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Petroleum Fuels Winter Outlook

2018-2019 New York State Winter Fuels Outlook Meeting

October 31, 2018

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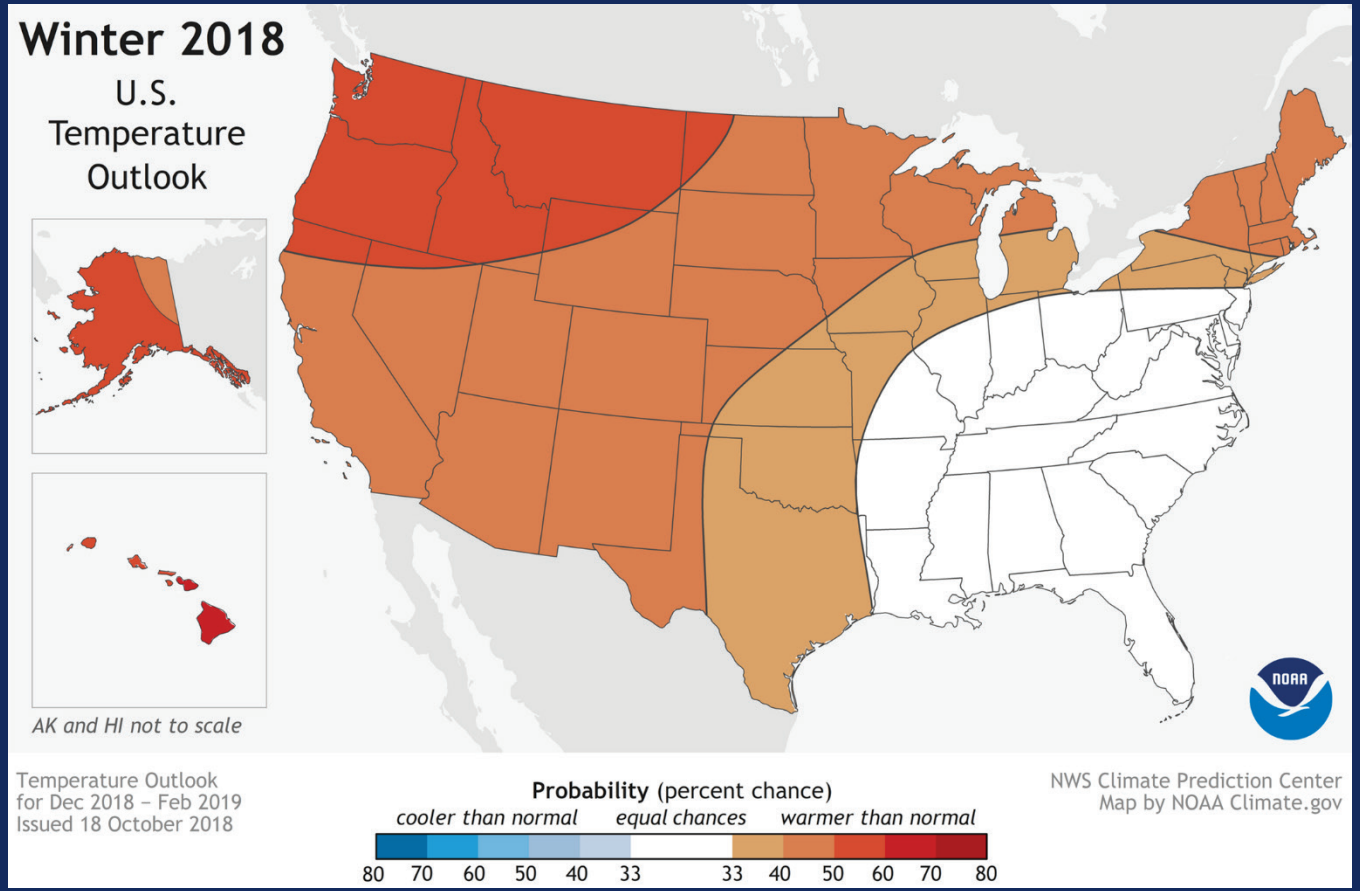
NYSERDA

Contents

NOAA Weather Forecast



- Greater than 33% chance of above normal temperatures for Western and Downstate NY. Greater than 40% chance of above normal temperatures for Northern and Eastern NY.
- NOAA U.S. Winter Outlook Temperature Probability for Dec. – Jan. –Feb. released Oct. 18

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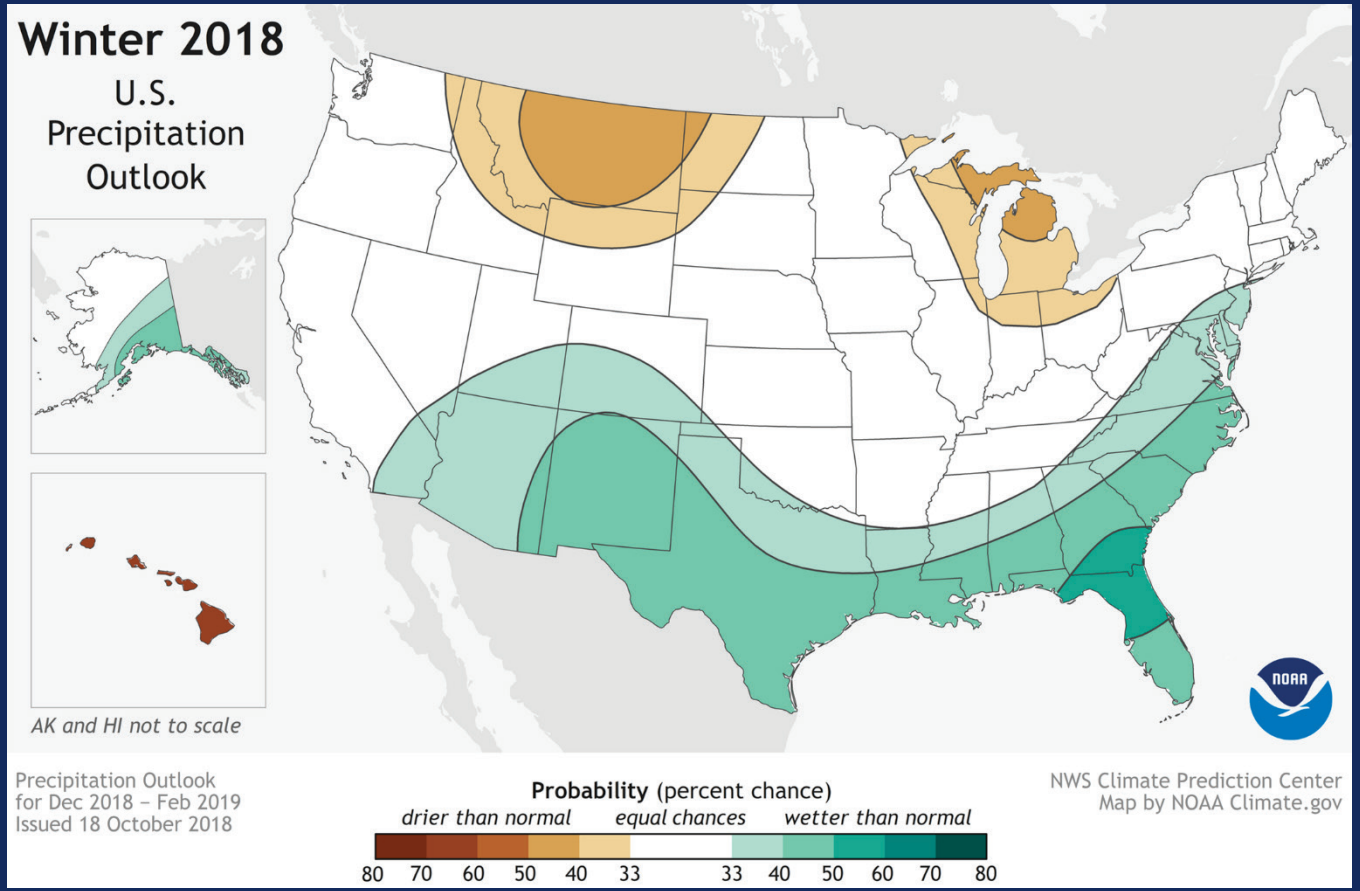

- Equal chances of drier than normal, normal, or wetter than normal precipitation for all of NYS for the upcoming winter season.
- NOAA U.S. Winter Precipitation Outlook Probability for Dec. – Jan. –Feb. released Oct. 18

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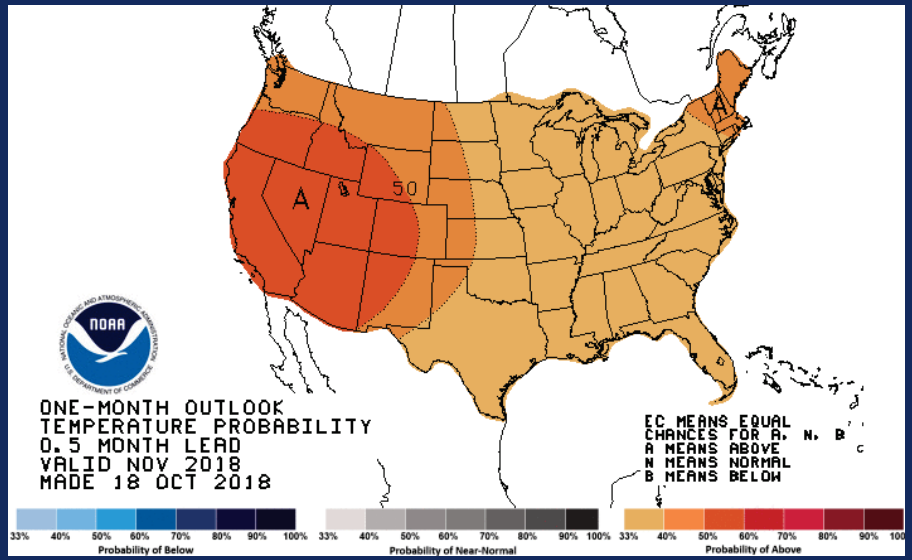
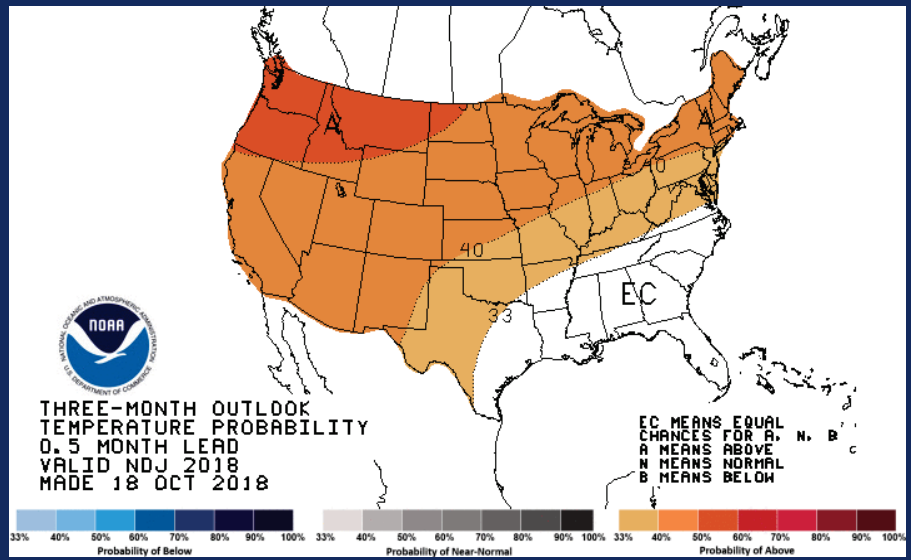
NOAA Winter Weather Outlook 2018-2019

November 2018



November-January 2018-19



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NOAA Winter Weather Outlook 2018-2019

New York HDD Forecast (10/18/18)							
Month	Forecast HDD	Normal (1981-2010)	Forecast Departure	%	Last Year (2017-2018)	Forecast Departure	%
Oct	418	397	21	5%	235	183	78%
Nov	**667**	**679**	**-12**	**-2%**	**716**	**-49**	**-7%**
Dec	**1006**	**1038**	**-32**	**-3%**	**1129**	**-123**	**-11%**
Jan	**1181**	**1207**	**-26**	**-2%**	**1236**	**-55**	**-4%**
Feb	**1007**	**1021**	**-14**	**-1%**	**854**	**153**	**18%**
Mar	**888**	**892**	**-4**	**0%**	**911**	**-23**	**-3%**
Apr	**518**	**516**	**2**	**0%**	**702**	**-184**	**-26%**
Total	**5685**	**5750**	**-65**	**-1%**	**5783**	**-98**	**-2%**

NOAA Outlook New York heating degree-days forecast (October – April):

- 1.1% warmer than normal (1981-2010) winter
- 1.7% warmer than last season.

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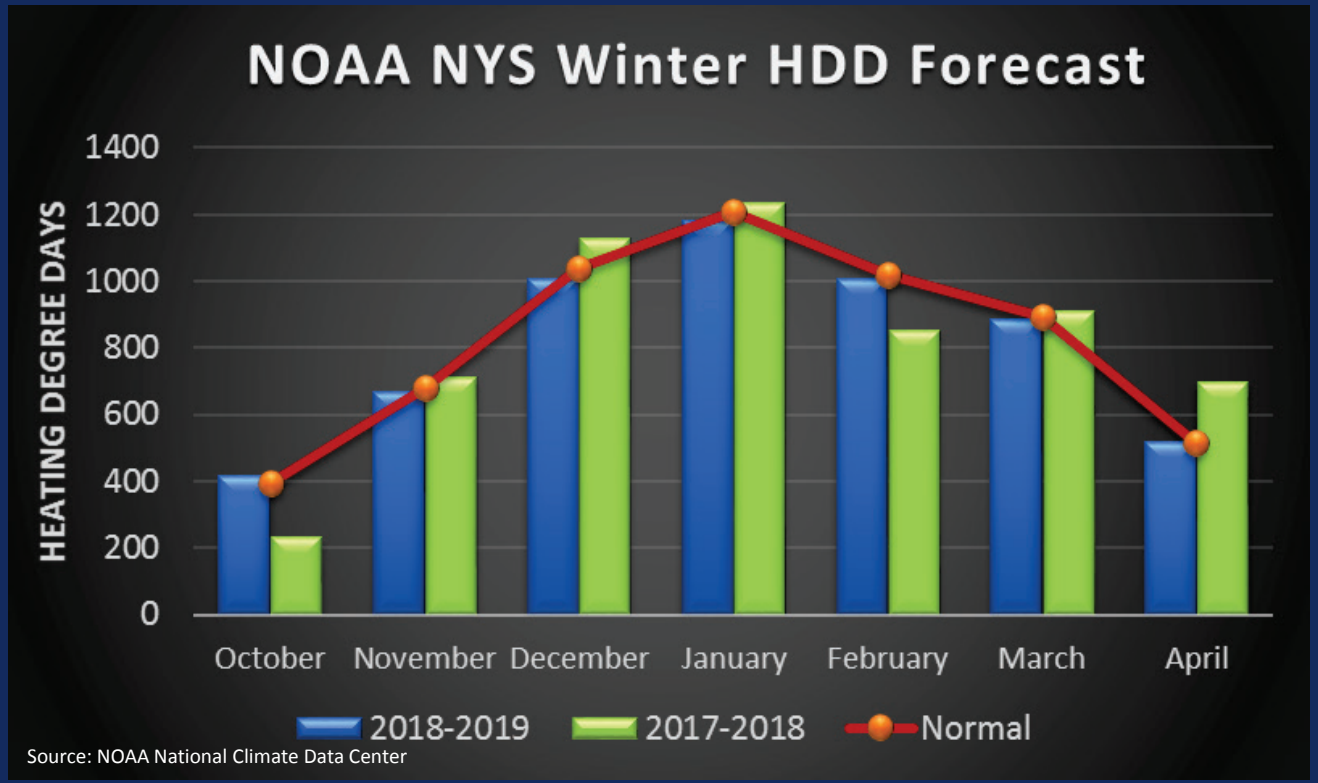
NOAA Winter Weather Outlook 2018-2019



Source: NOAA National Climate Data Center

NOAA Outlook New York heating degree-days forecast:

- 1.1% warmer than normal (1981-2010) winter
- 1.7% warmer than last season.

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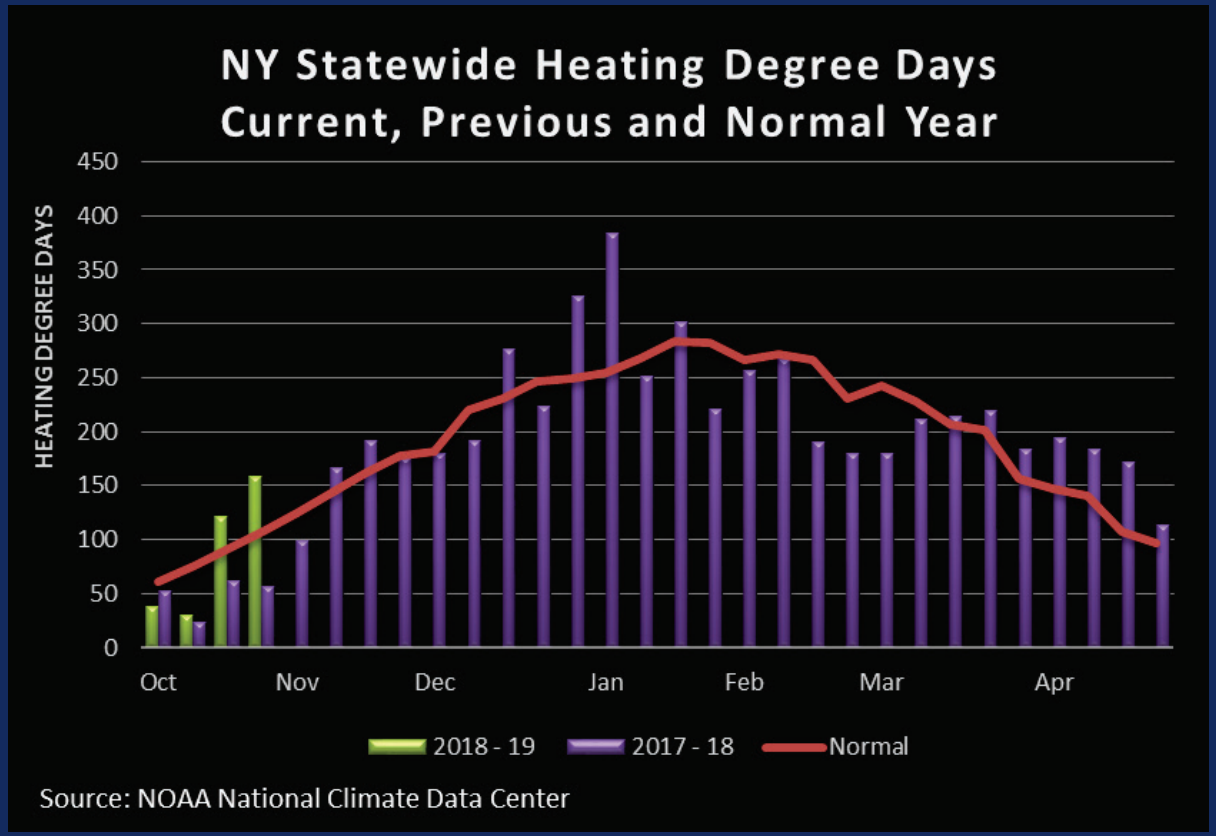
New York State Heating Degree-Days



- **For the week ending October 27, NYS cumulative HDD's since October 1 total 348 HDD and are 12 HDD or 3.6% above the normal level and 155 HDD's or 80.3% above last year's level.**
- **The 348 HDD's represent about 6.1% of the total normal heating season.**

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Winter Fuels Outlook for 2018-19 Winter Season

Winter Fuels Outlook for 2018-19

- EIA expects higher heating fuel prices this winter for heating oil and electricity in the Northeast. EIA expects propane prices to be about the same and natural gas prices to decrease slightly compared to last year.
- Based on the HDD forecast by NOAA, NYSERDA is projecting fewer heating degree-days than last year (1.7%) (Oct. – Apr.).
- Based on EIA and NOAA data, NYSERDA projects higher average household heating fuel expenditures in New York for heating oil and electricity, and lower average household heating fuel expenditures for propane and natural gas compared to last year.

Fuel Expenditure Variance Example

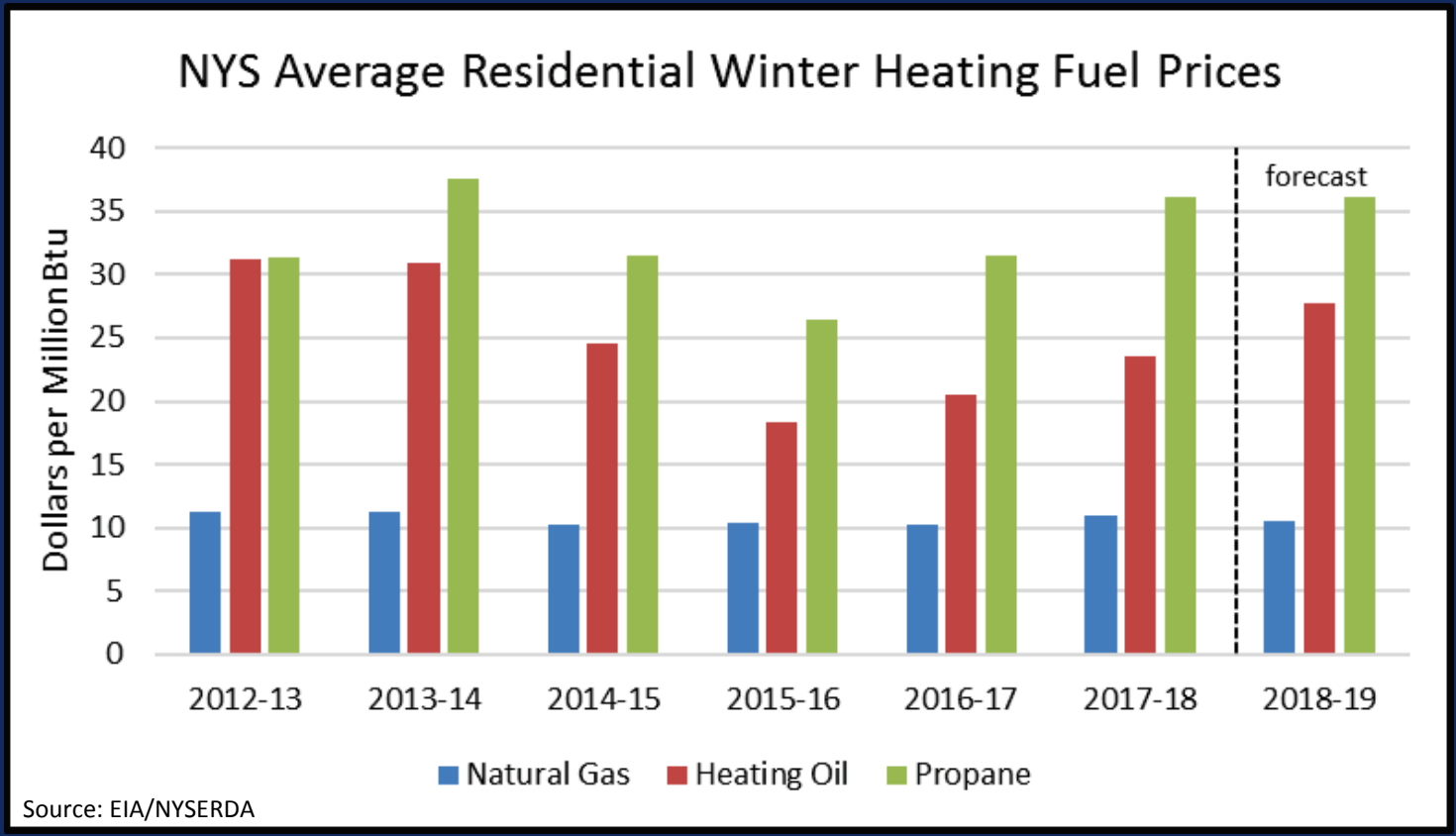
Colder or warmer (+/- 10% HDD) than forecast winters can swing expected fuel expenditures by as much as 16% or as little as 5% depending on the fuel

Change in forecast fuel expenditures from last winter			
Fuel	Base Case	If 10% warmer than forecast	If 10% colder than forecast
Heating oil*	**20%**	**7%**	**33%**
Natural gas	**5%**	**-4%**	**16%**
Propane *	**-1%**	**-17%**	**15%**
Electricity	**3%**	**-2%**	**9%**

*Note: * Propane expenditures are a volume-weighted average of the Northeast and Midwest regions. All other fuels are U.S. volume-weighted averages. Propane and heating oil prices do not reflect prices locked in before the winter heating season starts.*

Source: EIA Short-Term Energy Outlook, October 2018.

New York State Fuel Price Forecast



Source: EIA/NYSERDA

Fuel prices are forecast to be:

- Higher for heating oil
- The same for propane
- Lower for natural gas.

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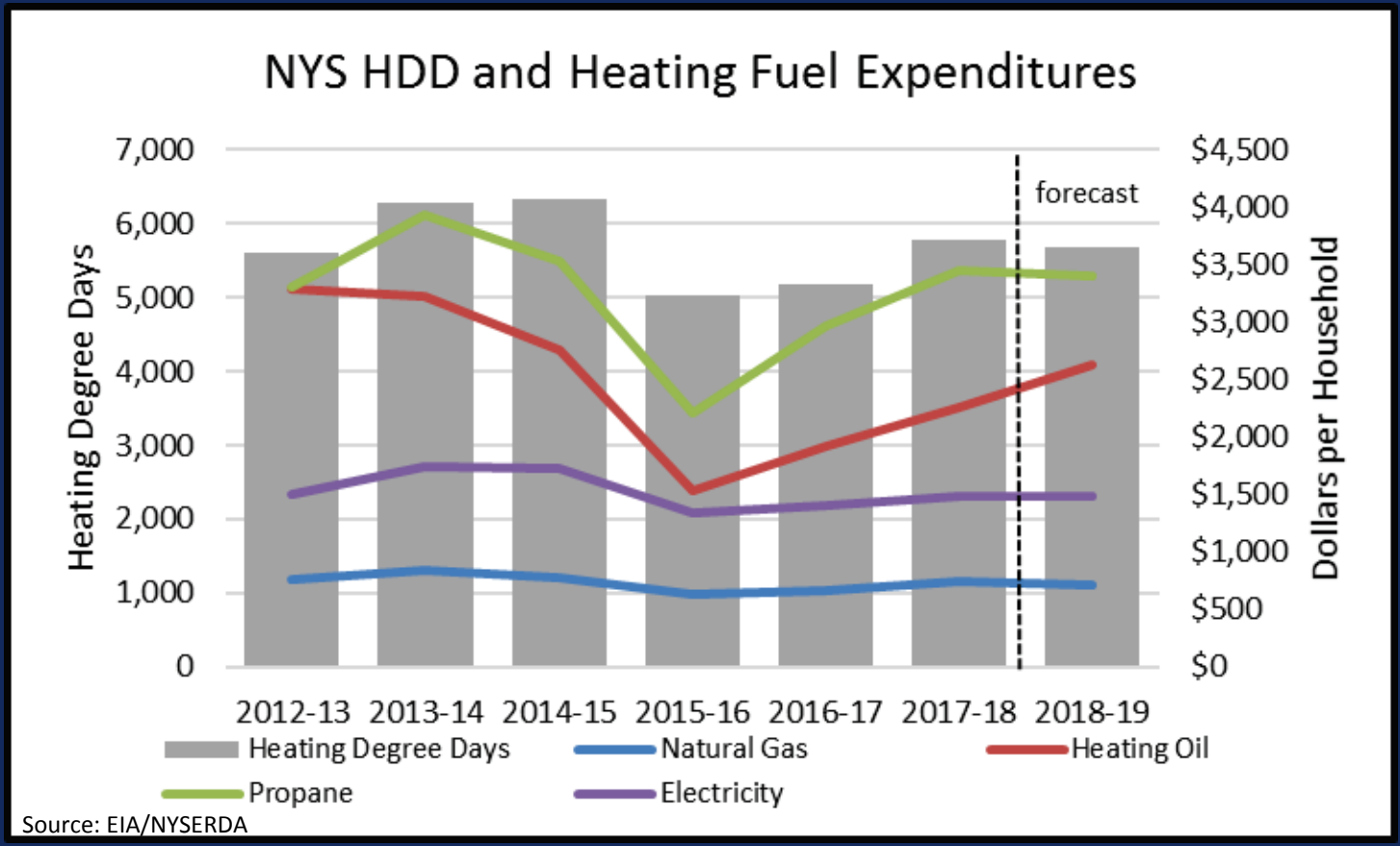
New York State HDD and Heating Fuel Expenditures



Source: EIA/NYSERDA

- Heating oil and propane expenditures vary more from winter to winter than electricity and natural gas

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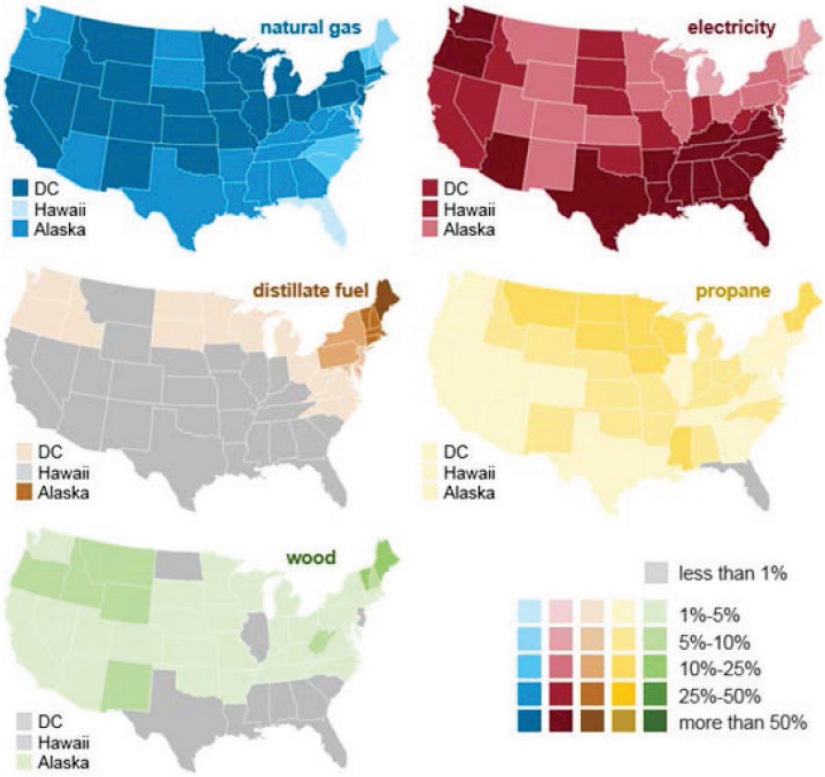
Heating fuel market shares vary across U.S. regions

Primary home heating fuel by state, 2017



Source: U.S. Energy Information Administration based on 2017 American Community Survey

2017 New York Percentages:

59.4% Natural Gas

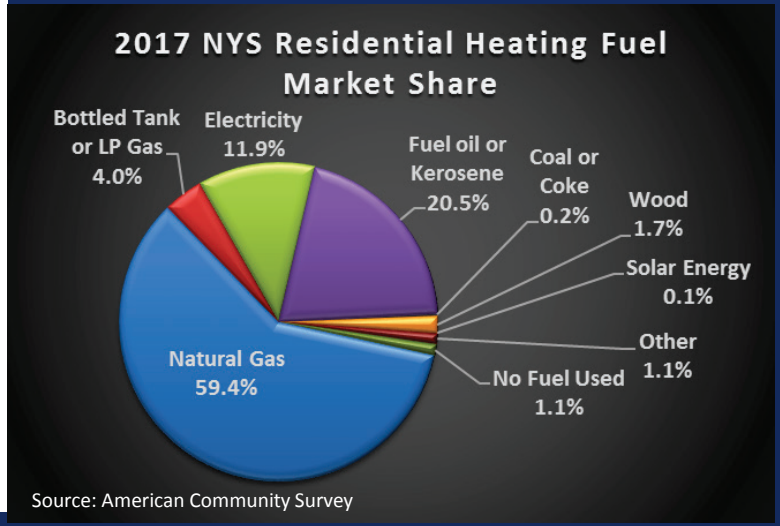
20.5% Heating Oil

4.0% Propane

11.9% Electricity

1.7% Wood

2.5% Other

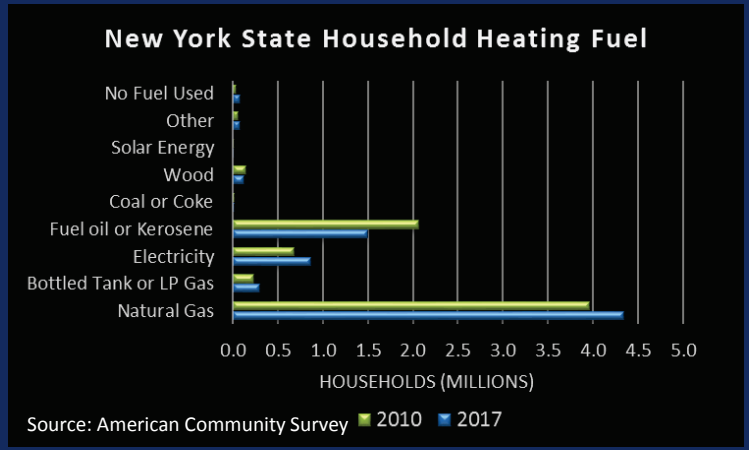


New York State Household Heating Fuel

New York State Household Heating Fuel	2017	%	2010	%	Change	% Change
Total Occupied Housing Units	7,304,332	100%	7,196,427	100%	107,905	1%
Natural Gas	4,339,349	59%	3,961,085	55%	378,264	10%
Bottled Tank or LP Gas	294,973	4%	227,607	3%	67,366	30%
Electricity	867,925	12%	676,262	9%	191,663	28%
Fuel oil or Kerosene	1,496,843	20%	2,068,004	29%	-571,161	-28%
Coal or Coke	17,881	0%	19,949	0%	-2,068	-10%
Wood	122,088	2%	143,242	2%	-21,154	-15%
Solar Energy	5,988	0%	1,823	0%	4,165	228%
Other	77,386	1%	61,664	1%	15,722	25%
No Fuel Used	81,899	1%	36,791	1%	45,108	123%

Source: *American Community Survey*

- Natural Gas up 378k homes (+10%) over 7 years
- Heating Oil down 571k homes (-28%) over 7 years



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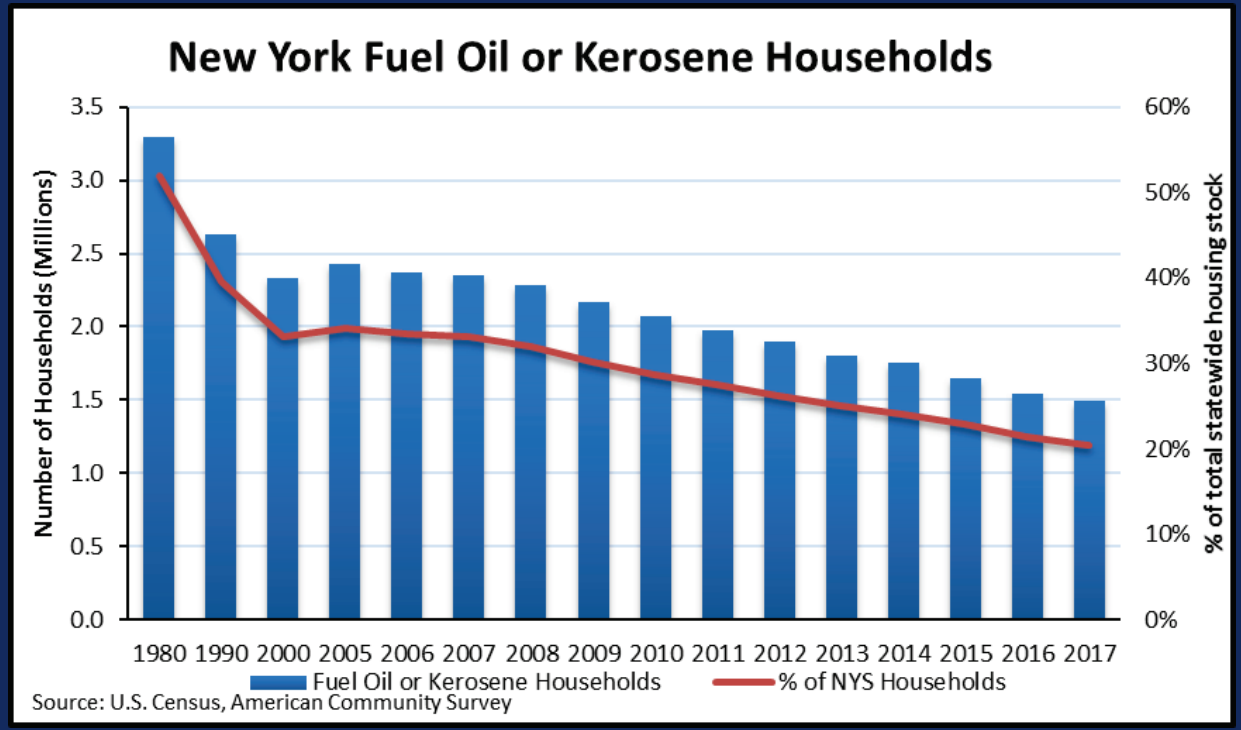
New York State Household Heating Fuel

Year	Fuel Oil or Kerosene Households	% of NYS Households
1980	3,290,683	51.9%
1990	2,629,172	39.6%
2000	2,336,714	33.1%
2005	2,429,348	34.1%
2006	2,373,350	33.5%
2007	2,347,031	33.1%
2008	2,281,188	32.0%
2009	2,165,896	30.1%
2010	2,068,004	28.7%
2011	1,979,067	27.5%
2012	1,901,118	26.3%
2013	1,802,442	25.0%
2014	1,752,656	24.1%
2015	1,649,860	22.8%
2016	1,540,787	21.4%
2017	1,496,843	20.5%

Source: *American Community Survey*



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New York State Winter Fuels Outlook, October 2018

New York Winter Heating Oil and Propane Fuel Summary

Household	Actual		Forecast	
Heating Oil	Avg. 13-17	17-18	18-19	% Change
Consumption (gals)	714	697	687	-1.4
Avg. Price ($/gal)	3.28	3.24	3.82	17.8
Expenditures ($)	2,342	2,259	2,624	16.2
Propane				
Consumption (gals)	1,074	1,049	1,032	-1.6
Avg. Price ($/gal)	3.00	3.30	3.30	0.0
Expenditures ($)	3,219	3,455	3,400	-1.6

Note: Individual household volumes, and so, expenditures will vary.

Note: Heating Oil data reflect New York prices and adjusted consumption to New York Averages.

Note: Propane data reflect New York prices and adjusted consumption to Btu equivalent heating oil.

Forecasts reflect updated NOAA projections.

Source: EIA Short-Term Energy Outlook, October 2018, NOAA, NYSERDA

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New York State Winter Fuels Outlook, October 2019

New York Winter Natural Gas & Electric Fuel Summary

Household	Actual		Forecast	
Natural Gas	Avg. 13-17	17-18	18-19	% Change
Consumption (mcf)	67.0	66.2	64.8	-2.0
Avg. Price ($/mcf)	10.96	11.29	10.91	-3.4
Expenditures ($)	735	747	707	-5.3
Electricity				
Consumption (kwh)	8,381	8,345	8,161	-2.2
Avg. Price ($/kwh)	0.184	0.178	0.183	2.4
Expenditures ($)	1,541	1,488	1,490	0.1

Note: Individual household volumes, and so, expenditures will vary.

Note: Natural Gas consumption is adjusted to New York Averages while Electricity consumption is based on Northeast Averages.

Note: Prices reflect New York average prices.

Forecasts reflect updated NOAA projections.

Source: EIA Short-Term Energy Outlook, October 2018, NOAA, NYSERDA

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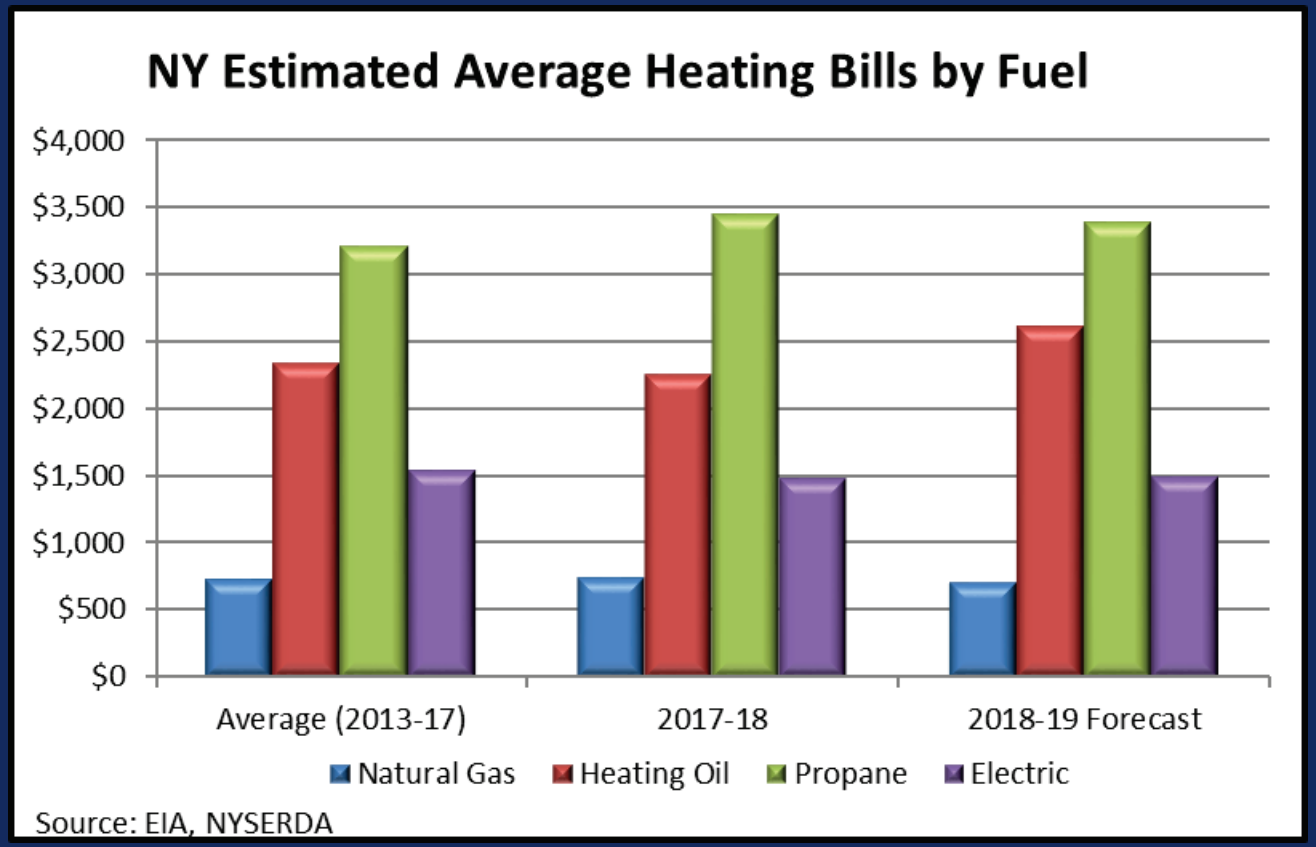
Estimated Average Heating Expenditures



Fuel Type	% Change Last Year	% Change 5-Year Avg.
Natural Gas	-5.3%	-3.7%
Heating Oil	16.2%	12.0%
Propane	-1.6%	5.6%
Electric	0.1%	-3.3%

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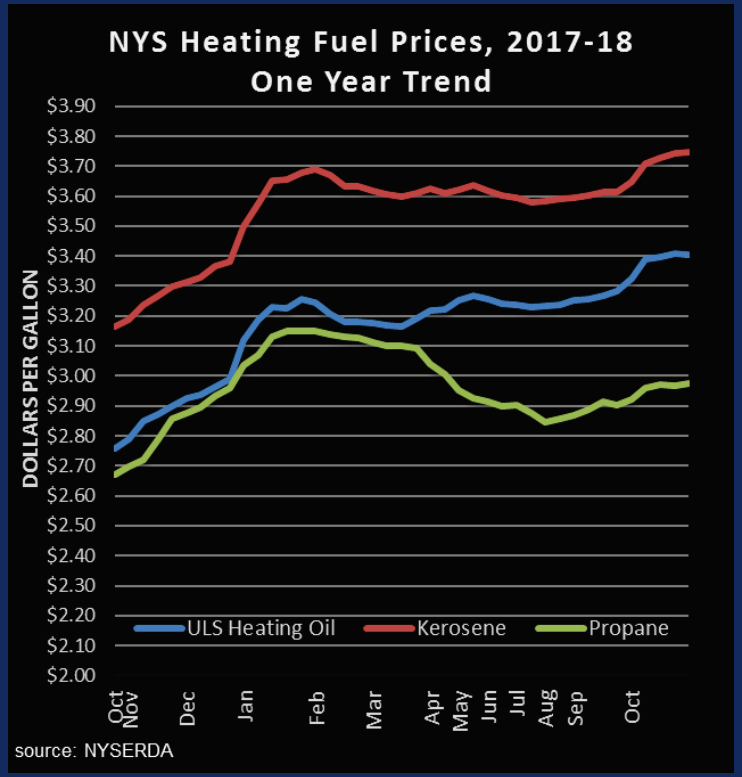
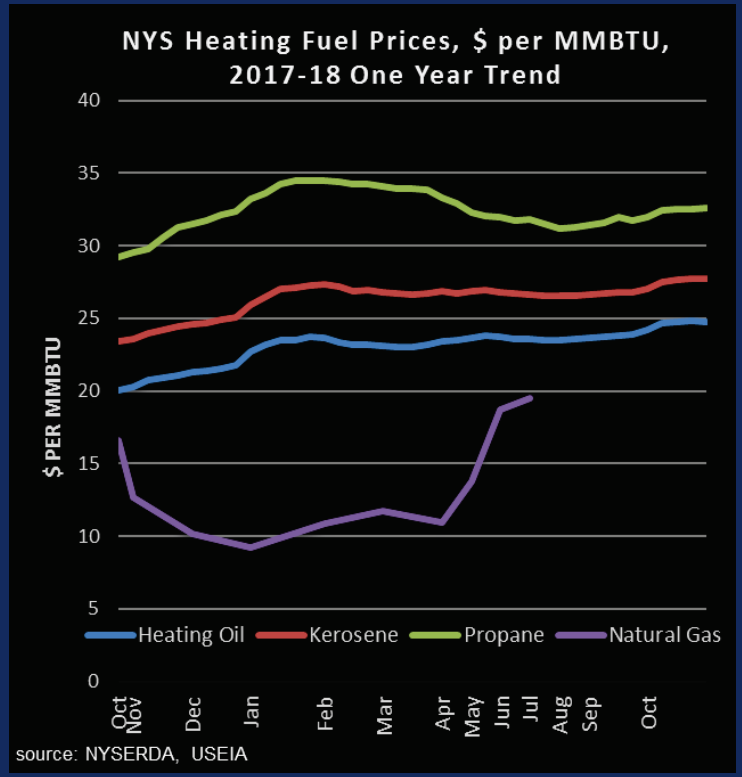
New York State Retail Heating Fuel Surveys

Current Prices: Heating Oil - $3.40, Kerosene - $3.75, Propane - $2.97





- Year over year change:
- Heating Oil: +23.3%
- Kerosene: +18.4%
- Propane: +11.4%

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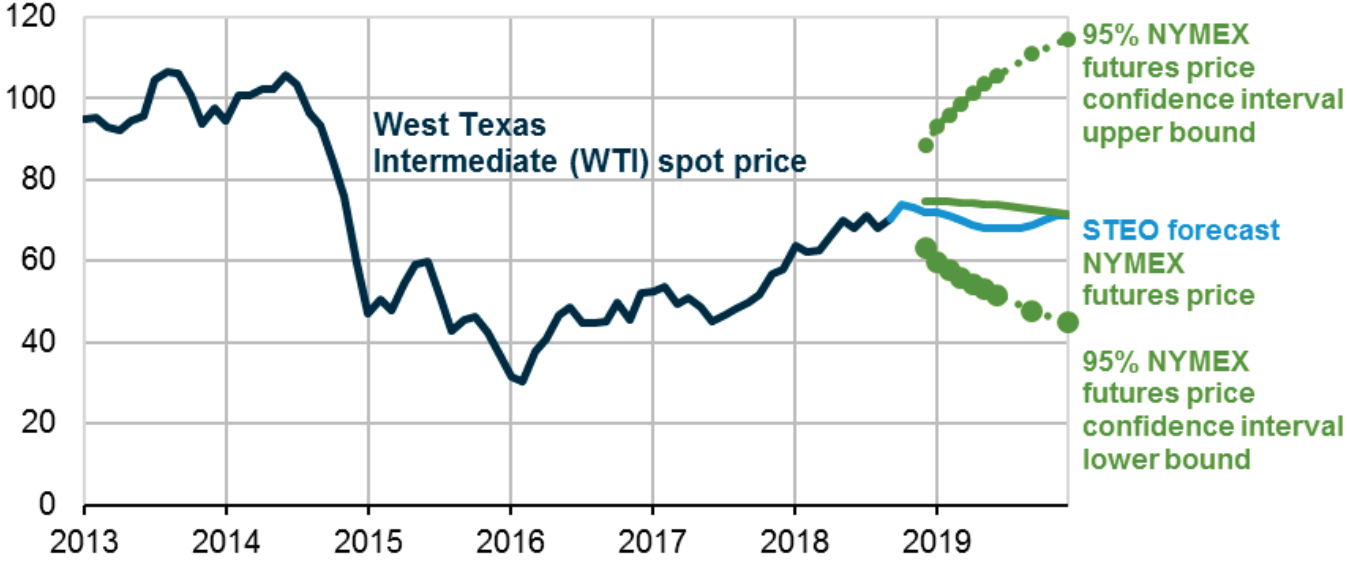
Crude Oil

U.S. Crude Oil Prices



Note: Confidence interval derived from options market information for the five trading days ending Oct 4, 2018. Intervals not calculated for months with sparse trading in near-the-money options contracts.

Source: Short-Term Energy Outlook, October 2018, and CME Group

eia

- WTI crude oil prices have increased over the previous year
- Current weekly average WTI crude oil price for week of Oct. 19 is $70.24/bbl (36% higher than year-ago price)

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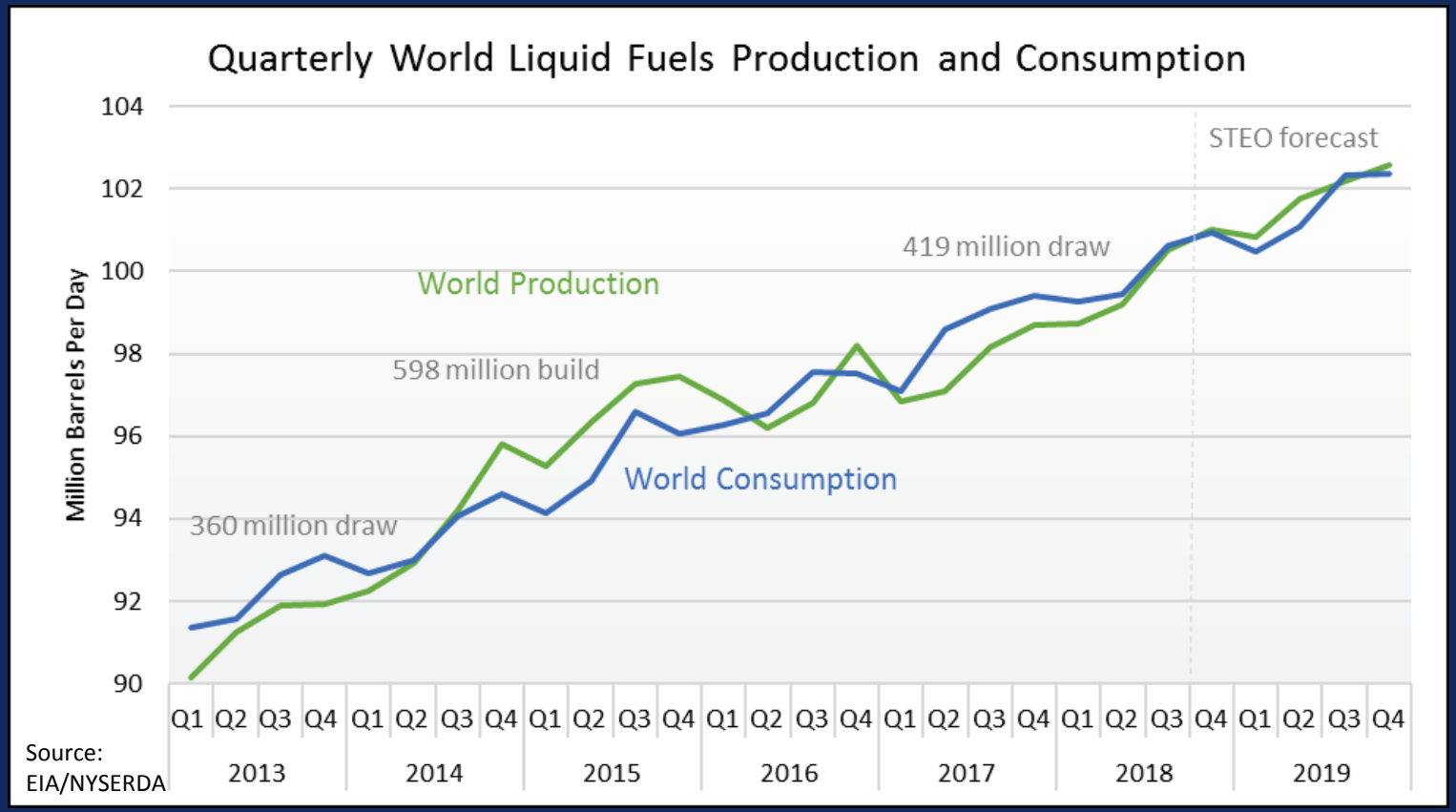
Factors Affecting U.S. Crude Oil Prices and Inventories

- Increasing uncertainty due to geopolitical considerations: Iran Sanctions, Venezuela production declines, Saudi Arabia, and other OPEC countries, economic tariffs
- Tightening of global crude oil supplies and reduced worldwide spare production capacity
- Higher worldwide economic growth leading to demand growth for crude oil
- Other monetary factors such as value of US Dollar, U.S. equities
- U.S. crude oil production and export increases

World Production and Consumption Balance



Source:
EIA/NYSERDA

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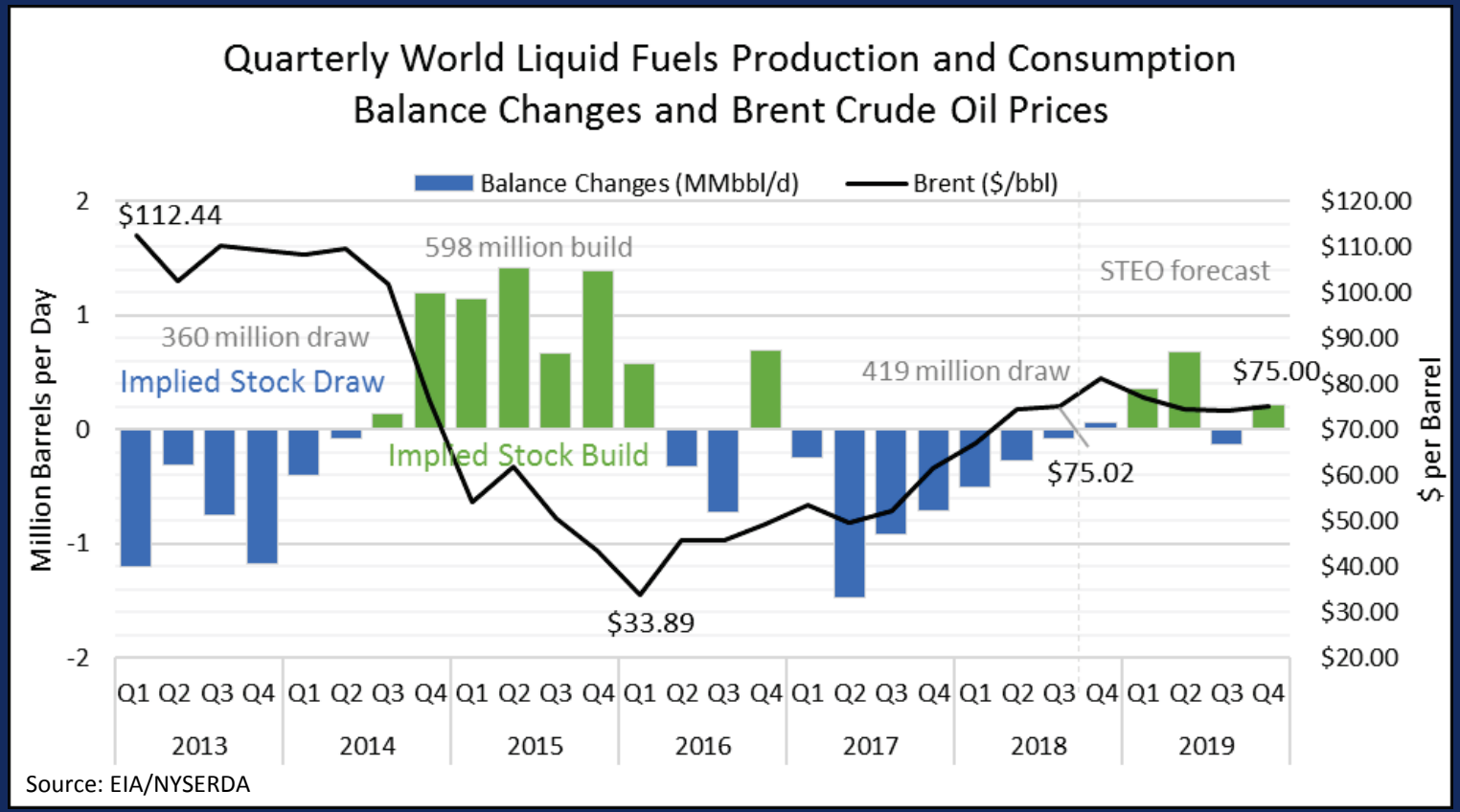
World Production and Consumption Balance



Source: EIA/NYSERDA

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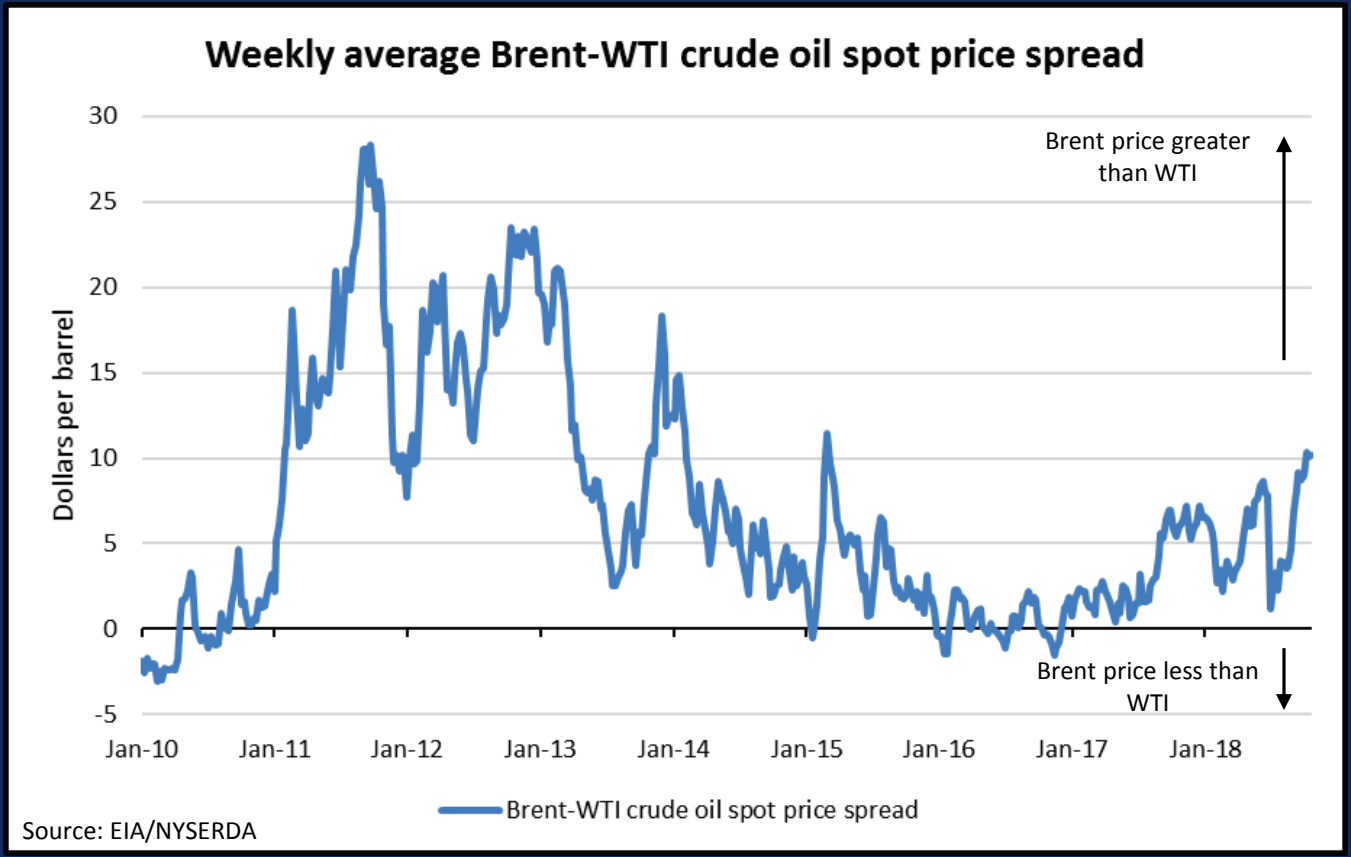
Widening Brent-WTI Price Spread



Source: EIA/NYSERDA

- Spread at its largest since 2015 – currently around $10 per barrel
- Not as large as 2011-2014
- Unlikely to be sufficient enough to change how East Coast refiners source crude oil.

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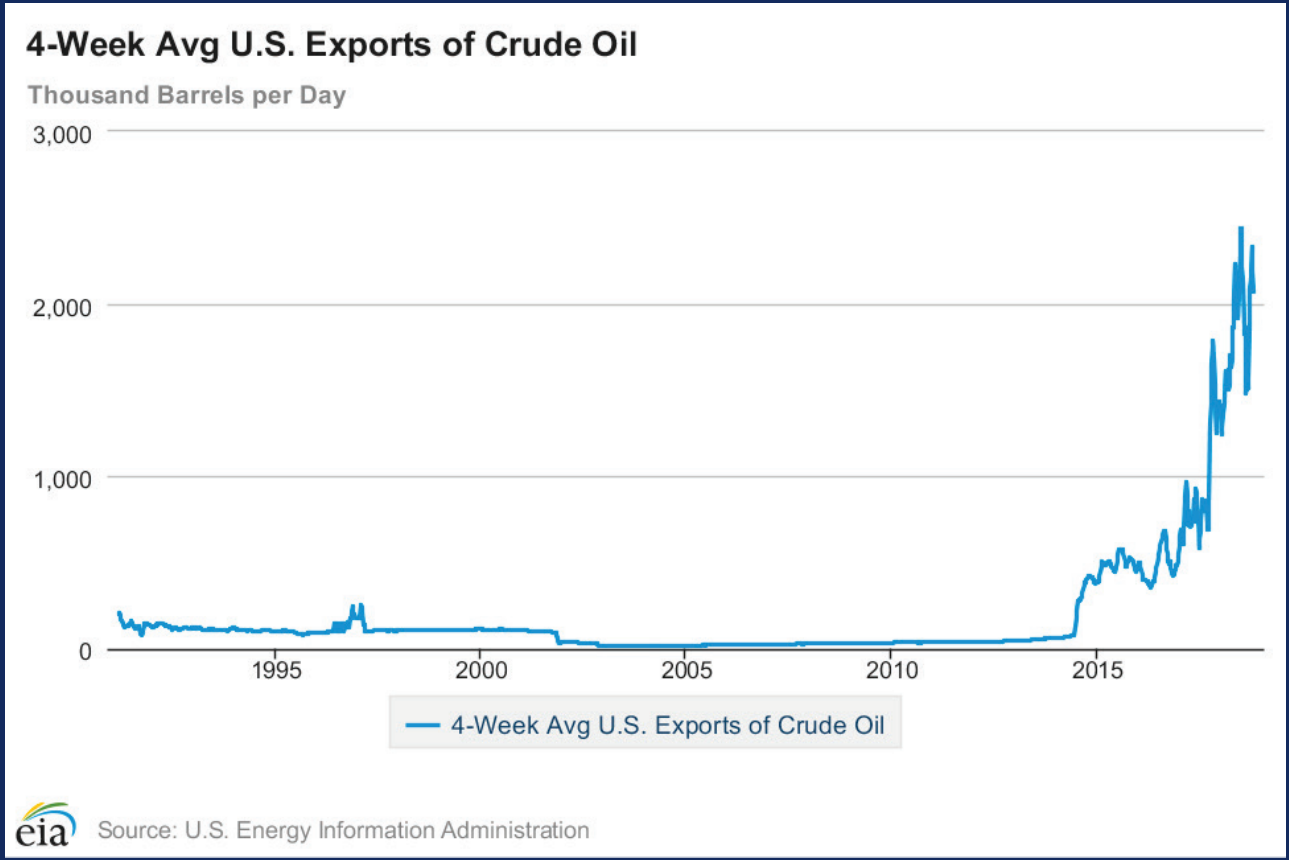
U.S. Crude Oil Exports



- U.S. crude oil export ban lifted in December 2015
- Explosive growth - current 4-week average is 2.1 million barrels per day
- Capacity to grow depends on new pipeline infrastructure and export facilities along U.S. Gulf Coast.

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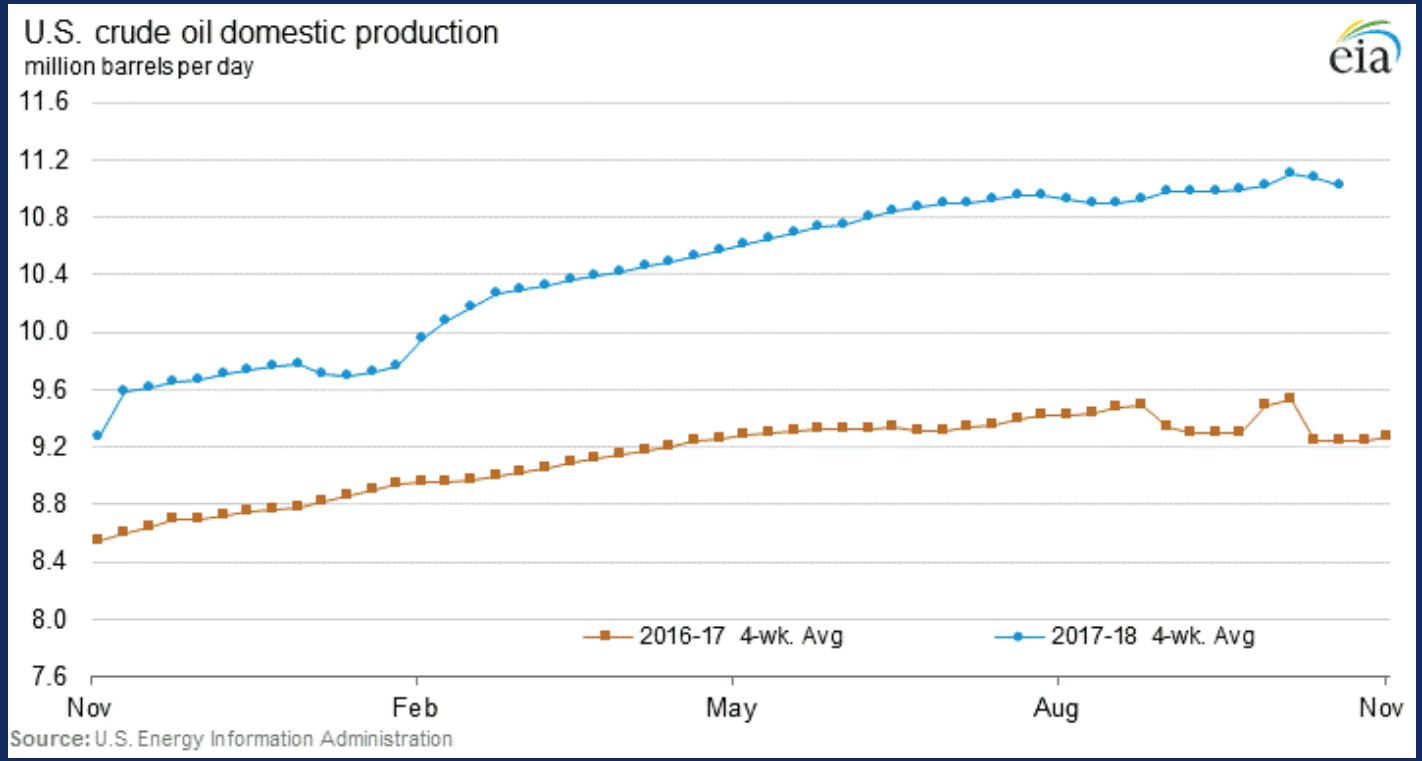
U.S. Crude Oil Production



- U.S. crude oil production over 11 million barrels per day.
  - ❖ As of August 2018, U.S. is largest crude oil producer in the world
- U.S. crude oil production has increased by 1.8 million barrels per day (19.3%) since last year.
- Infrastructure capacity limiting growth (pipeline takeaway capacity and export capacity)

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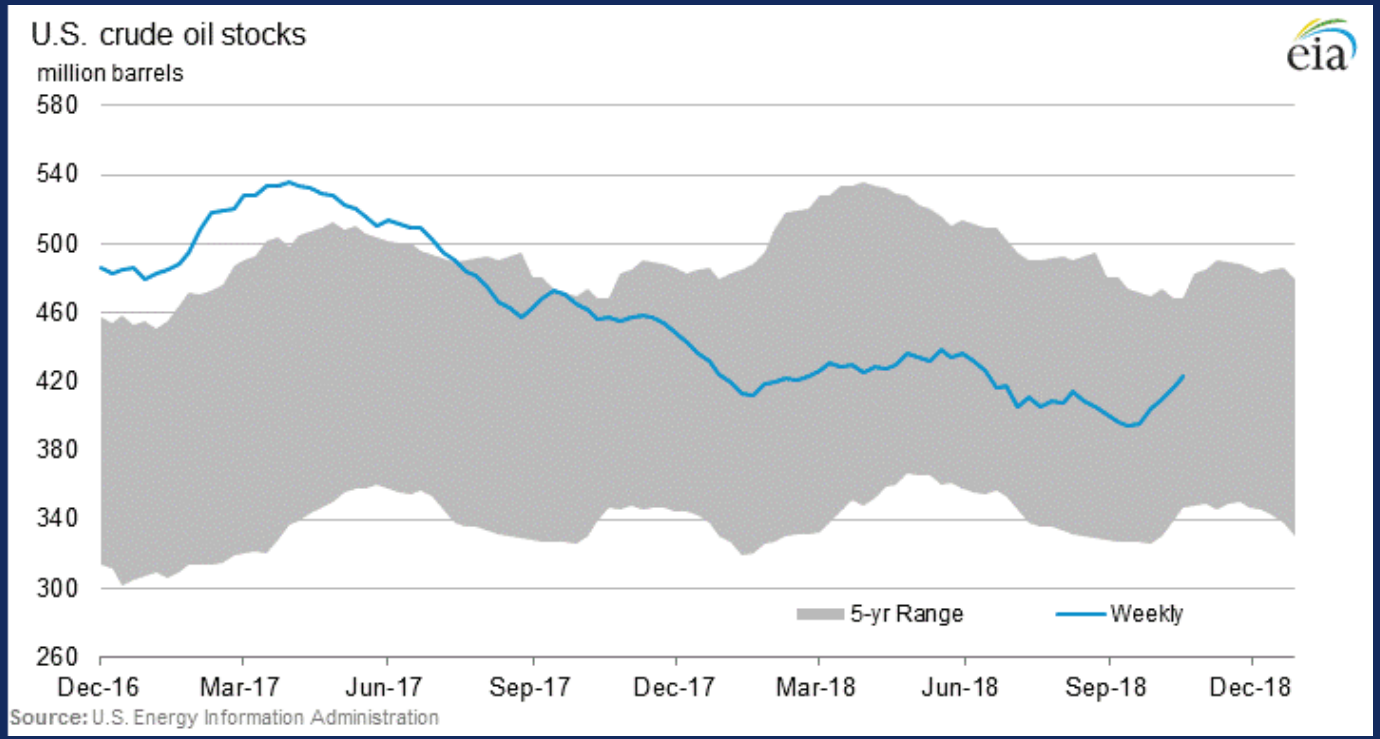
U.S. Crude Oil Stocks



- Current level 423 million barrels
- 35 million barrels below last year (7.6%)
- 7 million barrels above the 5-year average (1.8%)
- Peak 536 million barrels in March 2017

Heating Oil

Northeast Heating Oil Market

- U.S. home heating oil consumption is highly concentrated in the Northeast.

- More than four-fifths of all homes in the United States that use heating oil are located in the Northeast (source: U.S. Census Bureau, 2017 American Community Survey).

- 21% of homes in the Northeast use oil as their main heating fuel, down from 27% seven years ago as an increasing number of homes switch to using natural gas and electricity for space heating.

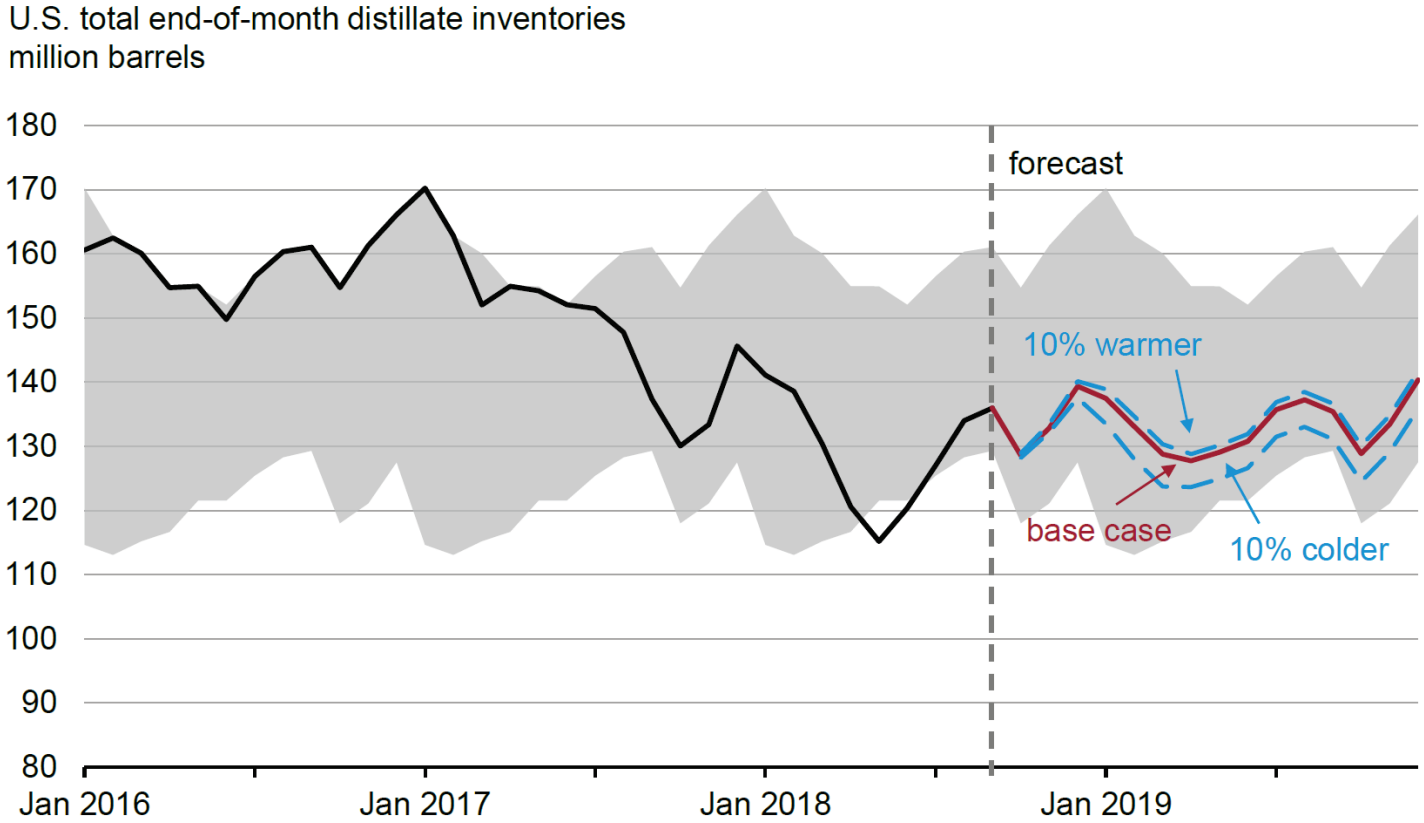
Winter 2018-19 takeaways – Heating oil

- Brent crude oil spot prices are expected to average $79 per barrel (bbl) this winter
  - $15/bbl (36 cents/gal) higher than last winter
  - Still expected to remain lower than 2010-14 levels when the average price of Brent crude oil exceed $100/bbl.
  - Prices are highly uncertain heading into the winter season.
- Higher heating oil prices due to higher crude oil prices and higher distillate fuel margins (price difference between wholesale distillate fuel and crude oil).
  - 38 cents/gal heating oil wholesale margin (5 cents/gal higher than last year)
  - Strong demand for distillate
  - U.S. distillate exports

Winter 2018-19 takeaways – Heating oil

- Distillate stocks in the Mid-Atlantic totaled 22.5 million barrels on October 19, 3.6 million barrels (14%) below the same time last year and 7.3 million barrels (25%) below the 5-year average.
  - ❖ Distillate inventories have remained below the 5-year average since March.
- Distillate inventories have been falling heading into winter due to recent refinery maintenance combined with strong domestic and international demand.
  - ❖ Lack of incentive to build stocks due to the backwardation of the market
- Mid-Atlantic ultra-low sulfur distillate inventories are 12% below last year's level and 19% below the 5-year average.
- Unless severely cold temperatures in the Northeast coincide with severely cold temperatures in Europe, distillate supplies should be able to meet demand but localized supply issues and upward pressure on distillate prices are possible.

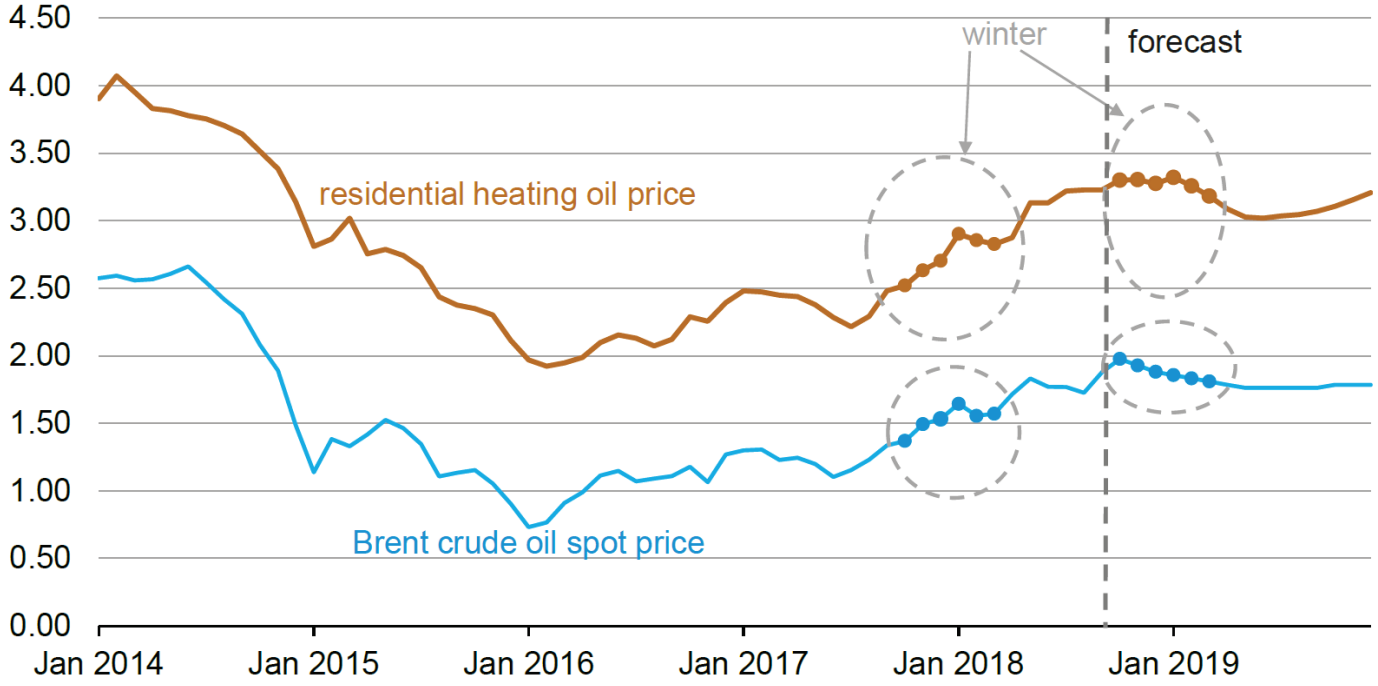
EIA forecasts distillate inventories to remain within the five-year average range, even in the 10% colder scenario



Note: Gray band represents the range between the minimum and maximum from 2013 to 2017.
Source: EIA Short-Term Energy Outlook, October 2018.

EIA expects average residential heating oil prices to be 18% higher than prices last winter

monthly average heating oil and Brent crude oil prices
dollars per gallon



Source: EIA Short-Term Energy Outlook, October 2018, and Thomson Reuters.

Northeast Sulfur & Bioheat Requirements

CHART 1. SUMMARY

LOW SULFUR & BIODIESEL BLENDING REQUIREMENTS IN THE NORTHEAST/MID-ATLANTIC

All data is listed for No. 2 Fuel Oil only. Compliance dates are July 1st of that year unless otherwise specified. Cities are listed in *italics*.

	Previous Sulfur	2012	2014	2015	2016	2017	2018+
New York State (Sulfur)	2,500-5,000ppm	15 PPM					
New York State (Bioheat)							5% Bio
New York City (Bioheat)		2% Bio				5% Bio	
Philadelphia, PA (Sulfur)	2,000ppm			15 PPM			
Delaware	3,000-10,000ppm				15 PPM		
New Jersey	2,000-3,000ppm		500 PPM		15 PPM		
Maryland	3,000ppm		2,000 PPM		500 PPM		
Pennsylvania	2,000-5,000ppm				500 PPM		
Massachusetts	3,000ppm		500 PPM				15 PPM
Rhode Island (Sulfur)	5,000ppm		500 PPM				15 PPM
Rhode Island (Bioheat)			2% Bio	3% Bio	4% Bio	5% Bio	
Vermont	20,000ppm		500 PPM				15 PPM
Connecticut	3,000ppm		500 PPM				15 PPM
Maine	3,000-5,000ppm						15 PPM
New Hampshire	4,000ppm						15 PPM
Washington, DC (Sulfur)	10,000ppm				500 PPM		15 PPM

*New York City will require 5% bends on October 1, 2017 and after a study and report, 10% in 2025, 15% in 2030 and 20% in 2034.

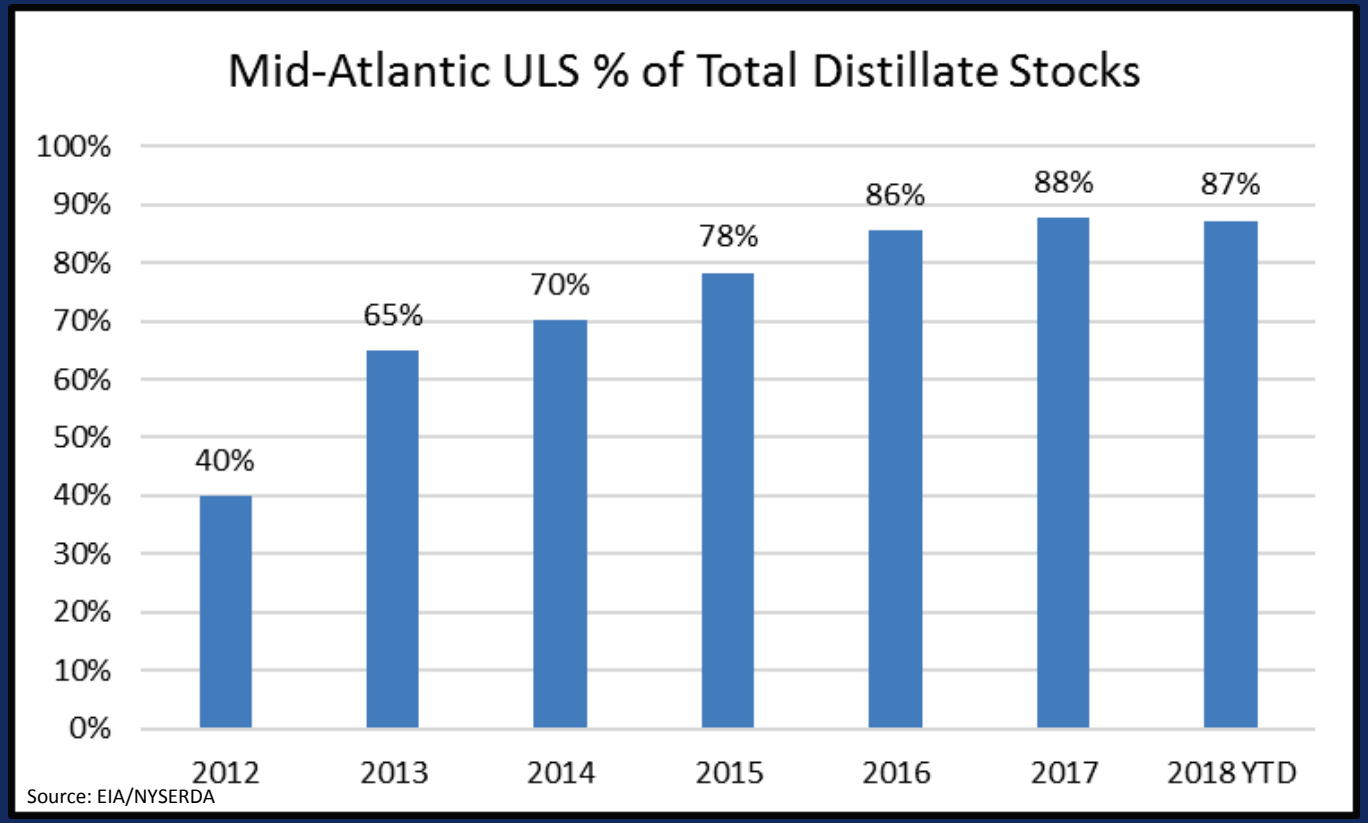
Note: The term Bioheat® is a registered trademark of the National Biodiesel Board (NBB). Its use in this document refers generally to biodiesel-blended heating oil.

Source: New England Fuel Institute (NEFI) June 2018

2018 Changes to the Heating Oil Market:

- New England States moved to ULS July 1, 2018
- Most of NYS (Downstate) requires 5% Bioheat

Mid-Atlantic Ultra-low Sulfur (ULS) % of Total Distillate Stocks



Source: EIA/NYSERDA

New York State moved to ULS for heating oil in 2012

New England States moved to ULS July 1, 2018

More than 85% of total distillate stocks have been ULS over the past three years.

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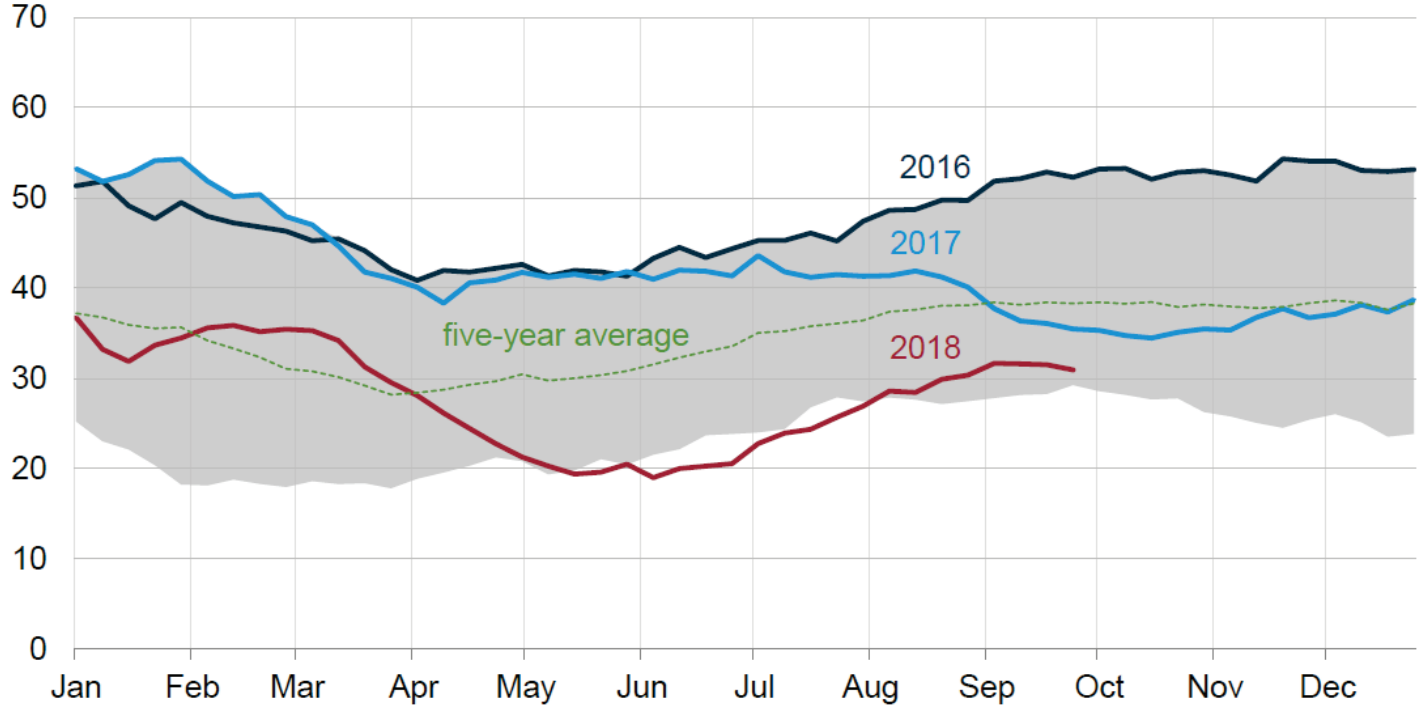
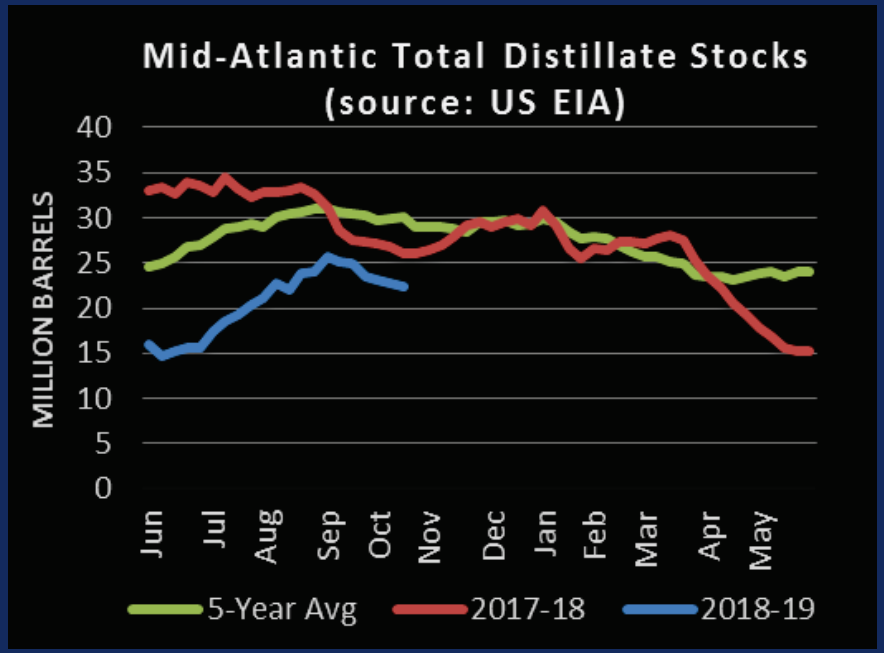
Distillate inventories in the Northeast have risen since the summer to move within the five-year range

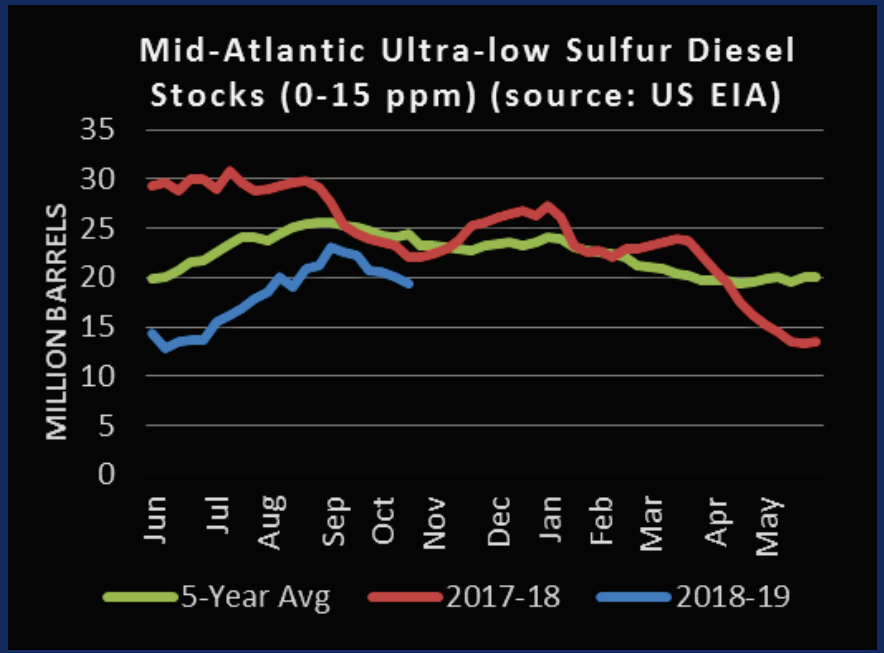
Northeast region weekly distillate inventories
million barrels



Note: Gray band represents the range between the minimum and maximum from 2013 to 2017.
Source: EIA, Weekly Petroleum Status Report.

Mid-Atlantic Distillate Stocks





- For the week ending October 19, total Mid-Atlantic distillate stocks are 14.0% below last year's level and 24.7% below the 5-year average.
- Ultra-low sulfur distillate stocks are 11.9% below last year's level and 19.4% below the 5-year average.

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Heating Oil Challenges and Concerns

- **No overall issues with current supply and industry expects to be able to meet demand.**
- Inventories on the lower side due to high demand, exports, and economics.
- Truck driver shortages – across all industries and nationwide.
  - ❖ Compliance with Hours of Service (HOS) rules and potential for waivers during prolonged cold periods to meet demand.
- “Interruptibles” put additional strain on supply especially for prolonged timeframes during extended cold periods.

Heating Oil Challenges and Concerns, Cont'd.

- Irving Oil refinery explosion in St. John, Canada in early October
  - 320,000 barrels per day, more than half of refined products are exported to the Northeast U.S. (Major source for NY and New England)
  - Refinery was undergoing maintenance so short-term impact limited, the explosion affected a unit required to produce distillate so affect on diesel production likely stronger than gasoline.
  - Limited information available on full restoration of refinery operations.
- New Bioheat requirements – 5% bioheat requirement in Downstate NY
  - Nassau, Suffolk, and Westchester counties B5 - July 1, 2018
  - New York City B5 - October 1, 2017 (B20 by 2034)
  - Approximately 70% of heating oil market in New York State.

On the Horizon – IMO 2020

- What is IMO 2020 – International Maritime Organization rules goes into effect globally January 1, 2020. States that marine fuel will have a maximum sulfur content of 0.5% compared to 3.5% today unless scrubbers are installed.
  - 5,000 ppm sulfur content limit compared to 35,000 ppm sulfur content limit
  - March 1, 2020 ban on carrying high sulfur residual bunker fuel
- What are options for compliance –
  - Install scrubbers aboard vessel – high upfront cost, customized to vessel, recoup long-term
  - Low-sulfur bunker fuel
  - Marine diesel (new fuel)
- Who does this affect – all global maritime shipping. U.S. was already in an Emissions Control Area (ECA) of 200 miles buffer around U.S. shoreline requiring 0.1% sulfur content as of January 2015.
- Why does this matter to NYS Heating Oil Industry – higher demand and thus potential higher price for distillate fuel (heating oil) heading into next winter

Propane

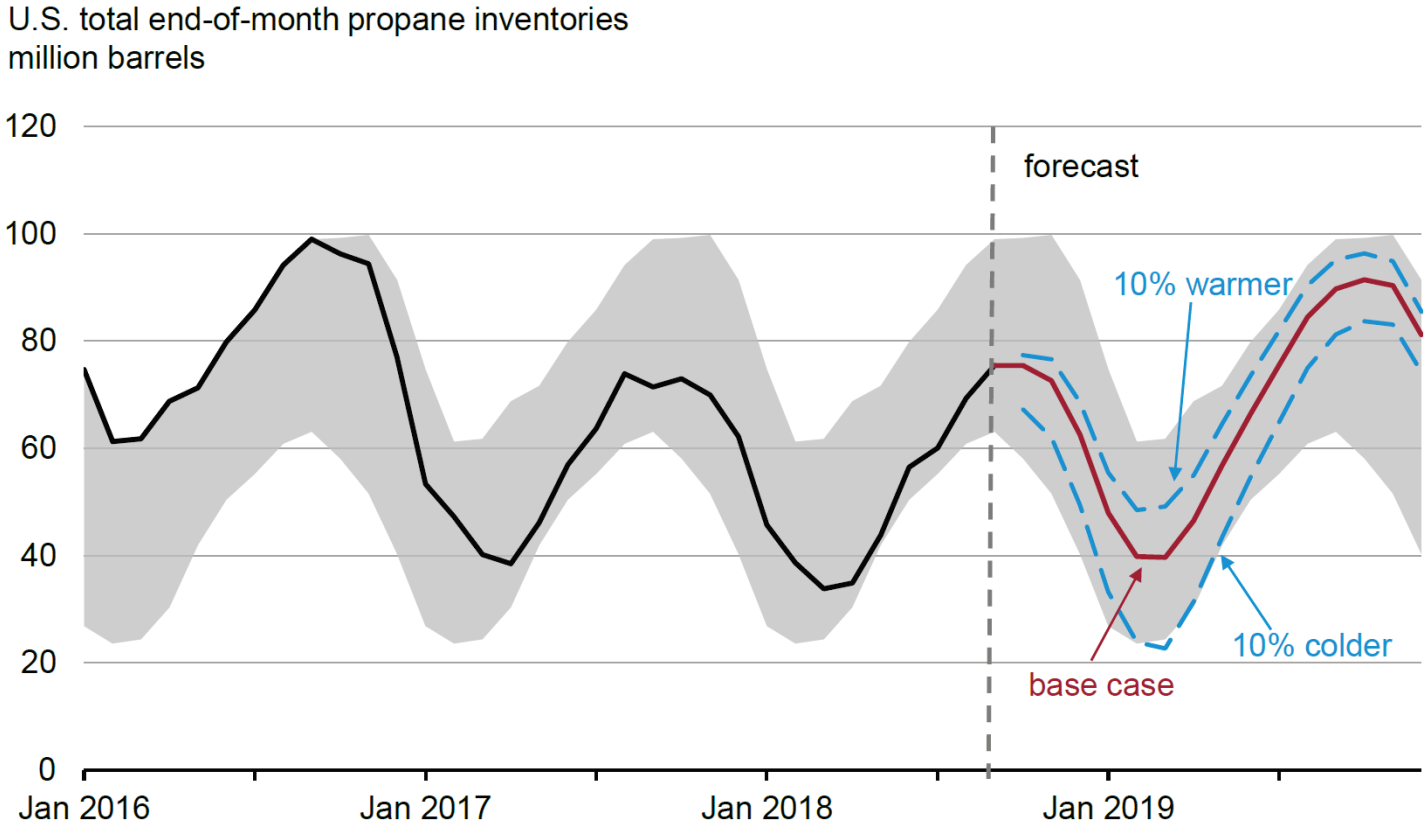
Winter 2018-19 takeaways – Propane

- U.S. propane production is forecast to be 14% higher this winter compared with last winter
- Total propane consumption is expected to be about the same as last winter and net exports 19% higher.
- U.S. propane inventories on October 19 were 4.4 million barrels (5.6%) higher than year-ago levels, and 3.9 million barrels (4.5%) below the five-year average
- Mid-Atlantic propane inventories were 26.0% higher than the year-ago level and 44.3% above the five-year average.

Winter 2018-19 takeaways – Propane

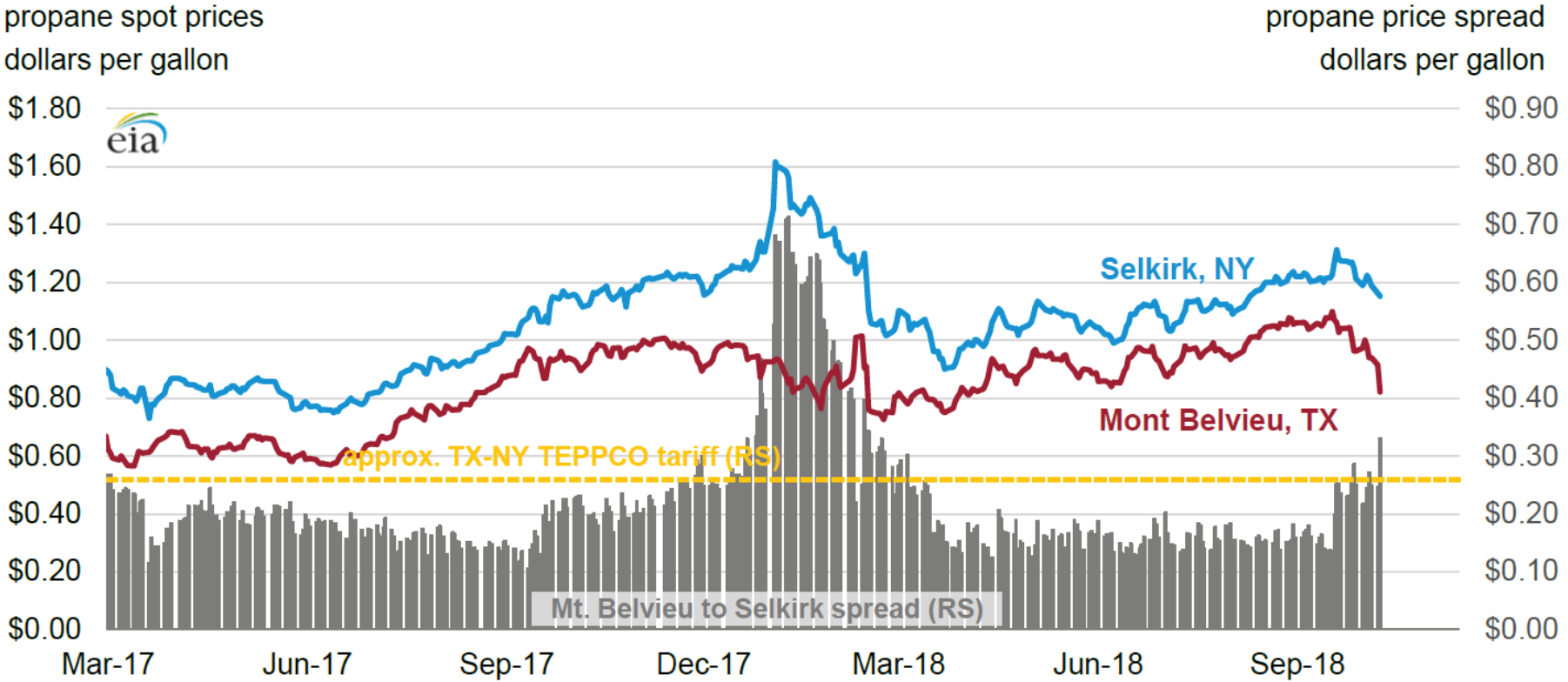
- Increasing Mid-Atlantic propane inventories coincide with increasing propane exports out of the Mid-Atlantic from strong global demand for propane.
- Mariner East Pipeline – Marcus Hook export terminal
  - ❖ Interruptions in service in Mariner East 1 pipeline (70,000 bbl/d)
  - ❖ Delays in completing Mariner East 2 pipeline (275,000 bbl/d)
  - ❖ Led to larger-than-normal inventory builds
- With increased production from shale formations and improved pipeline and rail delivery networks for propane, this should contribute to more robust propane supply chains than previous years.

U.S. propane inventories are starting the winter near the middle of the five-year range



Note: Gray band represents the range between the minimum and maximum from 2013 to 2017.
Source: EIA Short-Term Energy Outlook, October 2018.

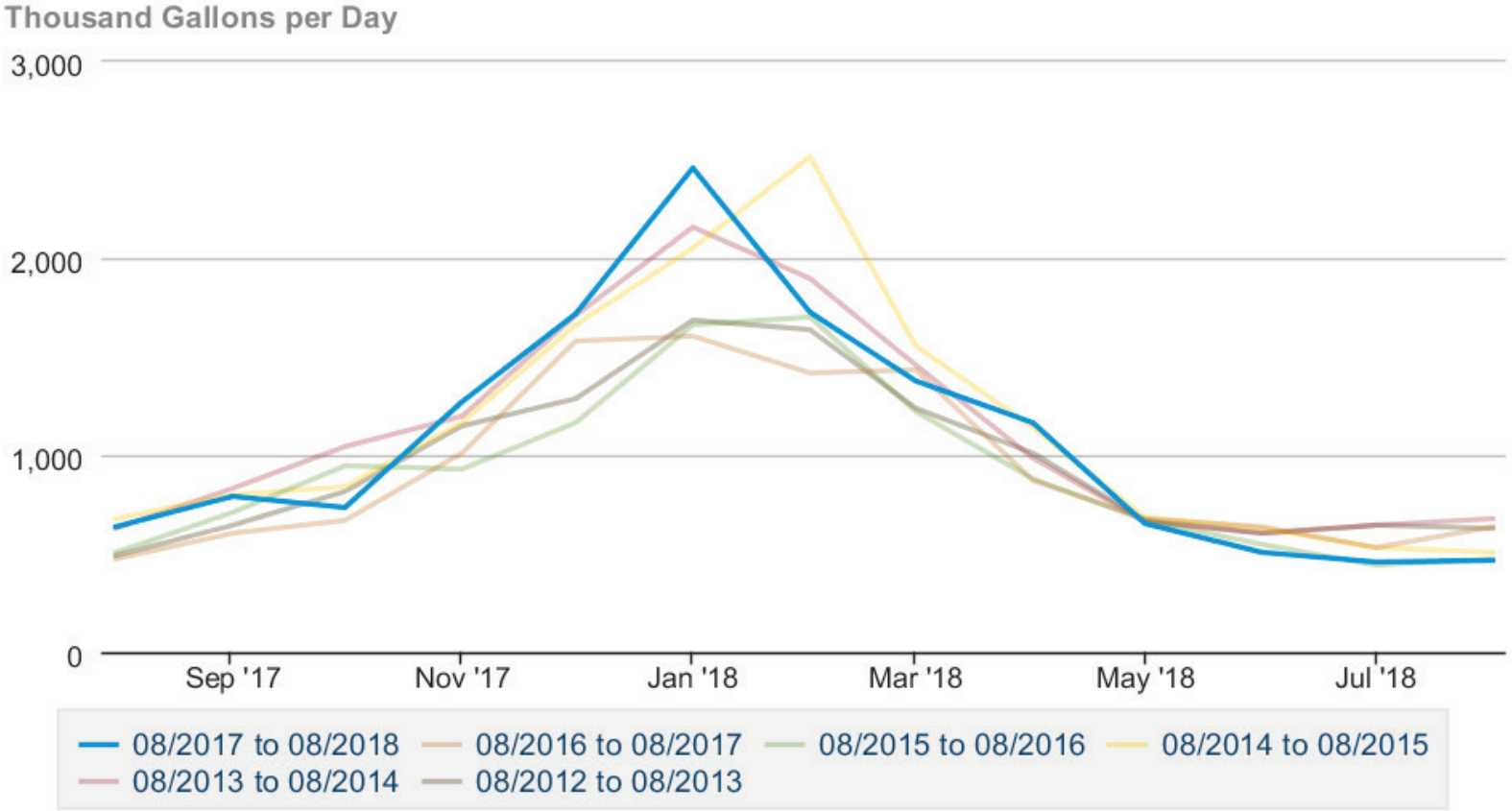
Northeast propane prices, generally dictated by tariff on TEPPCO* pipeline, rose relative to Gulf Coast spot prices, reflecting start of heating season



TEPPCO = Enterprise TE Products Pipeline Company LLC

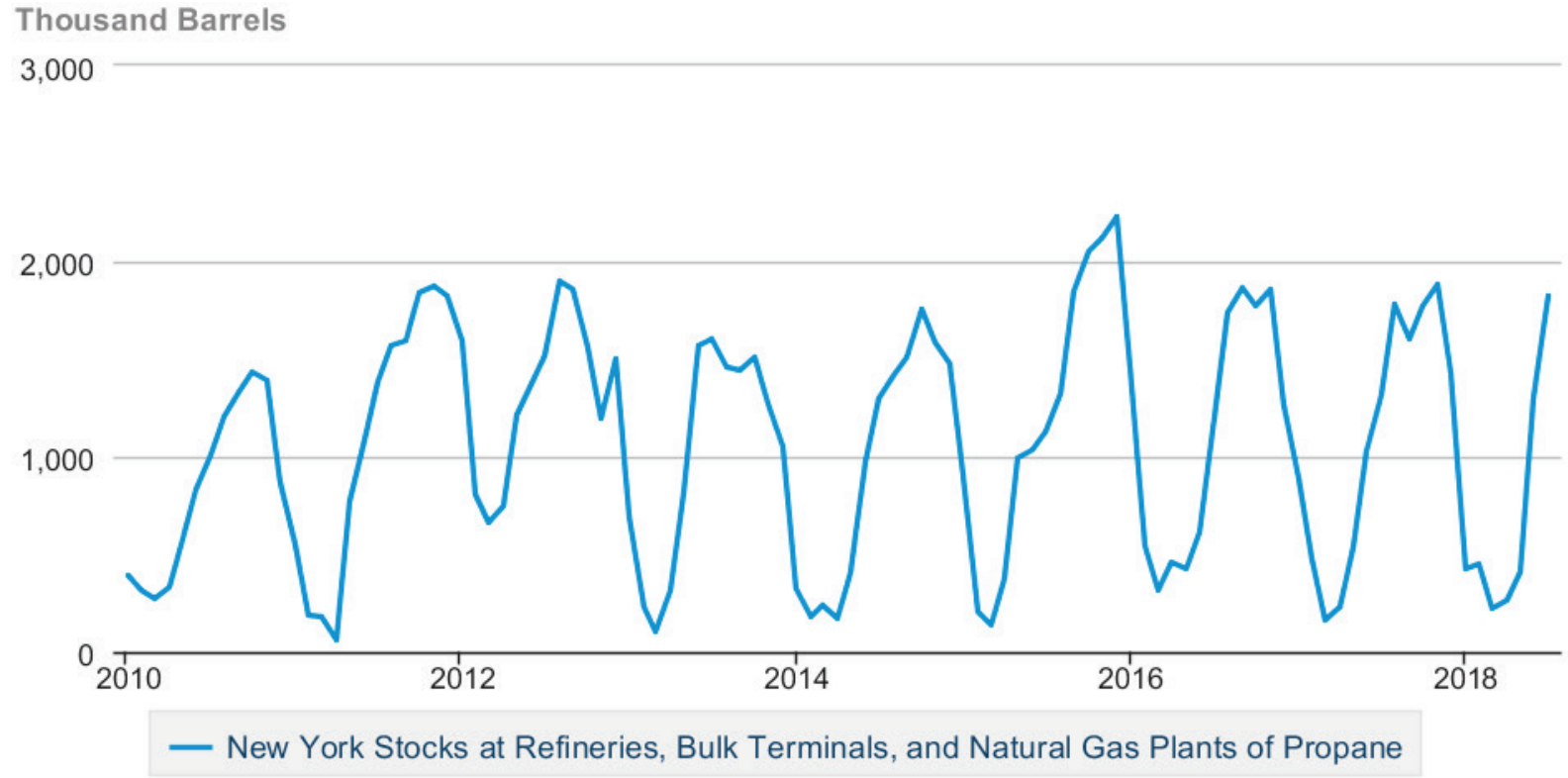
Source: EIA, Bloomberg, data through October 22, 2018; Enterprise Products Partners L.P., Effective Tariffs, FERC No. 54.42.0

New York Propane All Sales/Deliveries by Prime Supplier



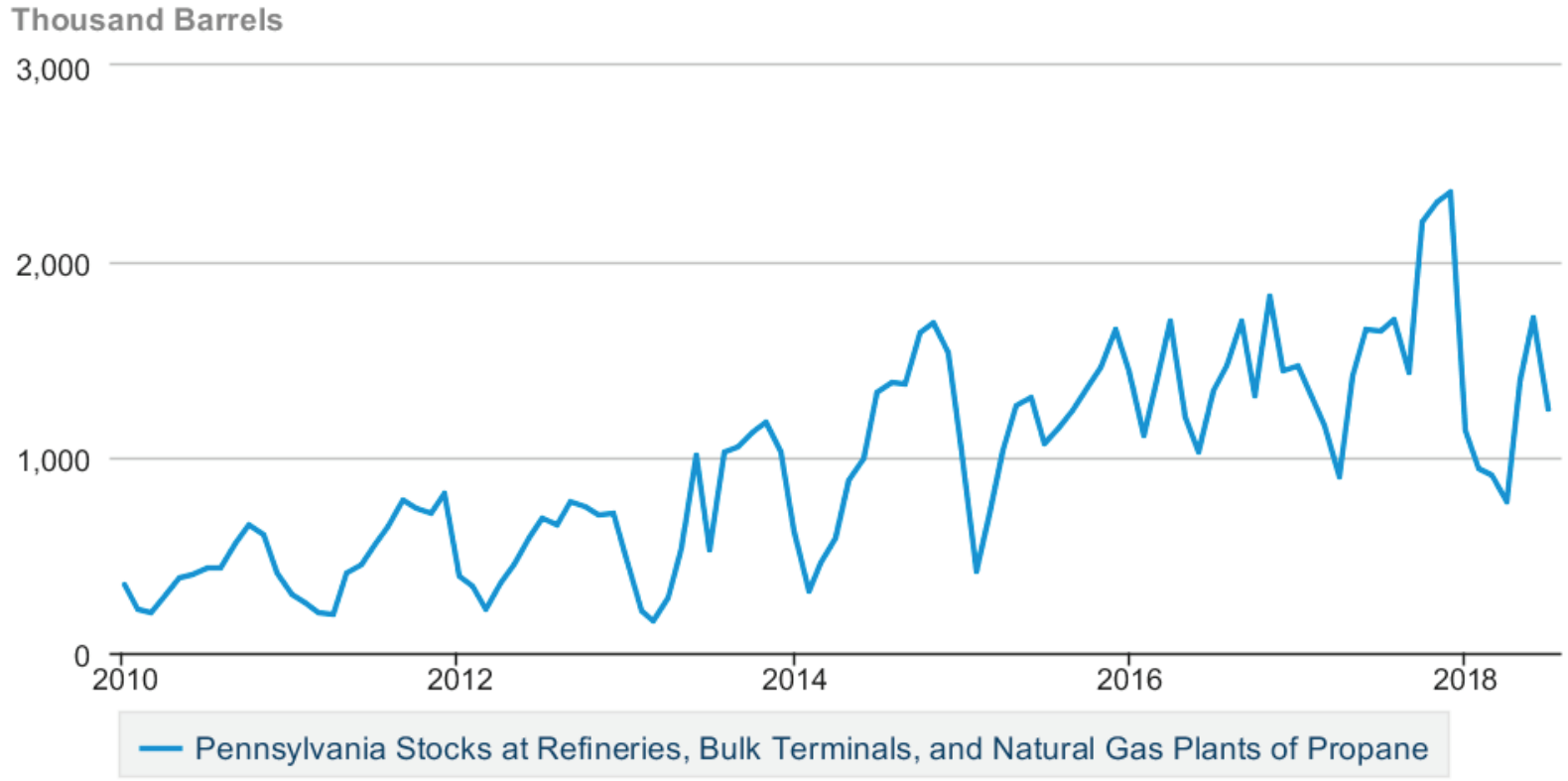
Source: U.S. Energy Information Administration

New York Stocks at Refineries, Bulk Terminals, and Natural Gas Plants of Propane



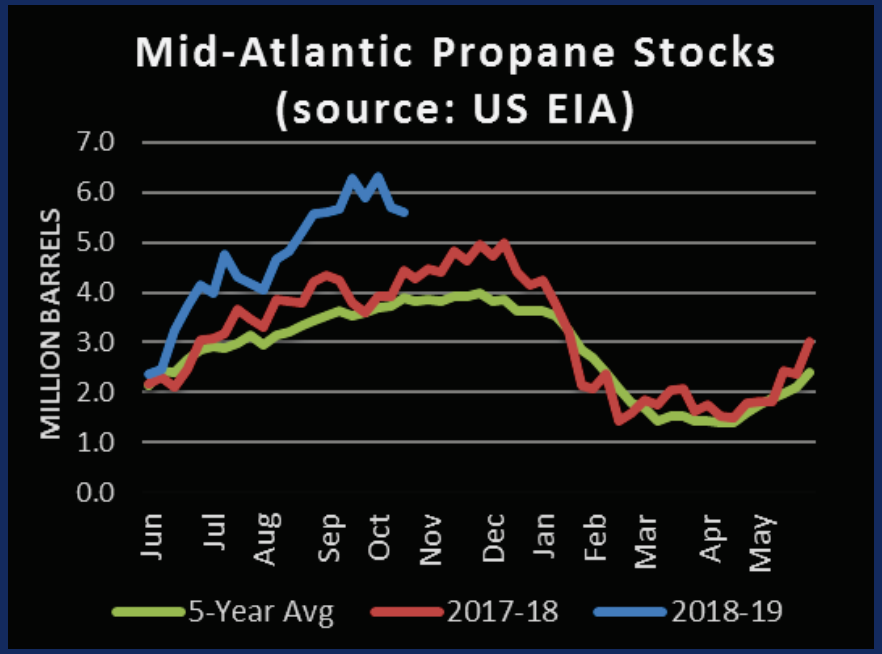
Source: U.S. Energy Information Administration

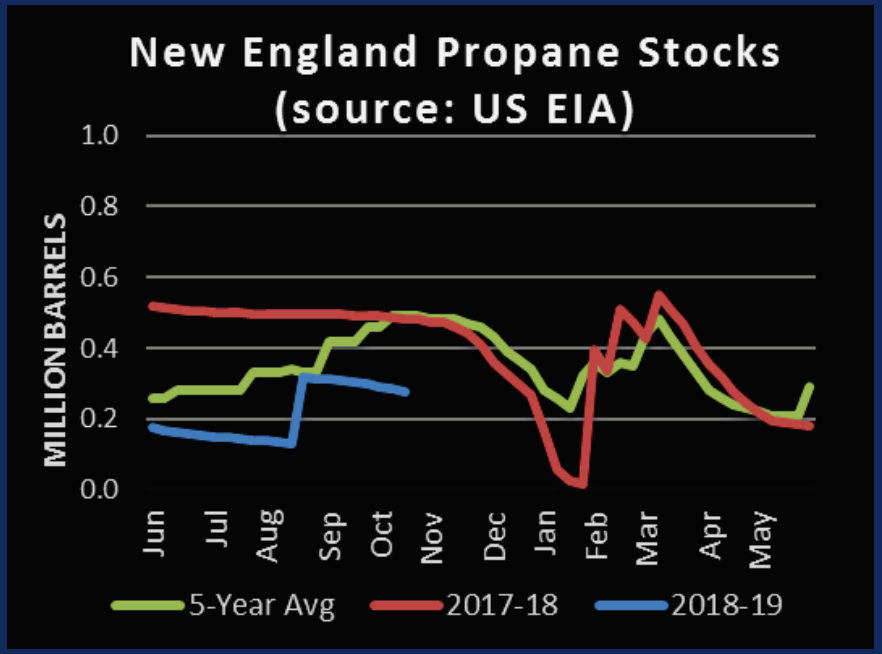
Pennsylvania Stocks at Refineries, Bulk Terminals, and Natural Gas Plants of Propane



Source: U.S. Energy Information Administration

Regional Propane Stocks





- Mid-Atlantic propane stocks are above both the 5-year average and last year's level heading into the winter season.
- Sea-3 terminal in Newington, NH remains operational and is the only remaining open marine propane terminal in New England. A shipment of propane was received in August.

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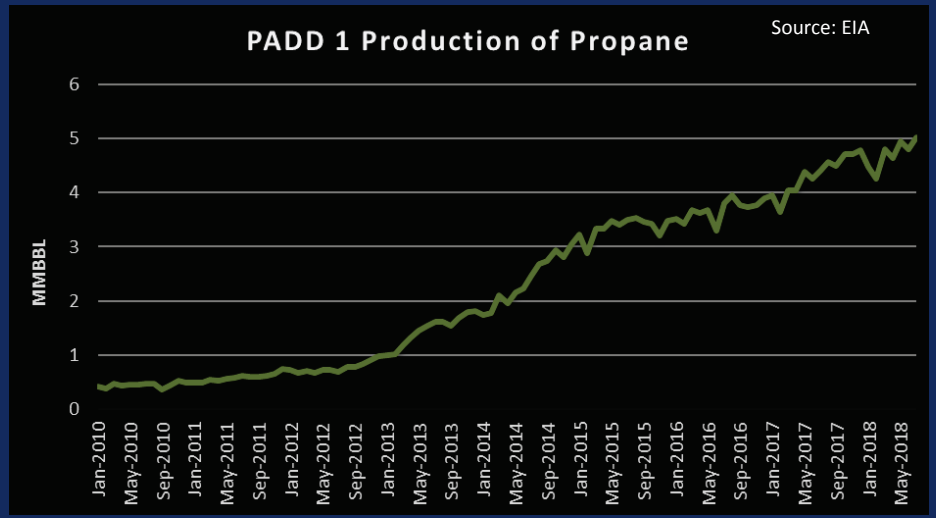
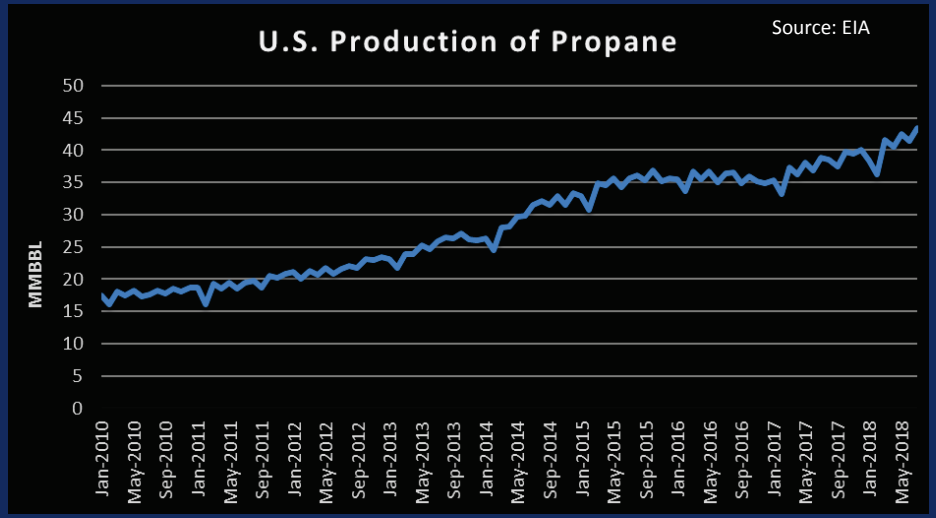
Propane Production





- Since 2010, East Coast propane production has increased by 1,092% while the U.S. propane production has increased by 148%.
- Increased propane production primarily due to increased natural gas production.

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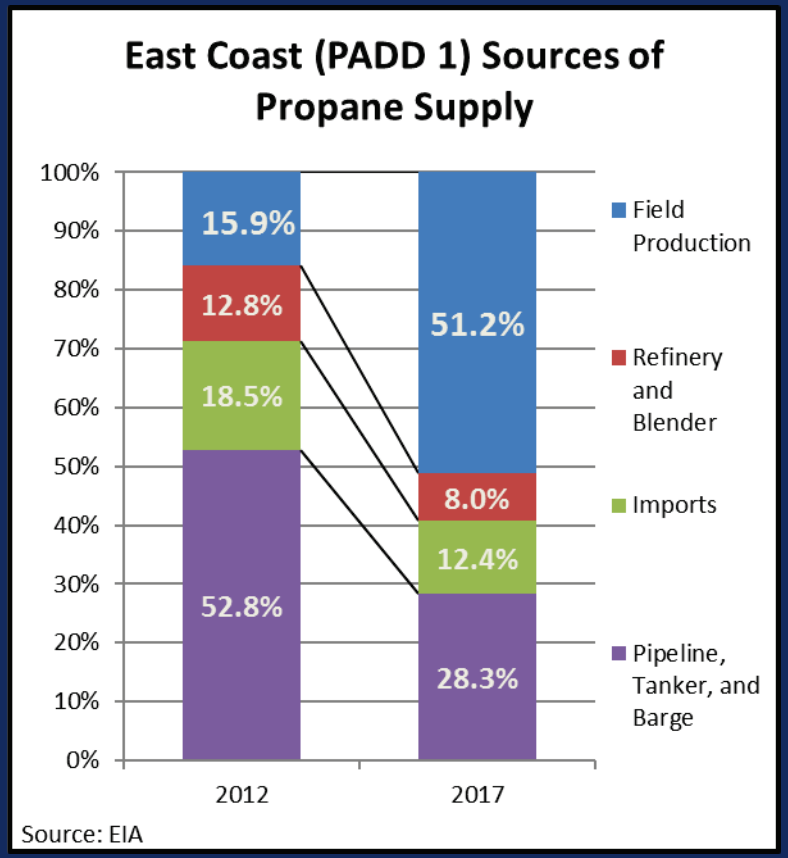
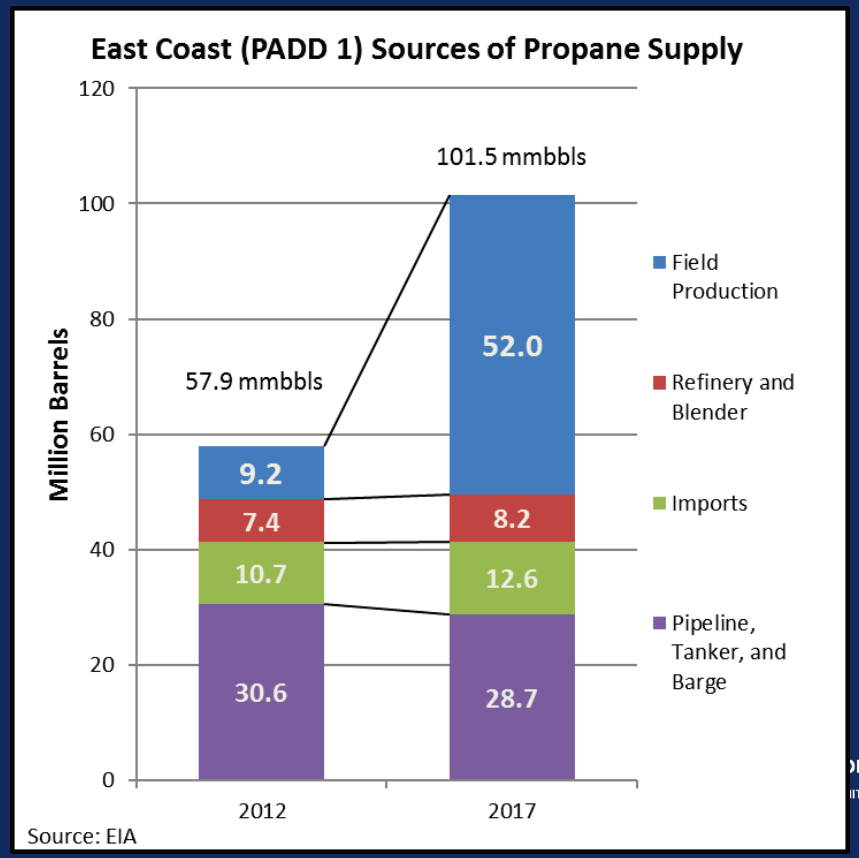
Propane Sources of Supply





Questions and Discussion

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