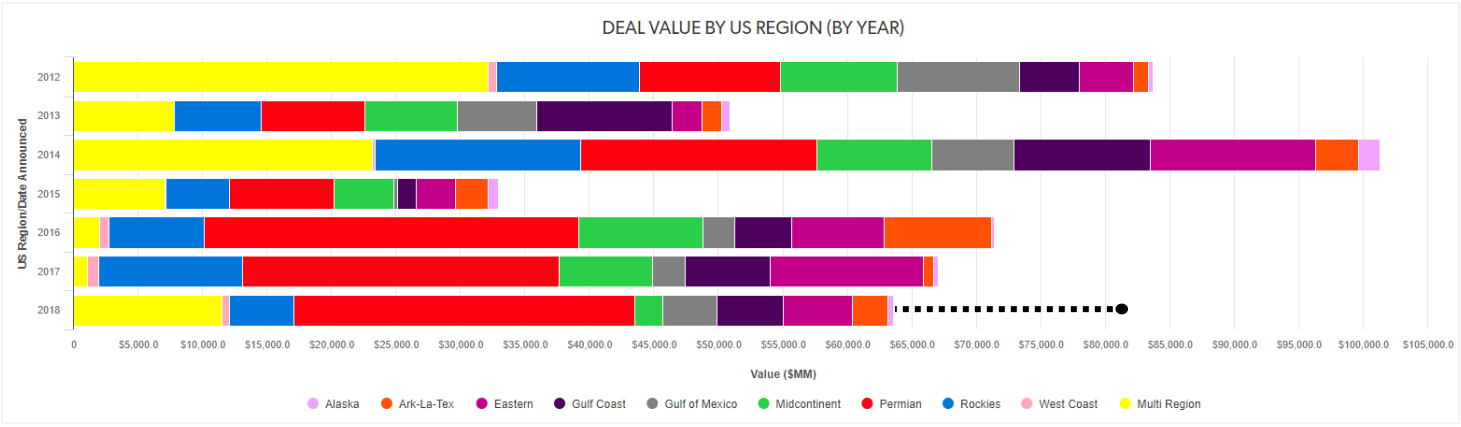
UPSTREAM YEAR-TO-DATE TRANSACTIONS BY US REGION









Projected Annualized Total Deals Value for 2018 @ Current Weekly Rate

**Source – PLS M&A Database*

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UPSTREAM ACQUISITIONS & DIVESTITURES – LATEST US DEALS

- **Texas General Land Office auctions off state land in the Permian, Eastern Eagle Ford, East Texas and Matagorda Bay. Buyers include: Pioneer Natural Resources, Diamondback Energy, Jagged Peak Energy, Abraxas Petroleum Corp., WildHorse Resource Development, Admiral Permian Resources ($32MM)**

LATEST INDUSTRY NEWS

WTI Closes Volatile Week Up 1.5% After Reaching 2018 High

The WTI front-month contract rose $1.09/bbl last week, or 1.5%, to settle on Friday at $74.34/bbl. Trading was volatile during the week with WTI reaching its highest level since 2014 on Wednesday but shedding 3% on Thursday in the largest daily decline in nearly two months. On Monday, Oct. 1, WTI rose $2.05 to settle at $75.30/bbl. Market sentiment has turned bullish on the news that OPEC and other major oil producers will not hike oil output to replace Iranian volumes displaced by US sanctions. The sanctions are effective Nov. 4, and supply shortages are anticipated by many market watchers. On the demand side, a replacement for NAFTA was reached, which is seen as a positive for global demand growth. The new deal was named US-Mexico-Canada Agreement, or USMCA. On Tuesday, Oct. 2, the front-month contract fell 7 cents to $75.23/bbl. “Today was a bit of a respite," Bart Melek, head commodity strategist at Toronto Dominion Bank, said in a Bloomberg story. "We briefly reached the high we found back in July and retraced, but the market continues to worry about Iranian supply.” Traders on Tuesday were also positioning themselves for Wednesday's EIA oil storage report after analysts surveyed by Bloomberg anticipated a 1.5 MMbbl build.

On Wednesday, Oct. 3, WTI rose $1.18 to $76.41/bbl, reaching its highest level since 2014. And for the first time since September 2017, WTI's 50-day moving average went above the 100-day average. This despite the EIA's report Wednesday that US crude inventories rose by 8 MMbbl—more than 4x higher than anticipated—to 404 MMbbl the week of Sept. 28. Motor gasoline stocks fell 500,000 bbl and distillates fell 1.8 MMbbl. Refineries ran at 90.4% of operable capacity, highlighting the fact that we're well into refinery maintenance season. Crude production remained at a record 11.1 MMbo/d. Wednesday's price spike was also not deterred by Russian Energy Minister Alexander Novak's announcement that Saudi Arabia and Russia are producing an extra 1 MMbo/d in response to volume declines in Venezuela, Libya and Iran. Novak added that Russia could add another 200,000-300,000 bo/d in a "few months." On Thursday, Oct. 4, WTI dropped $2.08 to $74.34/bbl in the largest daily decline in seven weeks. Genscape reported a 1.7 MMbbl crude oil build at Cushing, adding to Wednesday's surprise 8 MMbbl increase in US crude inventories. With refinery maintenance season having just begun, inventory builds could continue for months. On Friday, Oct. 5, WTI settled up 1 cent to $74.34/bbl, closing out a volatile week.

**Source – PLS Quick Price*

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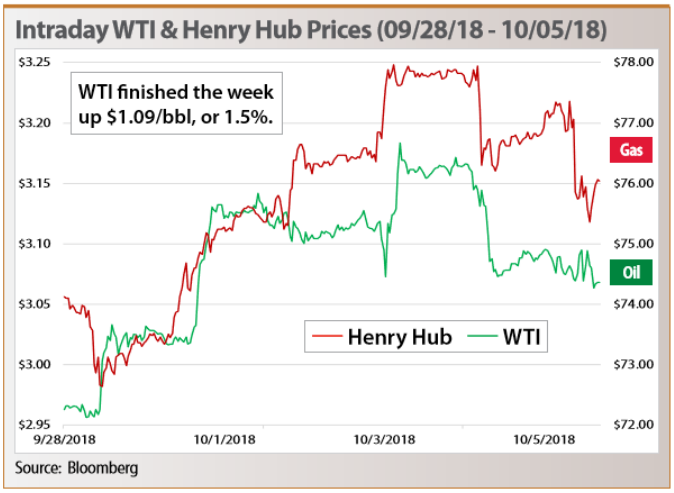
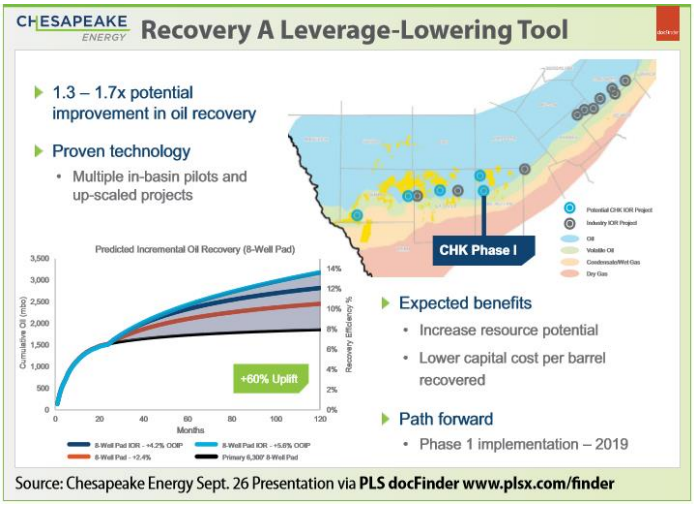


Chesapeake Issues $1.25 Billion in Notes to Pay Down Term Loan

Chesapeake Energy Corp. closed the sale of $1.25 billion aggregate principal amount of senior notes in two tranches on Sept. 26, bringing its total debt sold YTD to about $5.1 billion. This time the company issued $850 million of 7% senior notes due 2024 and $400 million of 7.5% senior notes due 2026, both at 100, to raise proceeds that, together with cash on hand, will pay off a secured term loan due in 2021 that had over $1.2 billion outstanding. Even with interest rate hikes looming, the B- rated company achieved better pricing overall for the September-issued debt than it did back in April when it sold nearly $1.3 billion principal amount each of 8% senior notes due 2025 at a discount of 98.522 and 8% senior notes due 2027, which were sold at par. In January Chesapeake sold $1.25 billion of 5.5% convertible notes due 2026. President and CEO Doug Lawler earlier stated the company's goal of improving its leverage ratio to 2x net debt to EBITDA through organic production growth, exploration, strategic acquisitions and portfolio management. Its divestment of $1.9 billion of assets in the Utica marked the conclusion of the company's strategy of using proceeds from asset sales to reduce debt, Lawler said. Chesapeake also amended its credit facility with its 15-bank lending syndicate led by Mitsubishi UFJ. It reduced its borrowing base to $3.0 billion from $3.8 billion. The facility has an accordion feature out to $4.0 billion from time to time. Interest is payable at either a 150-300 bps spread over LIBOR or an alternate base rate plus 50-200 bps, depending on the size of the borrowing base being utilized at the time of the draw and whether Chesapeake's leverage ratio is higher than 4:1. The 2024s and 2026s were sold by a syndicate led by Goldman Sachs, JP Morgan, Wells Fargo and MUFG with senior co-managers ABN AMRO, BMO, BofA Merrill Lynch, Citigroup, Crédit Agricole, DNB, Mizuho, Morgan Stanley, Natixis and RBC.



**Source – PLS Capital Markets*

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Oil Declines on Hopes for U.S. Waivers on Iran, Saudi Assurance

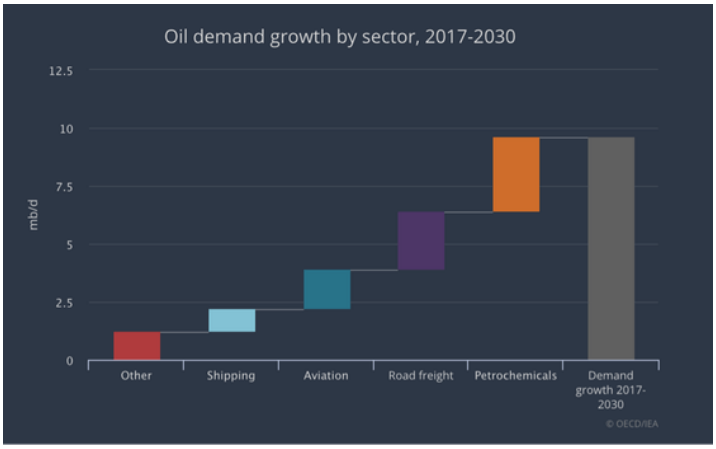
Oil fell to the lowest in a week in London on renewed hopes the U.S. may soften the blow of sanctions on Iran's crude exports, and as Saudi Arabia promised to fill any shortfall. Brent futures fell 1.3% to near $83/bbl, after retreating 2.5% over the past two sessions. The U.S. was said to be in talks with countries that want to continue buying from Iran after American sanctions are imposed Nov. 4. Saudi Arabia and its allies have raised output to offset declining supply from the Persian Gulf nation and the kingdom can tap its spare capacity immediately to boost production further, the Saudi crown prince said in an interview. Oil rallied to the highest in almost four years earlier this month on concerns that OPEC and its allies aren't raising output quickly enough to make up for the squeeze on Iranian shipments. U.S. law doesn't rule out waivers for some buyers of crude from the Persian Gulf nation, but the Trump administration hasn't granted any since deciding to reimpose sanctions in May. Renewed signals that America could allow some purchases to continue are helping to ease supply fears. "The U.S. appears to be abandoning its tough stance on buyers of Iranian oil," said Carsten Fritsch, an analyst at Commerzbank AG in Frankfurt. Brent for December settlement fell as much as $1.50 to $82.66/bbl on the London-based ICE Futures Europe exchange, and was at $83.05 at 1:30 p.m. in London. The global benchmark crude traded at a $9.77 premium to West Texas Intermediate for the same month. WTI for November delivery traded at $73.33/bbl on the New York Mercantile Exchange, down 1.4%. Total volume traded was about 5% below the 100-day average. Following U.S. President Donald Trump's pressure to tame surging prices, Saudi Arabia's Crown Prince Mohammed Bin Salman said the world's top oil exporter is doing its part by pumping near record levels. Output by OPEC's top producer is now at about 10.7 MMbpd, and it can add a further 1.3 million from its spare capacity "if the market needs that," he said in the interview. Meanwhile, the Trump administration was in discussions with countries that want to continue buying Iranian oil after sanctions are reimposed early next month, according to two U.S. officials. One of them said China may cut back by more than expected, while India remains a wild card. Another official said various nations have sought waivers and these were being considered, though America was not looking to grant exemptions.

China Slams Brakes on U.S. Crude Oil Imports

Even though Beijing hasn't sanctioned American oil imports yet, Chinese buyers aren't taking any chances. The world's second largest economy halted purchases of U.S. crude in August for the first time since September 2016, according to U.S. Census Bureau data released Friday. In July, Chinese buyers received nearly 12 MMbo from the U.S. Beijing, once an enthusiastic buyer of U.S. crude after Washington lifted its restrictions on exports in December 2015, has even jockeyed with Canada for the position of top importer at times. Yet, China's interest in American oil has diminished amid the escalating trade spat between the two nations. In June, Beijing threatened to slap a 25% tariff on crude imports in response to U.S. President Trump's $50 billion levy on Chinese imports. China's largest refiner Sinopec then suspended its incoming shipments of U.S. crude, yet eventually resumed some purchases after crude was removed from that list. The future of American crude shipments into China remains uncertain and there is still no guarantee that threats of a U.S. crude tariff won't resurface as the trade conflict persists. American oil producers, particularly those who operate in the key Permian basin of West Texas and New Mexico, risk feeling the pain from the ongoing tensions as they increasingly look to foreign shores to market their supplies, as local demand becomes saturated.

Petrochemicals Will Drive World's Oil Demand: IEA

Petrochemicals are set to account for more than a third of the growth in world oil demand to 2030, and nearly half the growth to 2050, adding nearly 7 million barrels of oil a day by then.



**Source – World Oil/ Oil and Gas 360*

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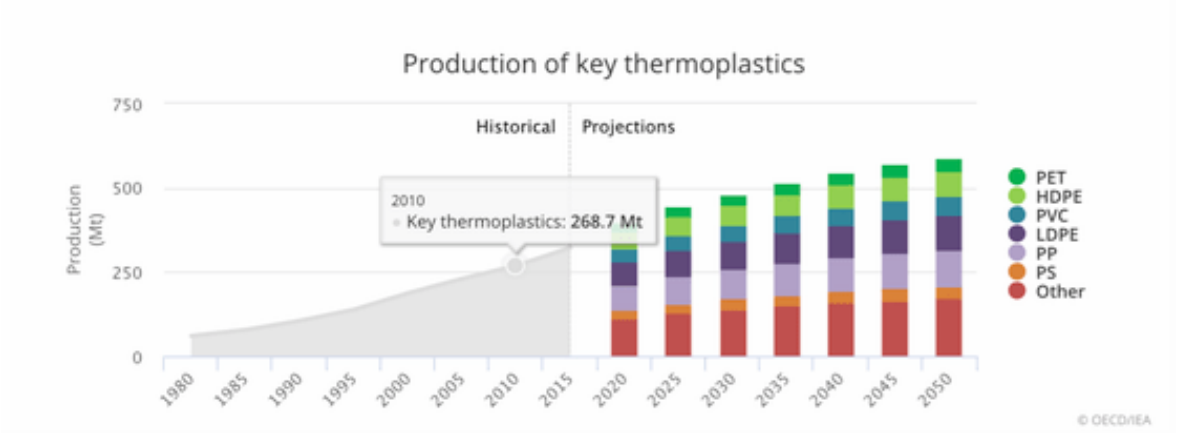
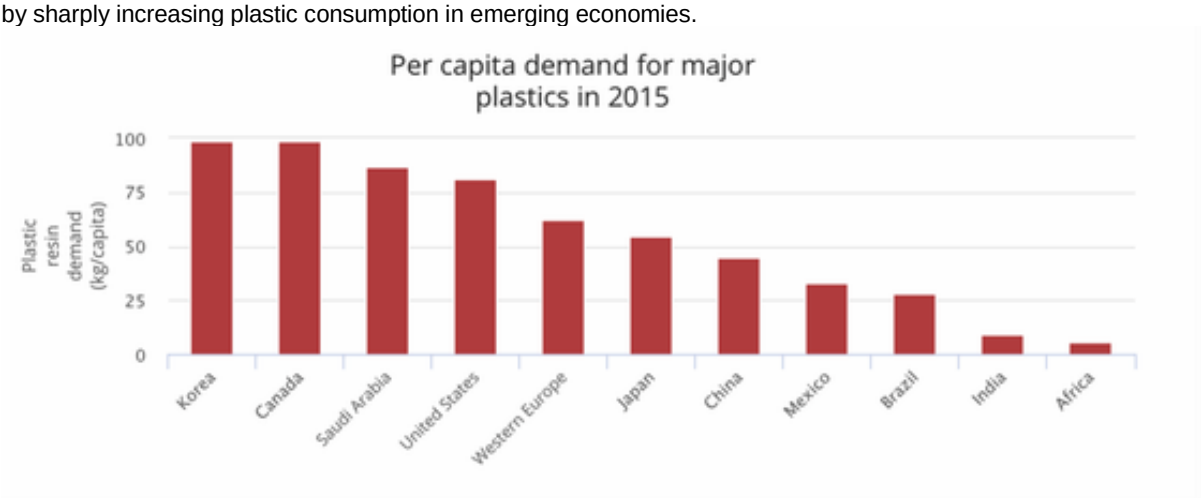
They are also poised to consume an additional 56 billion cubic meters (bcm) of natural gas by 2030, and 83 bcm by 2050. Petrochemicals – components derived from oil and gas that are used in all sorts of daily products such as plastics, fertilizers, packaging, clothing, digital devices, medical equipment, detergents and tires – are becoming the largest drivers of global oil demand. Bigger than cars, planes and trucks, according to a major study by the International Energy Agency. “Our economies are heavily dependent on petrochemicals, but the sector receives far less attention than it deserves,” said Dr Fatih Birol, the IEA’s Executive Director. “Petrochemicals are one of the key blind spots in the global energy debate, especially given the influence they will exert on future energy trends. In fact, our analysis shows they will have a greater influence on the future of oil demand than cars, trucks and aviation.”

Petrochemicals are particularly important given how prevalent they are in everyday products. IEA said that “they are also required to manufacture many parts of the modern energy system, including solar panels, wind turbines, batteries, thermal insulation and electric vehicles.” Demand for plastics – the key driver for petrochemicals from an energy perspective – has outpaced all other bulk materials (such as steel, aluminum, or cement), nearly doubling since 2000. Advanced economies currently use up to 20 times more plastic and up to 10 times more fertilizer than developing economies on a per capita basis, underscoring the huge potential for global growth.



The dynamism of the petrochemical industry is also driving new trends around the world. After decades of stagnation and decline, the United States has re-emerged as a low-cost location for chemicals production thanks to the shale gas revolution, and it is now home to around 40% of the global ethane-based petrochemical production capacity. Meanwhile, the Middle East remains the lowest-cost center for many key petrochemicals, with a host of new projects announced across the region. While substantial increases in recycling and efforts to curb single-use plastics are underway, especially in Europe, Japan and Korea, the impact these efforts can have on demand for petrochemicals is far outweighed by sharply increasing plastic consumption in emerging economies.



Source –Oil and Gas 360

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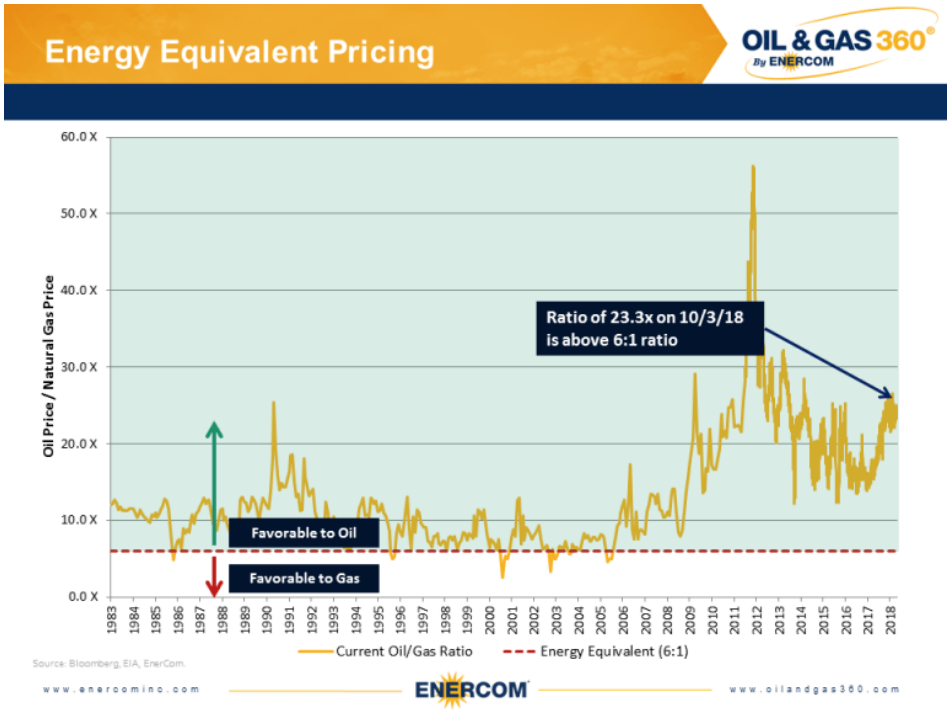
Despite near-tripling in plastic waste collection by 2050, the limited availability of cost-effective substitutes for oil feedstock means that oil demand for petrochemicals remains resilient.

Weekly Oil Storage: Surprisingly Large Build

Crude oil stocks rose by 7,975 MBBL last week to 403,964 MBBL from 395,989 MBBL. This is 13% below the 464,963 MBBL that was in storage at this point last year, and is even with the five-year average. This week's build was a surprise, as the average analyst prediction called for a build of 877 MBBL. Gasoline inventories decreased by 0.5 MMBBL this week to 235.2 MMBBL. Fuel oil inventories fell by 1.8 MMBBL to 136.1 MMBBL. Overall, petroleum stocks excluding the SPR increased by 8.0 MMBBL to 1,248.7 MMBBL. Preliminary data suggests over the past four weeks the U.S. produced 11,025 MBOPD, imported 7,846 MBOPD and exported 2,140 MBOPD. The four-week average total crude oil inputs to refineries are 17,094 MBOPD. This means refineries are running at 93.5% of capacity. American refineries produced an average of 10,109 MBBLPD of gasoline and 5,254 MBBLPD of distillate fuel oil over the past four weeks.



Weekly Gas Storage: Accelerating Build

In total, the EIA reports natural gas stocks rose by 98 Bcf last week, increasing to 2,866 Bcf from 2,768 Bcf. This is 18.2% below the 3,502 Bcf that was in storage at this point last year, and is 17.5% below the five-year average of 3,473 Bcf. This week's storage build exceeded expectations, as analysts predicted a build of 88 Bcf. Every region saw a build in inventories this week. The largest increases came in the East and Midwest regions, which added 34 Bcf and 36 Bcf, respectively. Stocks in every region are below the five-year average. Gas in storage in salt stocks in the South Central region is the farthest below the five-year average for the area, at 37.2% below the average.

**Source –Oil and Gas 360*

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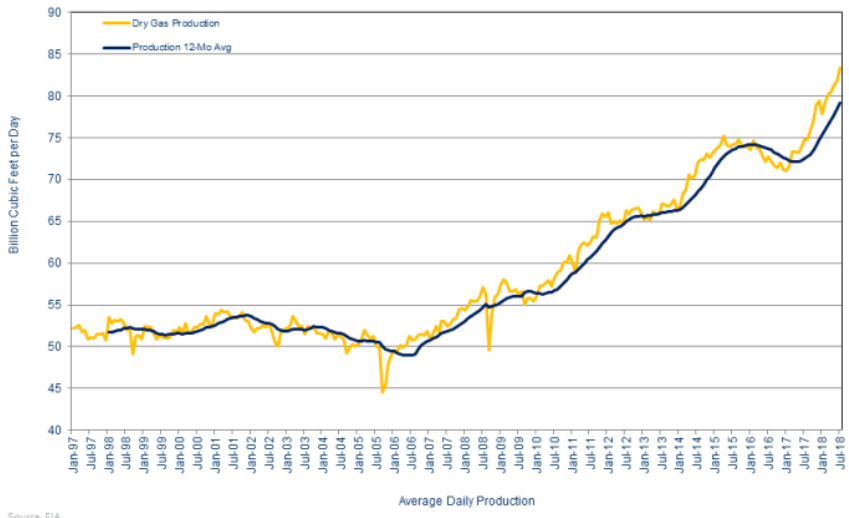
U.S. Natural Gas Production

OIL & GAS 360 By ENERCOM

Average daily production in the Lower 48 was up 1.92% in Jul-18 from Jun-18 and up 11.62% from Jul-17



Source: EIA.

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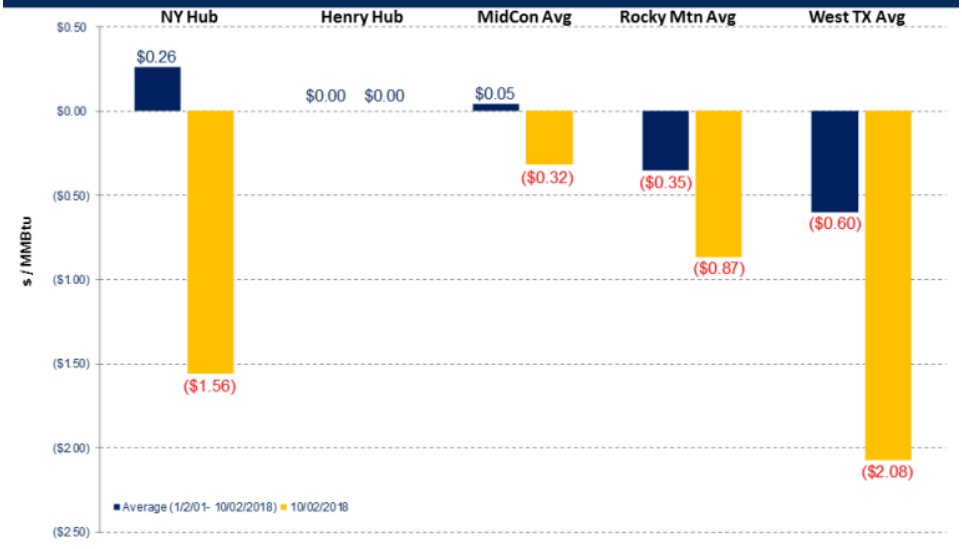
Regional Gas Price Differentials

OIL & GAS 360 By ENERCOM



Source: Bloomberg, EnerCom.

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**Source –Oil and Gas 360*

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BASIN STUDY: WILLISTON BASIN

Cursory Overview

The Williston Basin is a sedimentary oil and gas basin stretching across Montana, North and South Dakota and the Canadian province of Saskatchewan with recent industry development being primarily focused in Northwest North Dakota. The predominant formations for core, unconventional development is the Bakken Shale and the underlying Three Forks formation (**Figure 1)**. According to Natural Gas Intelligence, the Bakken and Three Forks formation chiefly produces a highly quality, light sweet crude oil that is similar to the West Texas Intermediate (WTI) crude benchmark.

The Williston Basin was found to be productive in 1951 by the Amerada Petroleum Company, and the Bakken formation was formally described in the H.O Bakken No. 1 well in 1953. The Bakken formation is a mixed lithology clastic-carbonate system with poor reservoir rock quality, most of the early vertical wells other than the ones in the naturally fractured Antelope field were marginal. The robust development of the Bakken started mid-2008 and continued to see an upward trend in crude oil production until early 2015 when the play, at the time, hit peak production levels at around 1.2MMbbld. Due to shrinking crude oil prices, the Williston Basin and the Bakken/Three Forks crude oil production retracted slightly to 1.0MMbld of crude for most all of 2016. Since then, and with healthier oil prices, crude oil production in the Bakken currently is at peak level at 1.3MMbbld (see above pages 4 and 5 for reference).

The state of North Dakota, thanks to the Williston Basin and the Bakken Shale, is the second largest crude oil producing state in the United States.

Figure 1 shows the location and physiographic features of the Williston Basin per the USGS whereby the black lines are the lineaments/faulting. In addition, the regional stratigraphic chart for the Williston Basin is also shown where the green highlights depict the location and age of the Bakken and Three Forks formations.

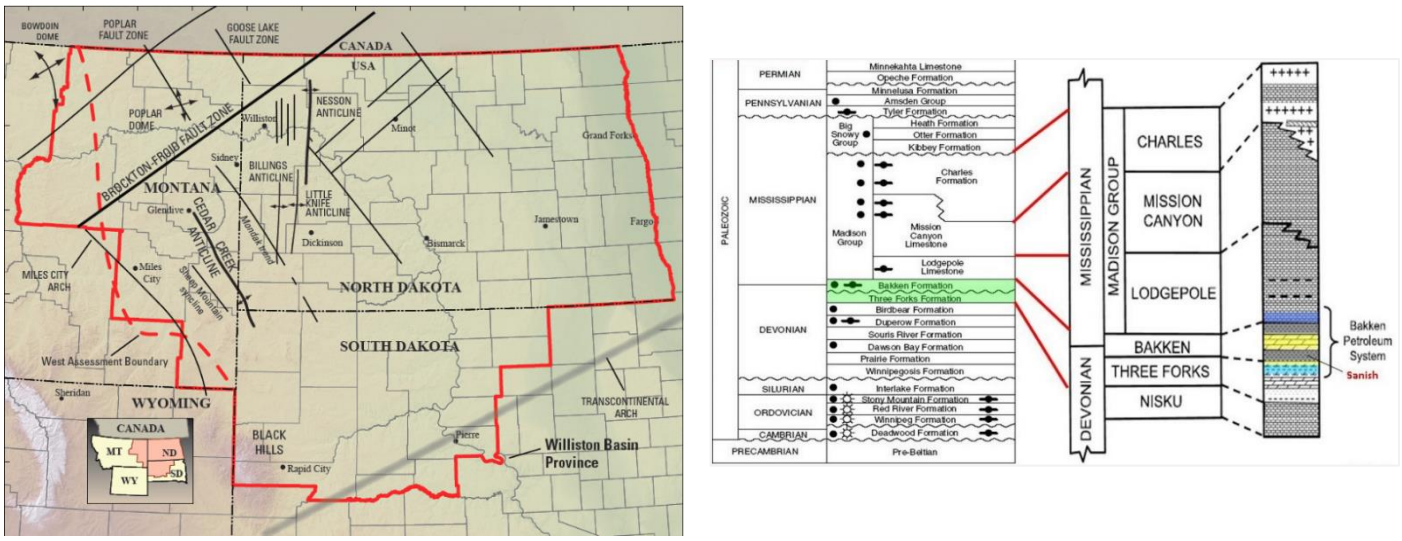

Figure 1 – Location and Physiographic Features of Williston Basin, Regional Stratigraphic Chart

**Source – The American Association of Petroleum Geologists (AAPG) / United States Geological Survey (USGS)*

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To understand the future drilling activity in the Williston Basin, **Figure 2** shows a heat map of the horizontal permits filed since January 1, 2015 to October 1, 2018 coupled with active operating rigs in the region. Most of the permits filed for the Williston Basin are concentrated in and around McKenzie County and Williams County, North Dakota. **Figure 3** shows horizontal well activity by vintage. In 2015 to 2016 well counts dropped over 55% from 1,670 to 730 horizontal wells which primarily was attributed to low crude prices. Since then, drilling and completing wells in the Williston have resumed to levels comparable to 2015 however with more efficiency, producing more with less (i.e. lower rig counts – pad drilling, longer laterals, etc.).

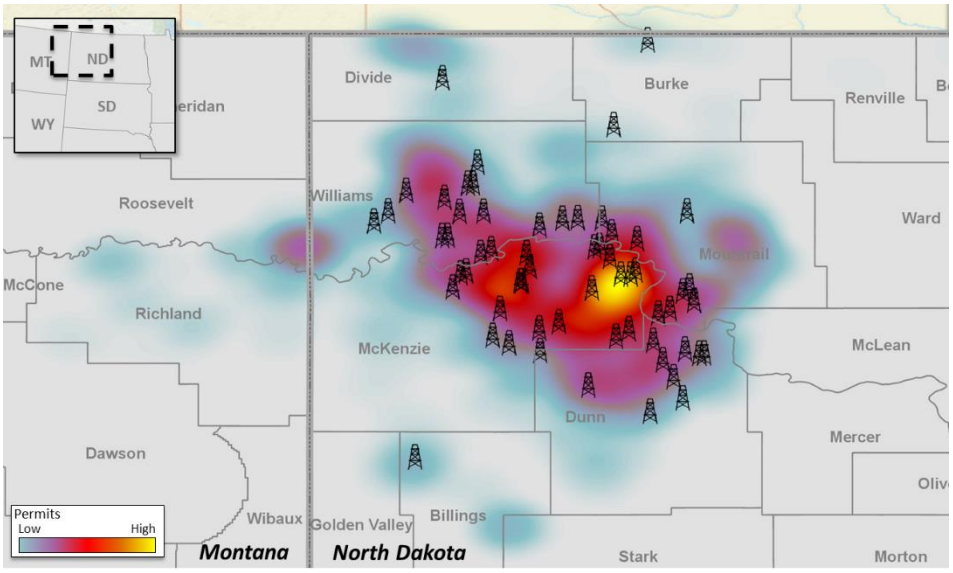

Figure 2 – Williston Basin: Permit Heat Map, Rig Activity

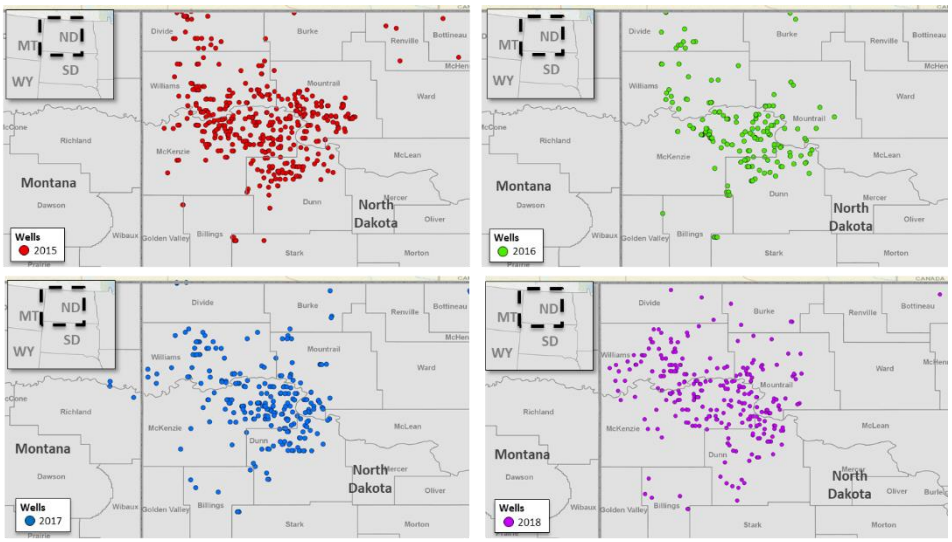

Figure 3 – Williston Basin: Horizontal Well County by Vintage

**Source – Drillinginfo*

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