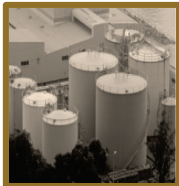


ENERGY LOGISTICS & DISTRIBUTION

Industry In-Sight™

FALL / WINTER 2019



The Voice of the Energy Supply Chain



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All charts in this report are updated to the latest information available at the time of publication. Due to differing reporting dates for various data used throughout the report, all charts are not updated to the same ending period.

INTRODUCTION ... About This Report

We are pleased to offer this periodic report which provides a comprehensive compilation of energy information, insights and data. It aggregates critical planning and forecasting information from a myriad of sources into one resource for energy supply chain analysts and decision-makers.

The energy supply chain is an increasingly complex network of upstream, midstream and downstream providers of construction, equipment, materials and services. As shale gas-oil and renewable energy continue to expand in the U.S., additional infrastructure is needed to connect the new sources to the current network of pipelines, storage and transmission stations. Current and new members of the supply chain will need to expand in order to build and service the additional infrastructure.

We define the Energy Logistics & Distribution Industry as any energy production, transportation and storage activities that take place from the well-head to the refinery or gas processing plant through delivery to the end user. Industry members include: producers and distributors of oil and natural gas, natural gas liquids, refined fuels and propane; energy storage and pipeline operators; oil and gas field services; producers and distributors of lubricants, oils, greases and fluids; service contractors, capital equipment manufacturers; materials suppliers; as well as logistics, transportation and maintenance providers.

Segments covered in this Industry In-Sight™ include:

- Crude oil and refined products, natural gas, liquefied natural gas (LNG), natural gas liquids including propane and heating/fuel oil, as well as drilling activity.
- Renewables, including solar, wind, hydropower and ethanol.
- Logistics, including storage and terminals, pipelines, trucking, shipping and rail.
- Economic and financial data pertinent to the Energy Logistics & Distribution Industry.

It is our intention that this publication will provide value in the following areas:

- **Aggregate Information** – The Data Center provides comprehensive statistics on the Energy Logistics & Distribution Industry including, among others: prices (domestic and international), production, consumption, inventory, imports/exports, LNG terminals, drilling activity, solar and wind capacities, energy consumption by sector and source, tank and underground storage capacities and utilization, pipeline mileage and trucking conditions. In all, the report offers more than 70 individual charts covering these topics and more. All charts in this report are updated to the latest information available at the time of publication.
- **Input to Business Decisions** – As a relevant and informative reference for use when contemplating decisions that will have a meaningful impact on your business. Accordingly, we welcome any input, feedback and suggestions to help us include meaningful and timely topical content in future publications. We especially would like to receive suggestions for ideas on Hot Topics in the Energy Logistics & Distribution Industry.
- **Identification of Opportunities** – The breadth of information provided will enable owners and operators of energy logistics businesses to track developments in energy segments outside of their day-to-day focus.
- **Public and Transaction Comparables by Segment** – This section provides the tracking of a cross-section of publicly-traded companies and transactions in various segments of the Energy Logistics & Distribution Industry. The data include operating metrics, such as revenues and EBITDA (earnings before interest, taxes, depreciation and amortization); and valuation analyses such as total enterprise value / latest twelve months revenues and total enterprise value / latest twelve months EBITDA.

Thank you for taking the time to review this Energy Logistics & Distribution Industry In-Sight™. Our goal is to provide the most comprehensive and beneficial information possible. Please forward your feedback and suggestions to any member of the Jordan Knauff & Company or Energy Equipment and Infrastructure Alliance team members listed on the last two pages of this report.

INTRODUCTION

Who is the Energy Equipment & Infrastructure Alliance (EEIA)?

EEIA ... The Voice of the Energy Supply Chain

The energy supply chain is over 120,000 companies in sixty industries, annually contributing more than \$170 billion to the U.S. economy, with hundreds of thousands of workers in communities throughout every state of the union. They provide construction, well services, capital equipment, supplies, logistics, professional services and technology in support of energy operations. They build energy infrastructure including production sites, transmission infrastructure, pipelines, storage facilities, processing plants and export terminals.

The shale energy revolution is transforming prosperity, security and quality of life in America. In a few short years, it has brought rising employment, income and opportunity to workers and businesses of all sizes and in all fifty states, often to communities that until recently have known limited prospects for growth. It has given Americans a cleaner environment, lower energy costs, renewed national competitiveness and energy security.

Creating a supportive public and policymaker environment for this miracle depends on active public engagement by energy supply chain stakeholders -- the non-oil and gas companies where energy-driven jobs and opportunities are greatest.

EEIA is that voice. We mobilize and lead the North American supply chain in pursuit of government policies that support full development of our energy resources, while protecting public health, safety and the environment. We also work for widespread public support for energy development.

The Energy Equipment & Infrastructure Alliance (EEIA) is active on all fronts: federal and state legislative, regulatory, judicial and public opinion. Our strength is based upon the supply chain's enormous fifty-state contributions to jobs, economic growth and community prosperity. We conduct economic research that measures and reports the facts about the energy supply chain's tremendous contributions to the American economy.

We are an organization of leading supply chain companies, trade associations and labor organizations. We are the voices of the businesses and workers of America's energy miracle.



INTRODUCTION

Who is Jordan Knauff & Company (JKC)?

JKC was founded in 2001 to undertake a distinct mission: to assemble and maintain a staff of top-notch investment banking personnel and offer their knowledge and experience to provide the best available investment banking services to middle-market companies, the entrepreneurs that lead them and the financial entities that transact with them. JKC has been active within the Energy Logistics & Distribution Industry as operators, investors, board members and investment bankers prior to the firm's founding in 2001.

On a combined basis, over the course of their careers our employees have completed over 200 transactions as investors, owners, operators, buyers, sellers and investment bankers of middle-market businesses across a variety of industries. The majority of our firm's broad transaction experience has been with private companies owned by one shareholder, a partnership, a family or private equity investors.

Experience has taught us that the owners and executives of middle-market businesses tend to have very different needs and goals in capital transactions from those that are common to capital events related to larger companies. Our personnel apply their considerable expertise to accomplish important goals: delivery of successful outcomes for our clients. Pursuant to that, we direct and manage all aspects of the capital transaction process, assist our clients with the management of important constituents (employees, customers, vendors and lenders), act as a teammate to other important client advisors (legal counsel, accountant, tax advisor) and collaborate with transaction counsel in the negotiations with the parties on the other side of the transaction.

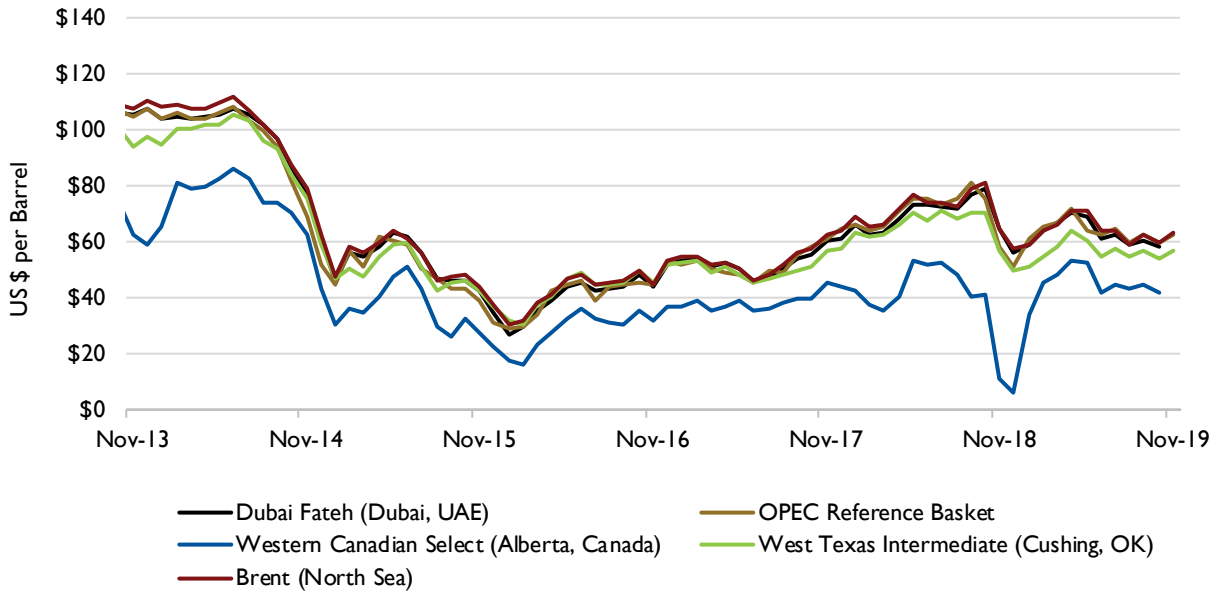
The Services We Provide

- **Sell Companies:** Generate a liquidity event on behalf of the owner(s) through whole, majority, or minority sale of assets, stock or units.
- **Raise Capital:** Representation of companies, management teams and entrepreneurs in the raising of senior debt, mezzanine debt or equity capital. Proceeds may be used for a variety of reasons, including, among others, recapitalizations, funding of growth, funding of acquisitions or liquidity for owners and investors.
- **Acquisition Advisory:** Assistance in sourcing and closing acquisitions -- whether it be a single transaction or a series of acquisitions as part of a consolidation strategy in an Industry Development Project™ (IDP) - a proprietary method for assisting private equity groups, companies or private investors that want to pursue multiple non-auction transactions within a single industry.
- **Strategic Business Services:** A suite of services for middle-market business owners and executives. Comprised of three components – Company Specific Valuation, Capital Road Map® and Strategic Industry Analysis – these services can be packaged together or used on an à la carte basis.

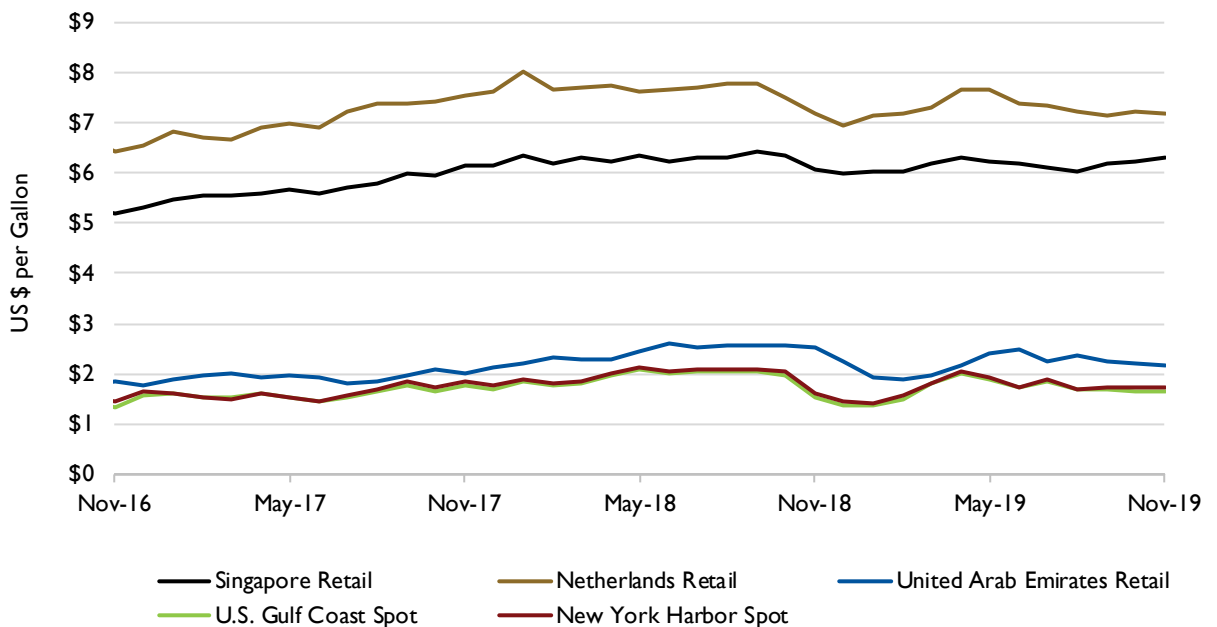
DATA CENTER

OIL

CRUDE OIL PRICES (MONTHLY AVERAGE) (1)



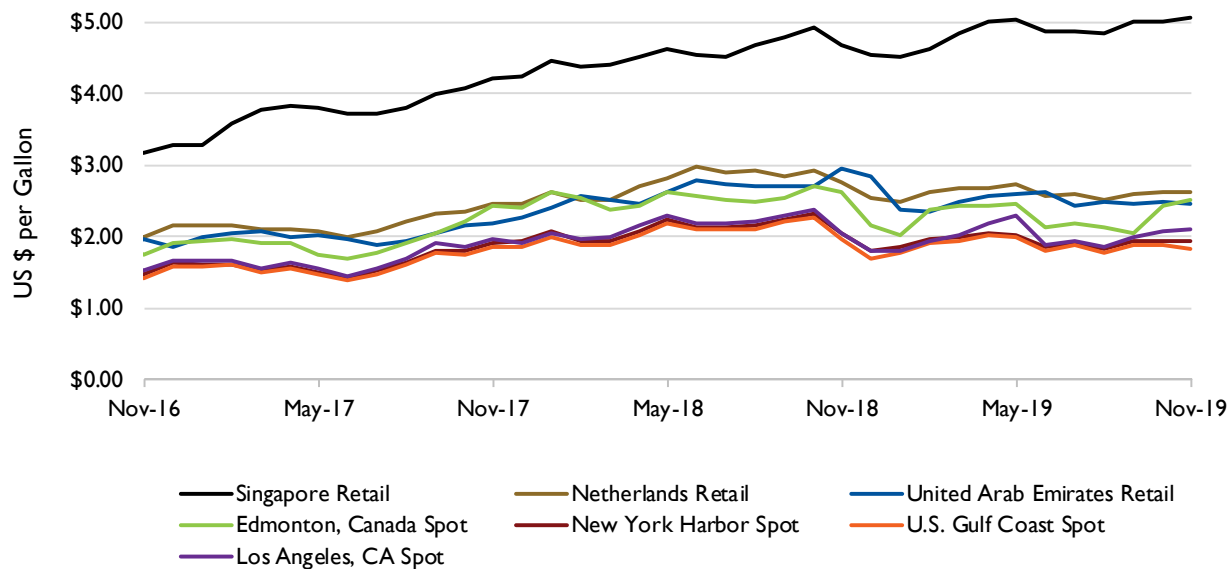
GASOLINE PRICES (MONTHLY AVERAGE) (2)



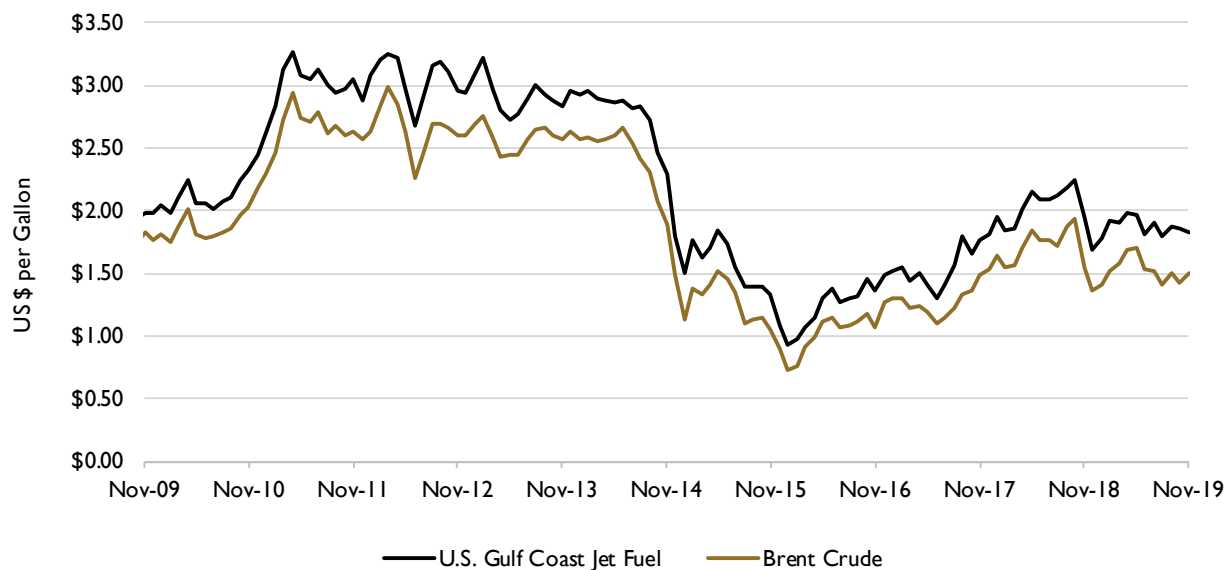
DATA CENTER

OIL

DIESEL PRICES (MONTHLY AVERAGE) ⁽³⁾



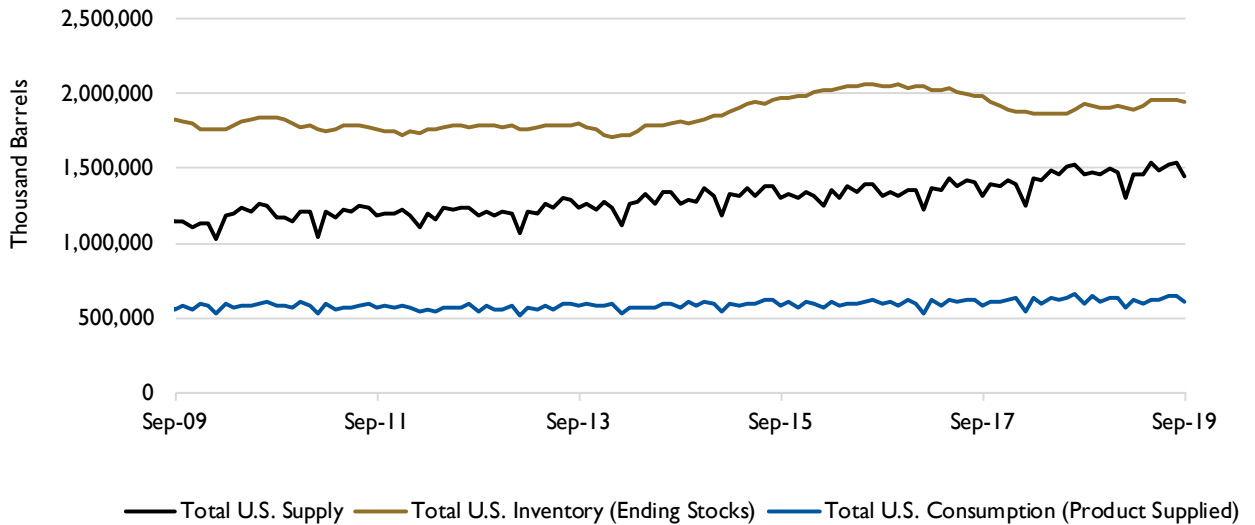
JET FUEL PRICES (MONTHLY AVERAGE) ⁽⁴⁾



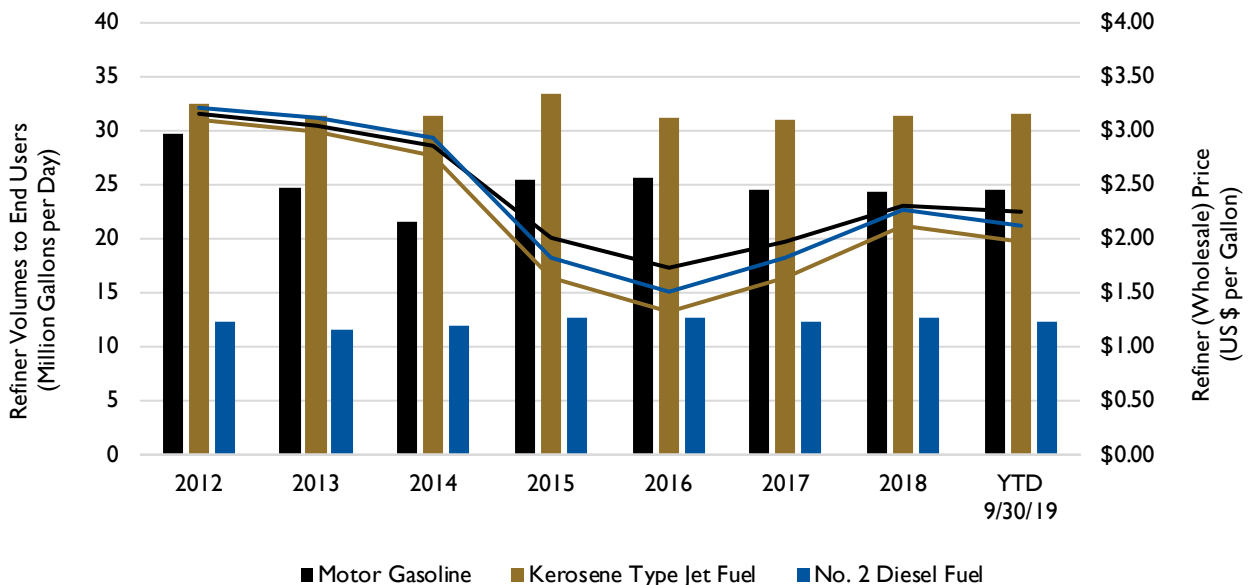
DATA CENTER

OIL

U.S. CRUDE OIL AND PETROLEUM PRODUCTS SUPPLY, INVENTORY AND CONSUMPTION (MONTHLY) ⁽⁵⁾



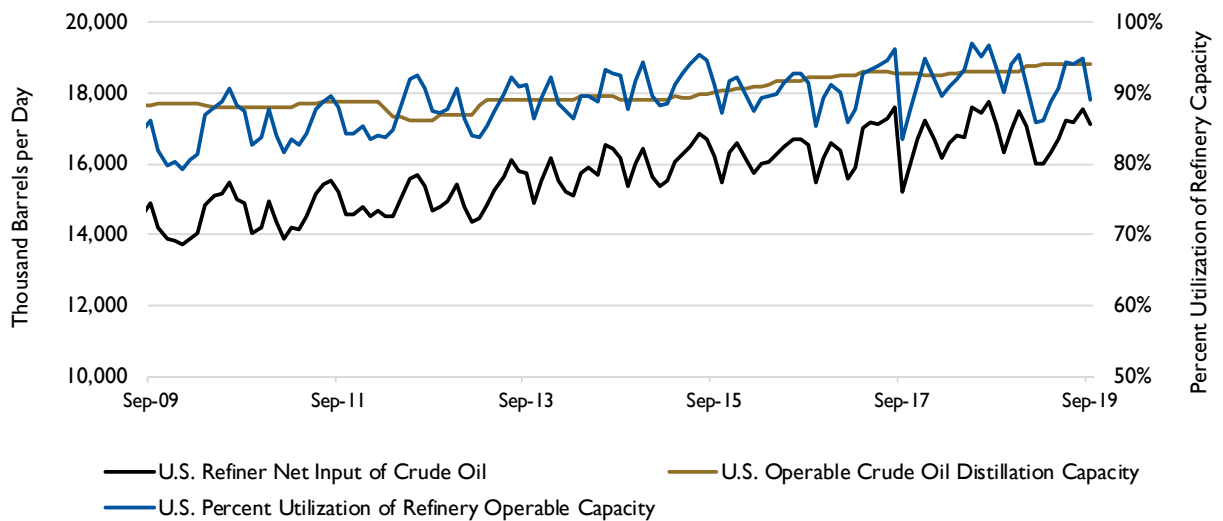
U.S. REFINERY VOLUMES AND WHOLESALE PRICES OF PETROLEUM PRODUCTS (ANNUAL AVERAGE) ⁽⁶⁾



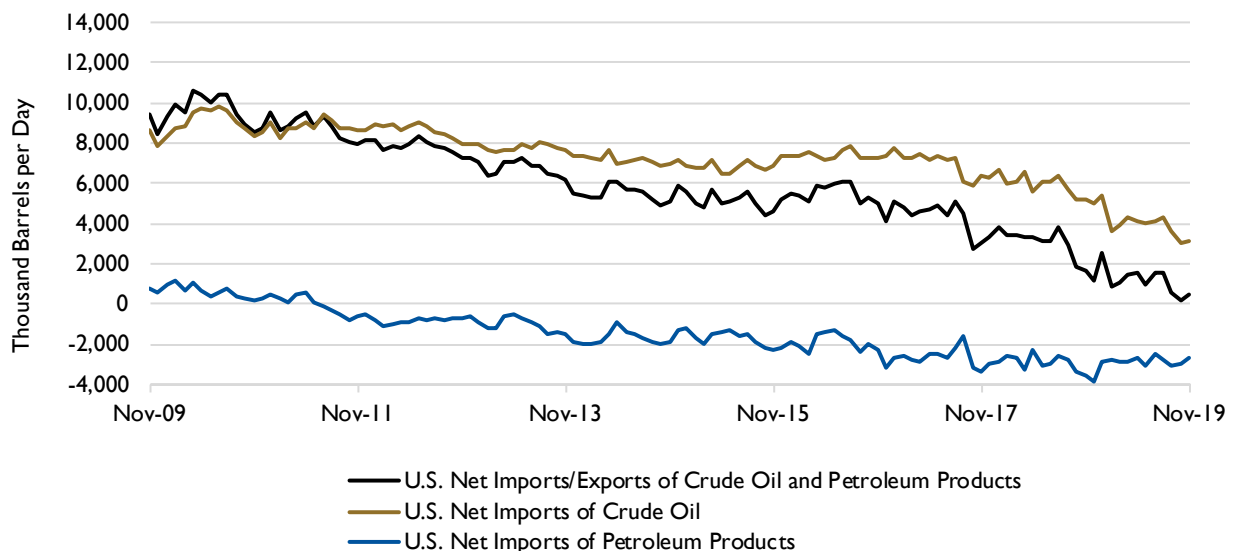
DATA CENTER

OIL

U.S. CRUDE OIL REFINERY INPUT, DISTILLATION CAPACITY AND REFINERY UTILIZATION (MONTHLY AVERAGE) ⁽⁷⁾



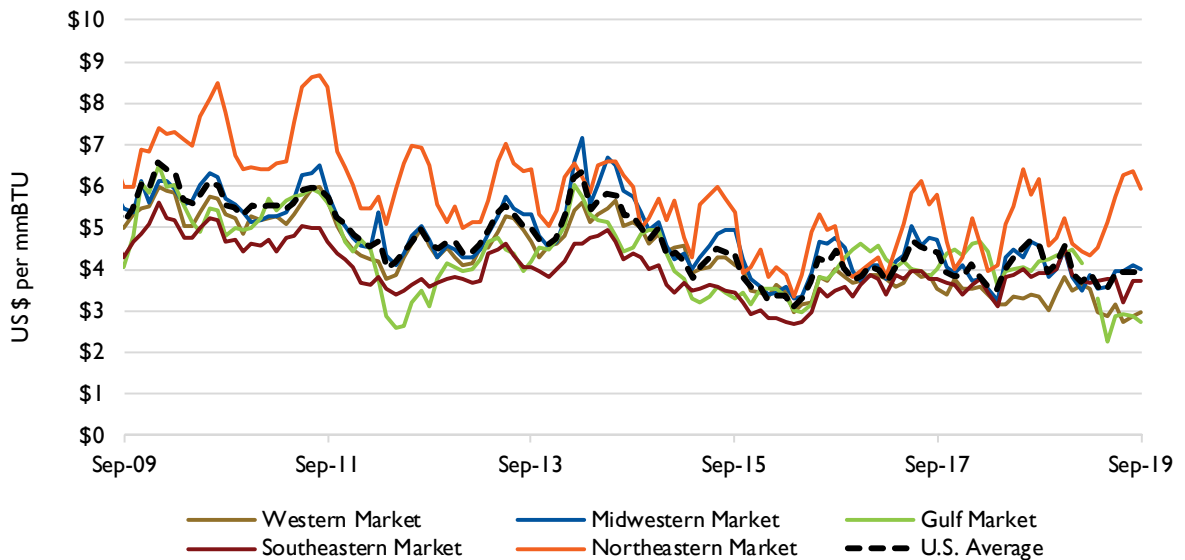
U.S. CRUDE OIL AND PETROLEUM PRODUCTS IMPORTS AND EXPORTS (MONTHLY AVERAGE) ⁽⁸⁾



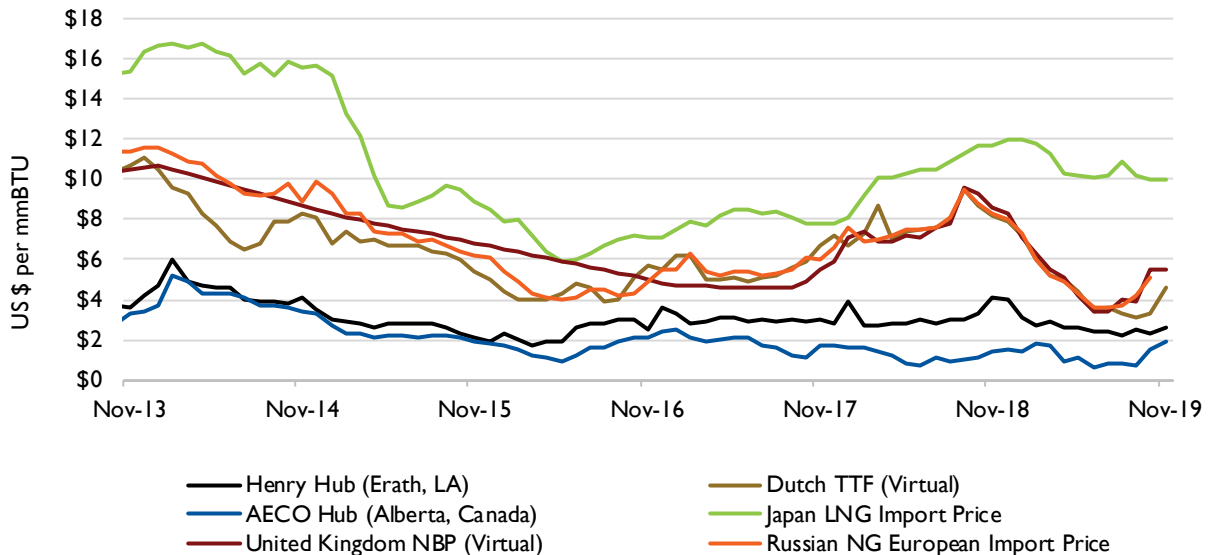
DATA CENTER

NATURAL GAS

DOMESTIC NATURAL GAS CITYGATE PRICES PER REGION (MONTHLY AVERAGE) (9)



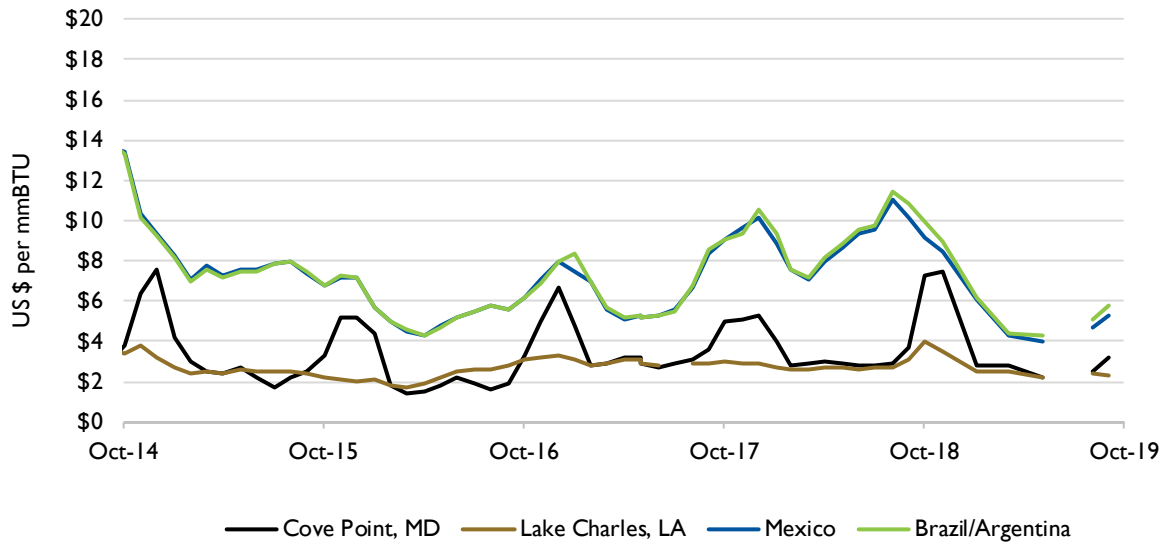
INTERNATIONAL NATURAL GAS PRICES (MONTHLY AVERAGE) (10)



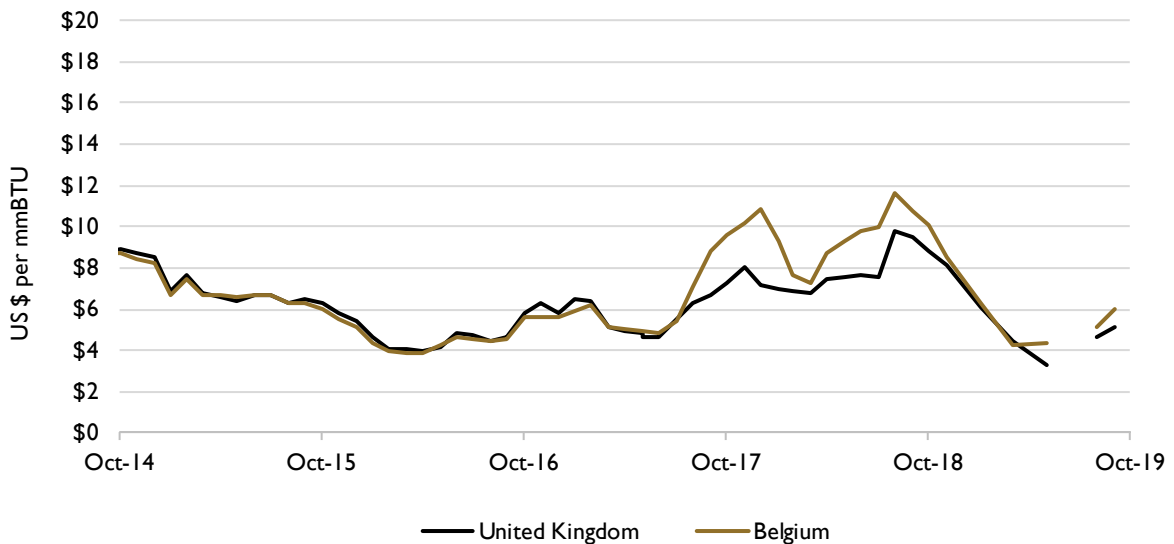
DATA CENTER

NATURAL GAS

AMERICAS LIQUEFIED NATURAL GAS PRICES (MONTHLY AVERAGE) (11)



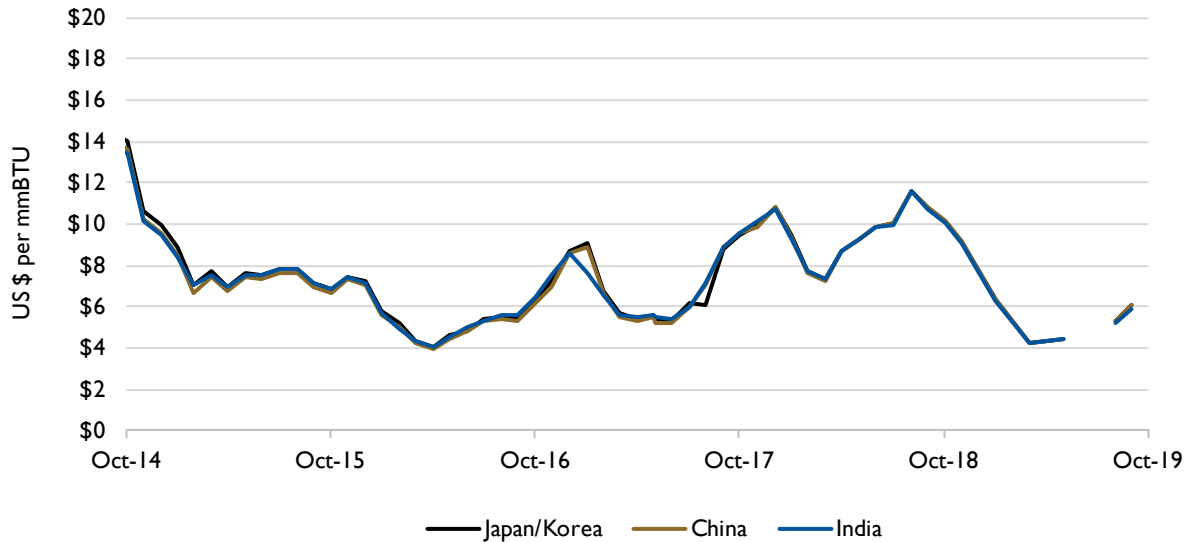
WESTERN EUROPE LIQUEFIED NATURAL GAS PRICES (MONTHLY AVERAGE) (12)



DATA CENTER

NATURAL GAS

ASIA LIQUEFIED NATURAL GAS PRICES (MONTHLY AVERAGE) (13)



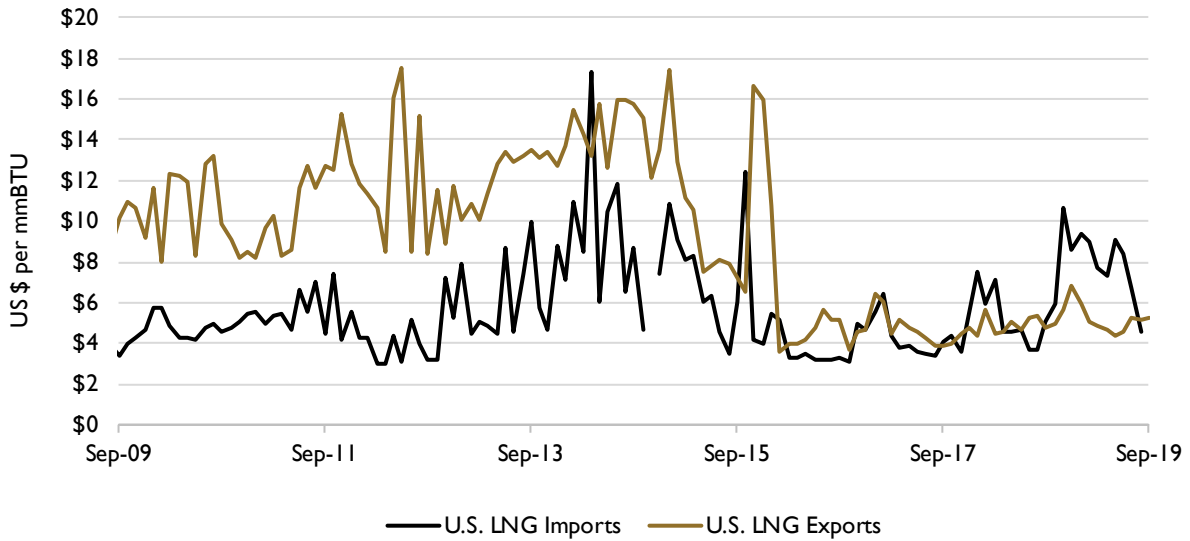
WORLD LIQUEFIED NATURAL GAS PRICES MAP (MONTHLY AVERAGE) (14)



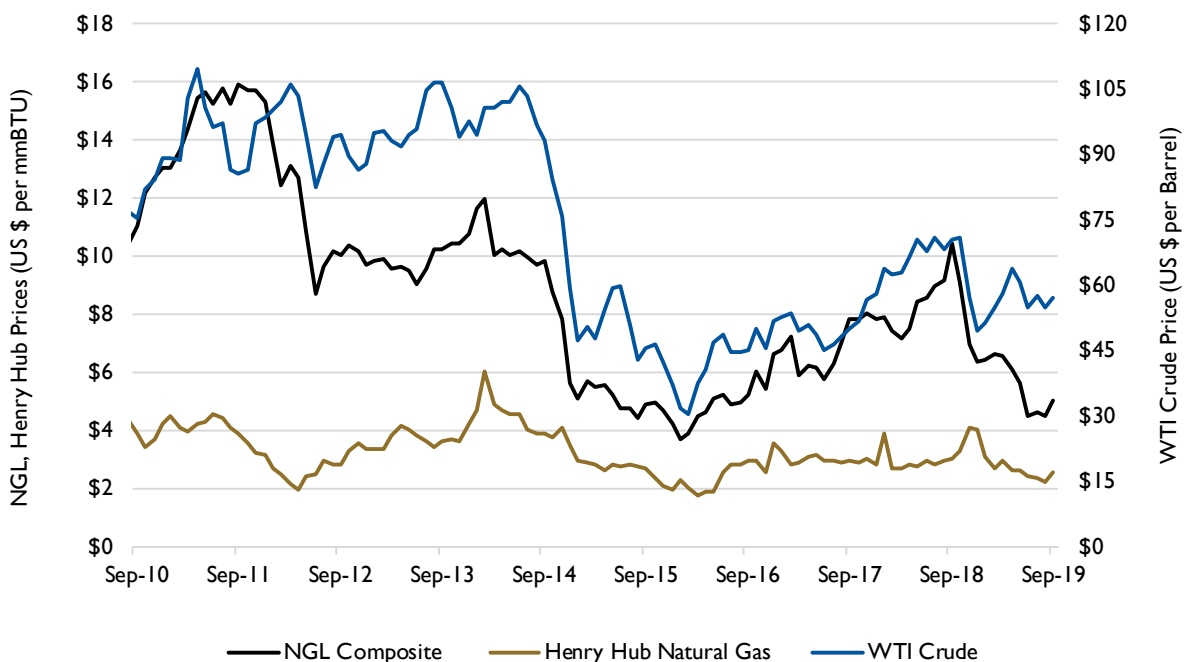
DATA CENTER

NATURAL GAS

U.S. IMPORT / EXPORT LIQUEFIED NATURAL GAS PRICES (MONTHLY AVERAGE) ⁽¹⁵⁾



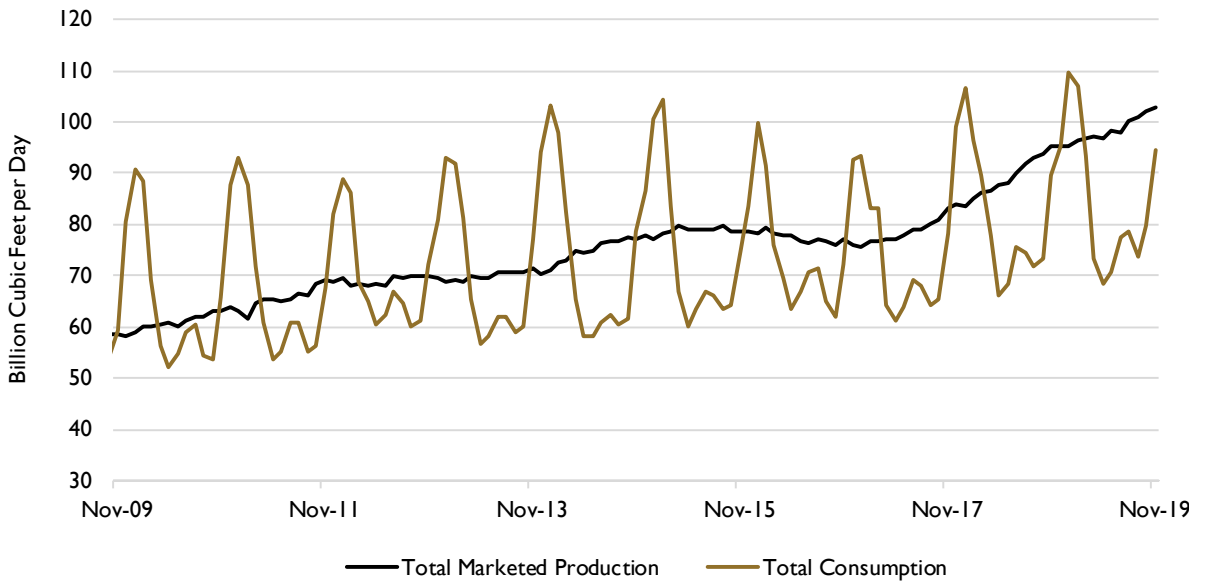
NATURAL GAS PLANT LIQUIDS PRICES (MONTHLY AVERAGE) ⁽¹⁶⁾



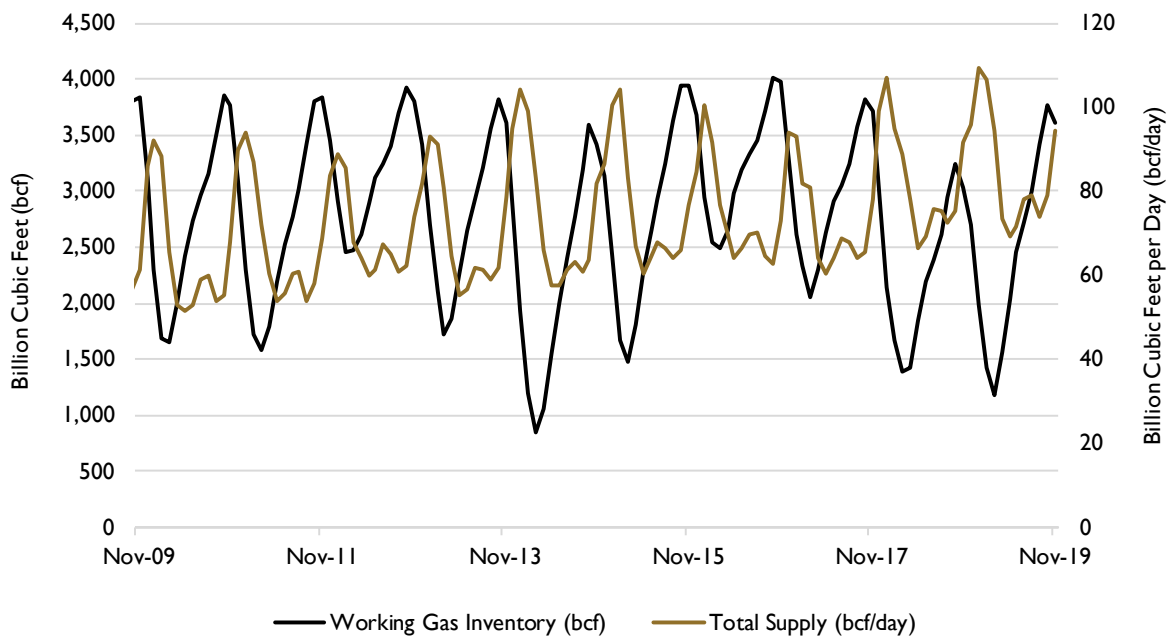
DATA CENTER

NATURAL GAS

U.S. NATURAL GAS PRODUCTION AND CONSUMPTION (MONTHLY) (17)



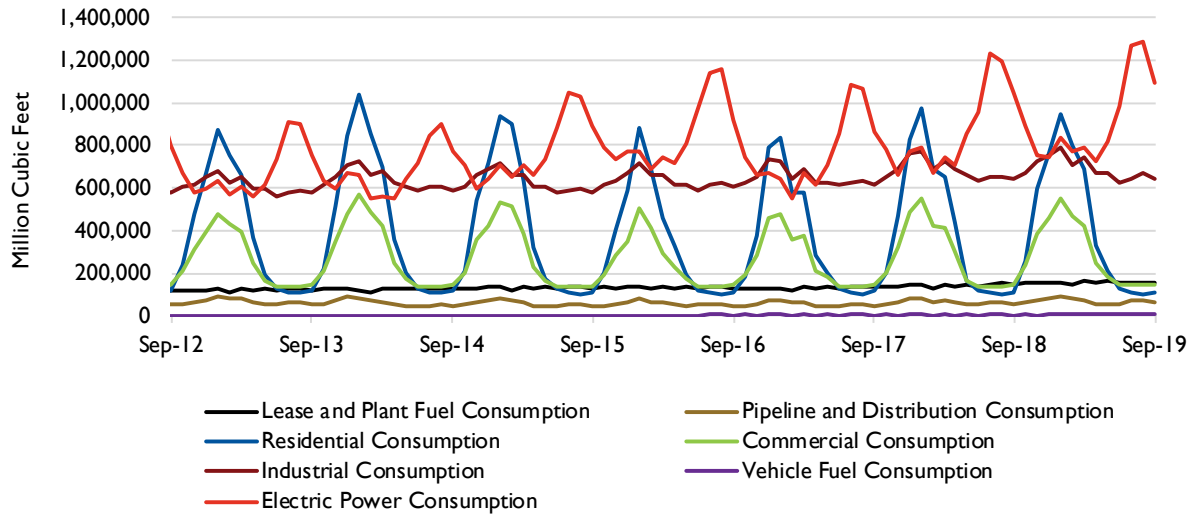
U.S. NATURAL GAS SUPPLY AND INVENTORY (MONTHLY) (18)



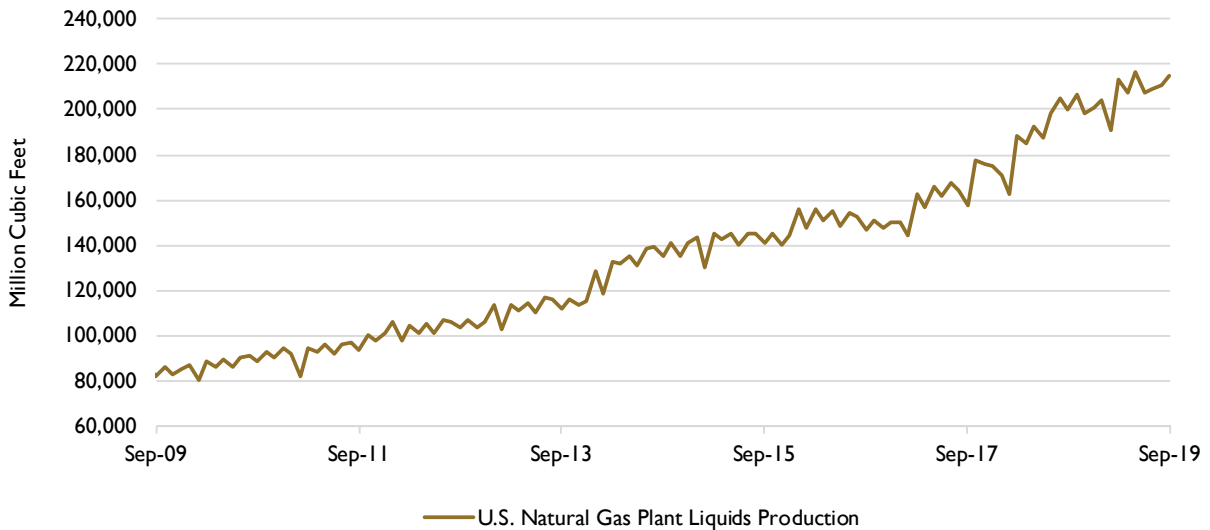
DATA CENTER

NATURAL GAS

U.S. NATURAL GAS CONSUMPTION BY END USE (MONTHLY) (19)



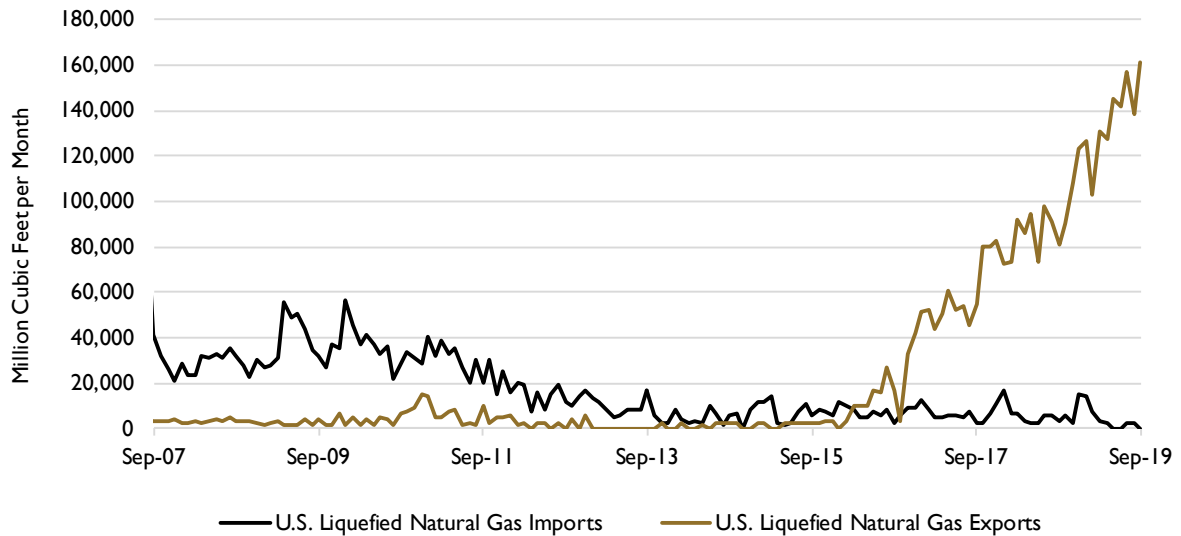
U.S. NATURAL GAS PLANT LIQUIDS PRODUCTION (MONTHLY) (20)



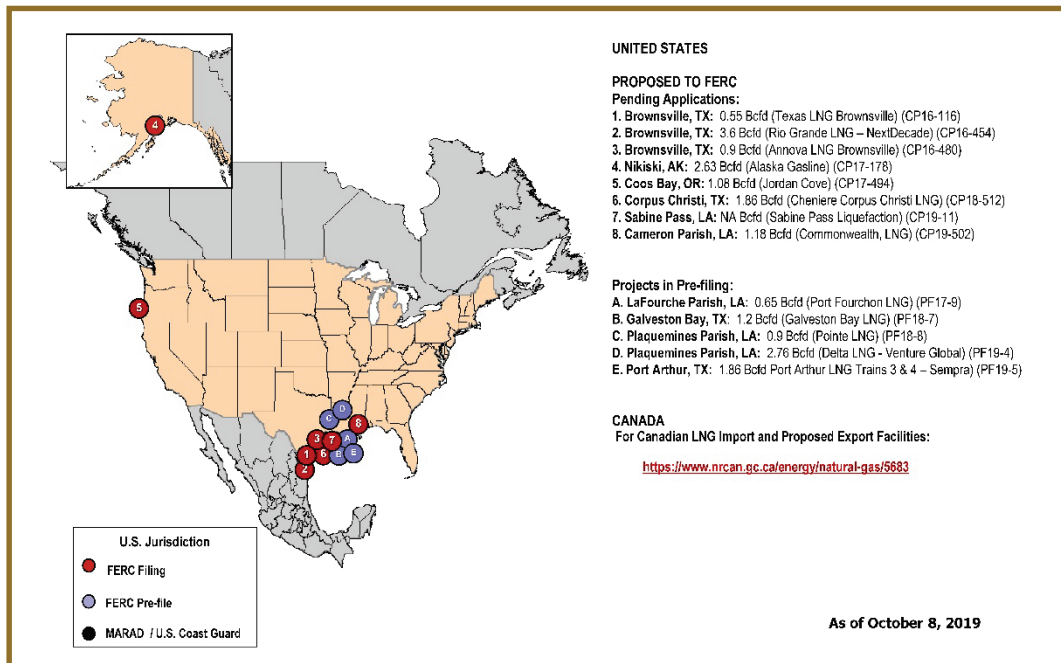
DATA CENTER

NATURAL GAS

U.S. LIQUEFIED NATURAL GAS IMPORT AND EXPORT VOLUMES (MONTHLY) ⁽²¹⁾



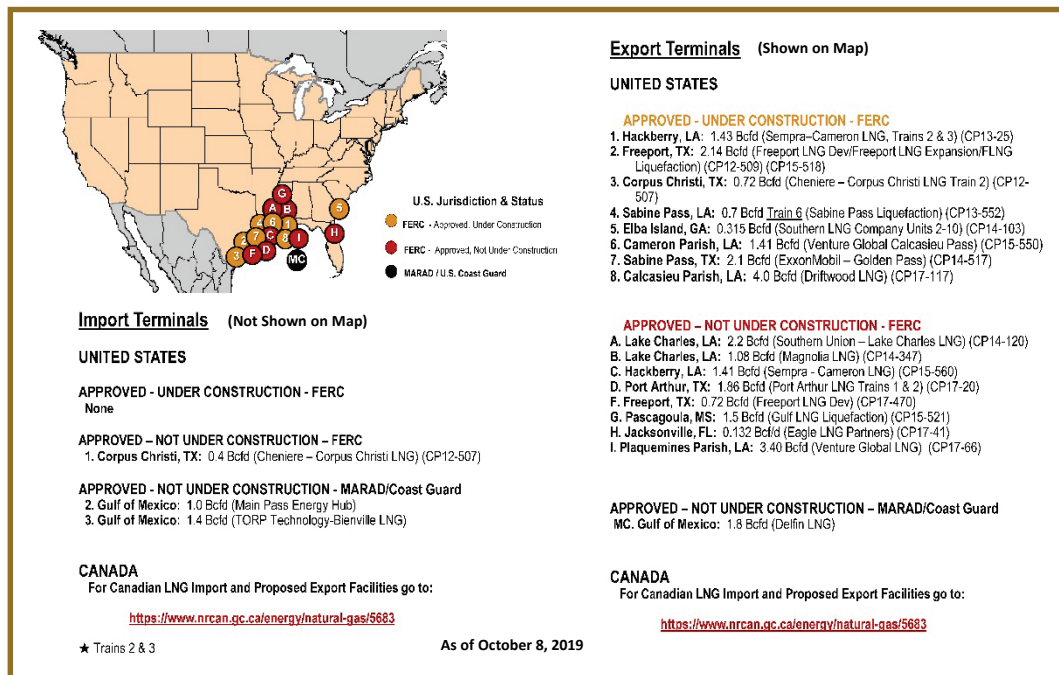
NORTH AMERICAN LNG EXPORT TERMINALS — PROPOSED ⁽²²⁾



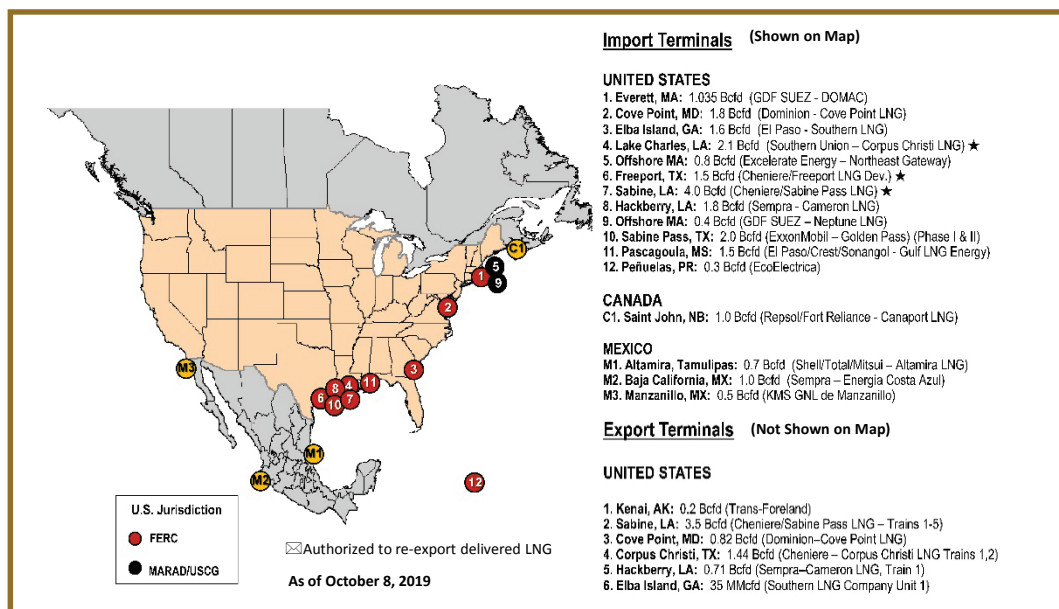
DATA CENTER

NATURAL GAS

NORTH AMERICAN LNG IMPORT/EXPORT TERMINALS — *APPROVED* (23)



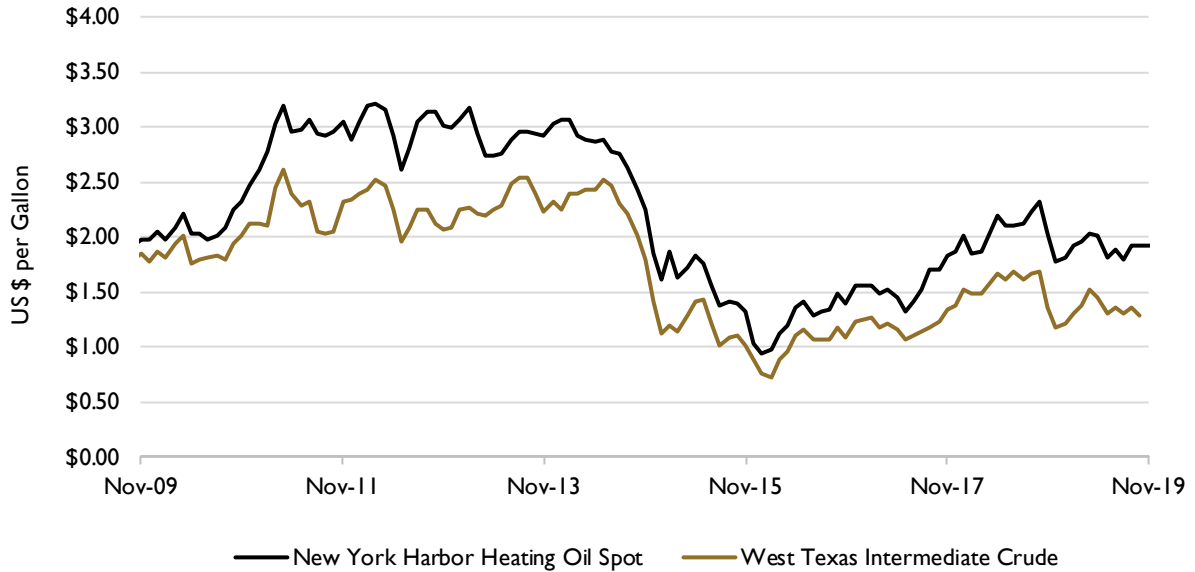
NORTH AMERICAN LNG IMPORT/EXPORT TERMINALS — *EXISTING* (24)



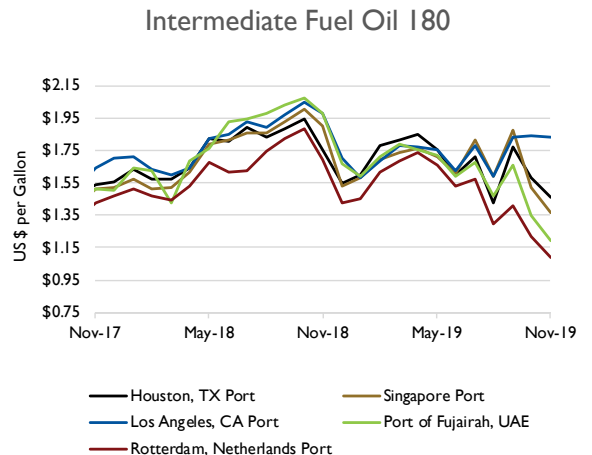
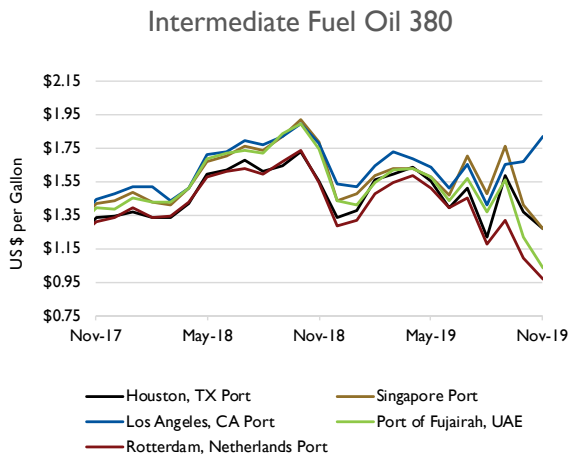
DATA CENTER

PROPANE AND HEATING/FUEL OIL

HEATING OIL PRICES (MONTHLY AVERAGE) (25)



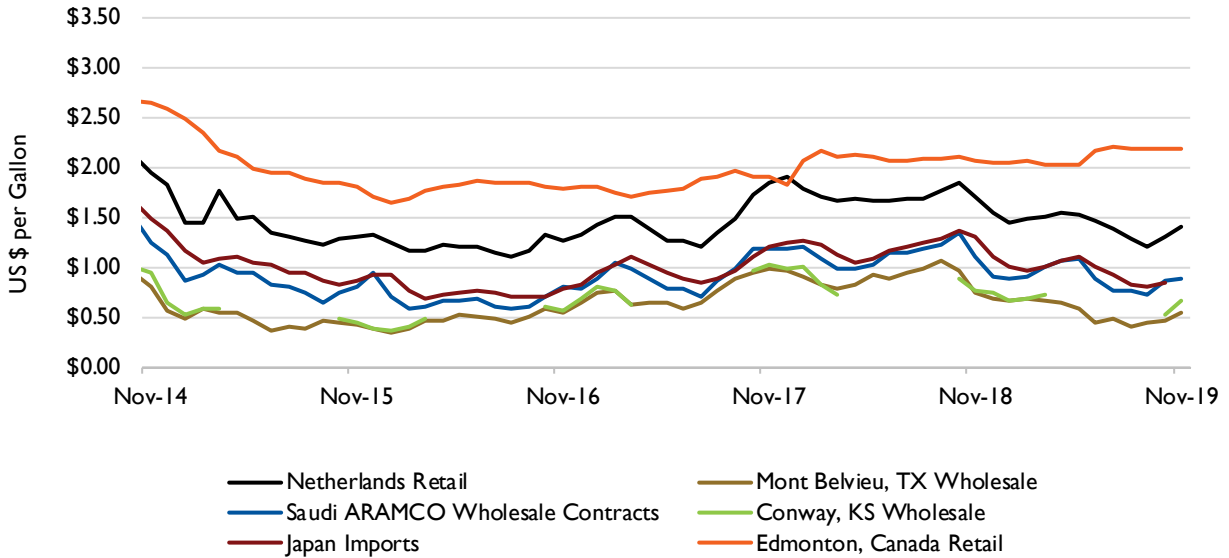
INTERMEDIATE FUEL OIL AKA “BUNKER FUEL” PRICES (MONTHLY AVERAGE) (26)



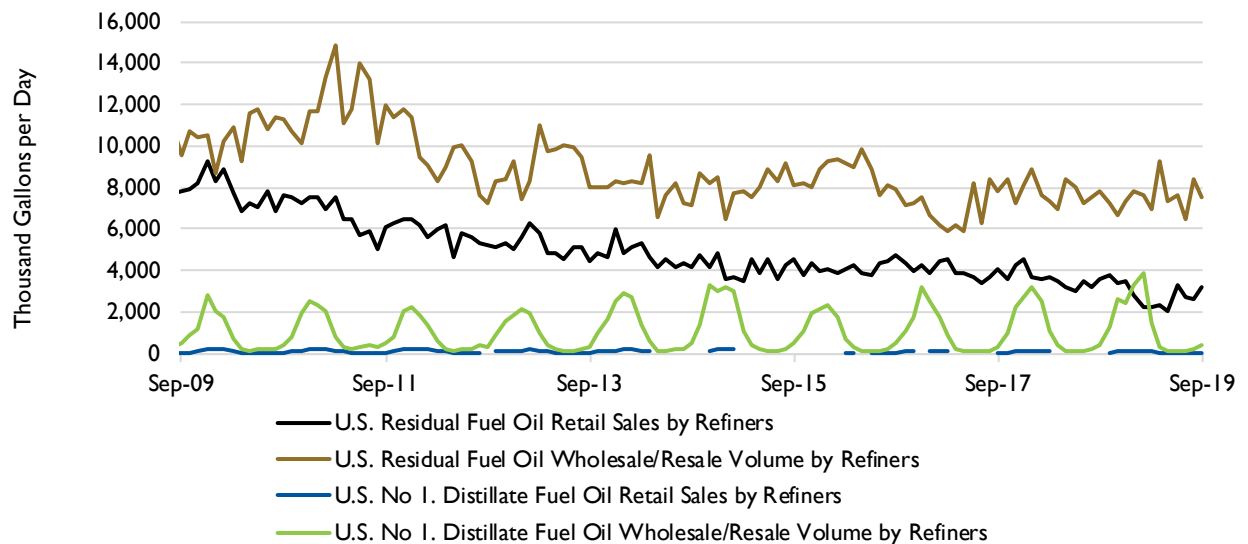
DATA CENTER

PROPANE AND HEATING/FUEL OIL

PROPANE PRICES (MONTHLY AVERAGE) (27)



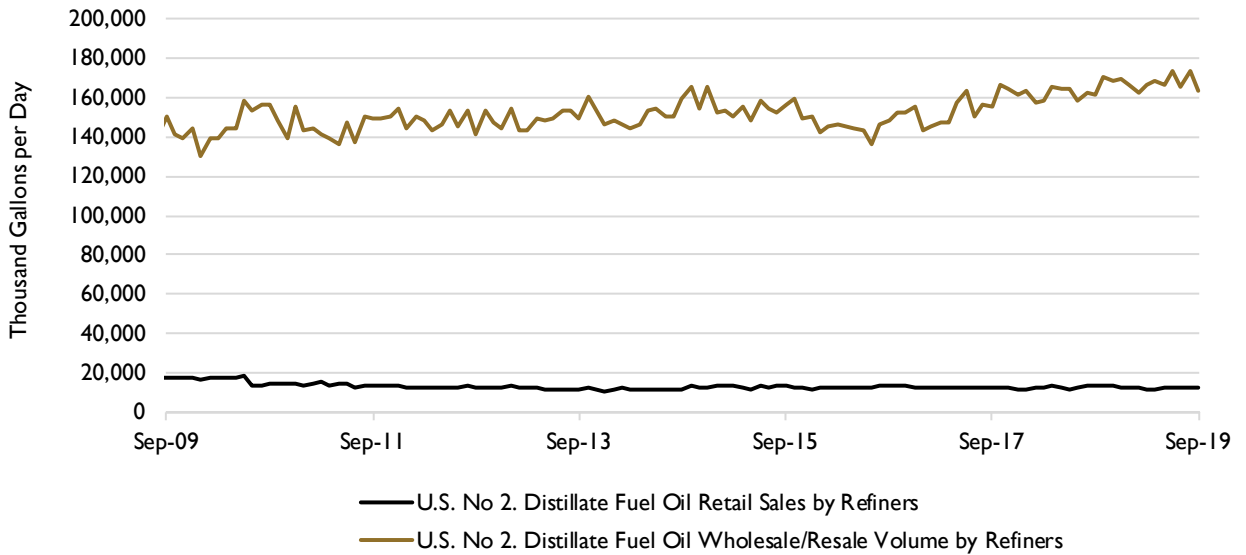
NO. 1 DISTILLATE FUEL OIL, RESIDUAL FUEL OIL WHOLESALE, RETAIL SALES VOLUME BY REFINERS (MONTHLY) (28)



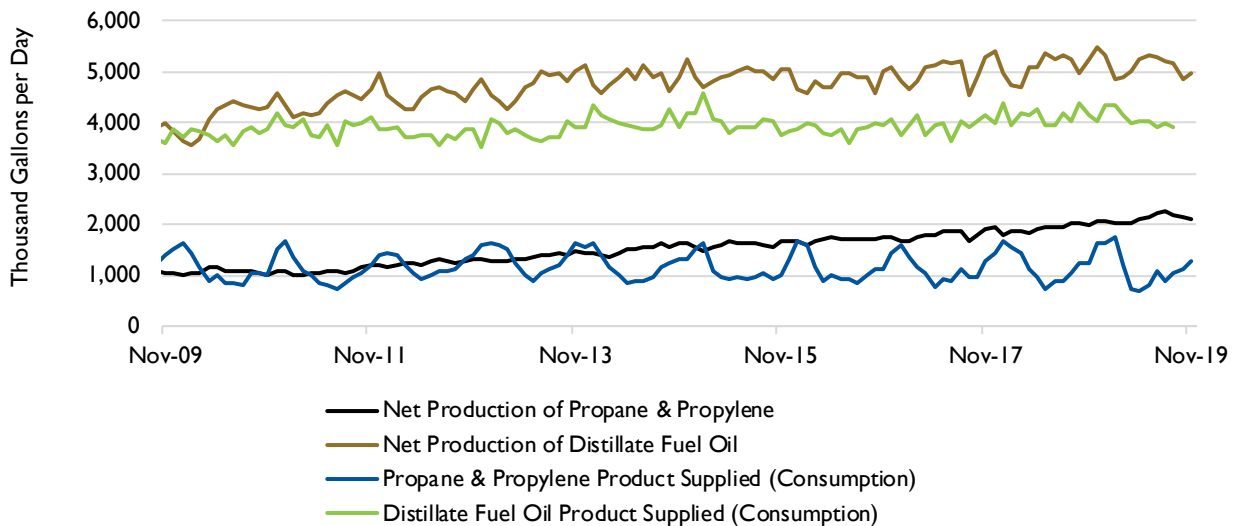
DATA CENTER

PROPANE AND HEATING/FUEL OIL

NO. 2 DISTILLATE FUEL OIL WHOLESALE, RETAIL SALES VOLUME BY REFINERS (MONTHLY) ⁽²⁹⁾



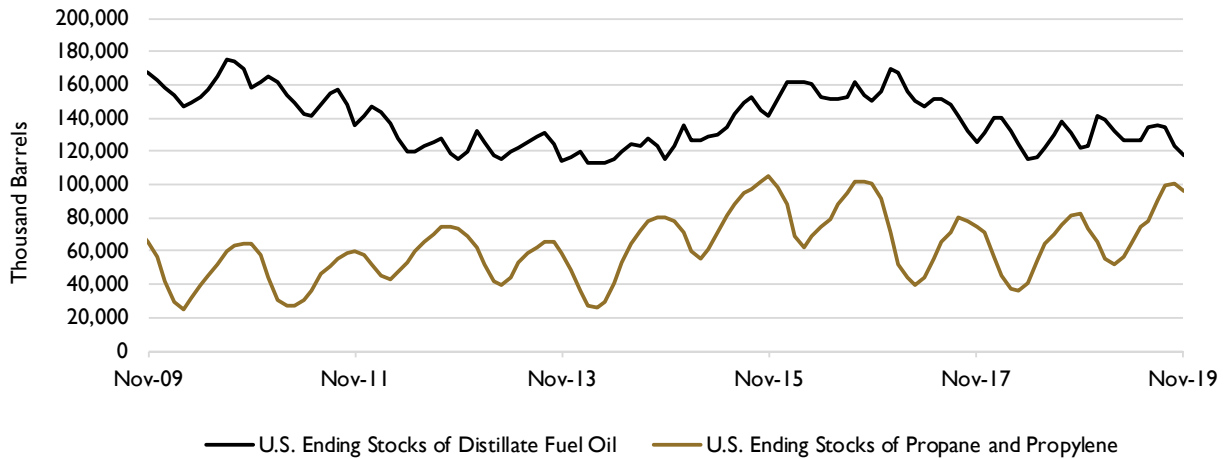
PROPANE & PROPYLENE AND DISTILLATE FUEL OIL PRODUCTION AND CONSUMPTION (MONTHLY) ⁽³⁰⁾



DATA CENTER

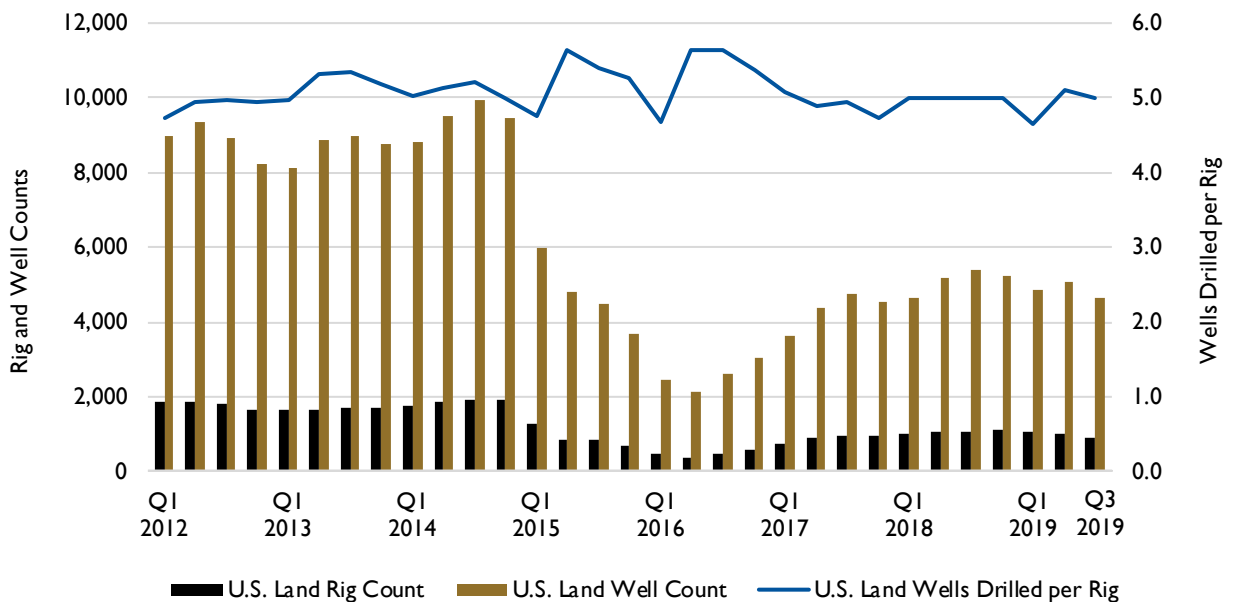
PROPANE AND HEATING/FUEL OIL

U.S. ENDING STOCKS OF PROPANE & PROPYLENE AND DISTILLATE FUEL OIL (MONTHLY AVERAGE) ⁽³¹⁾



DRILLING ACTIVITY

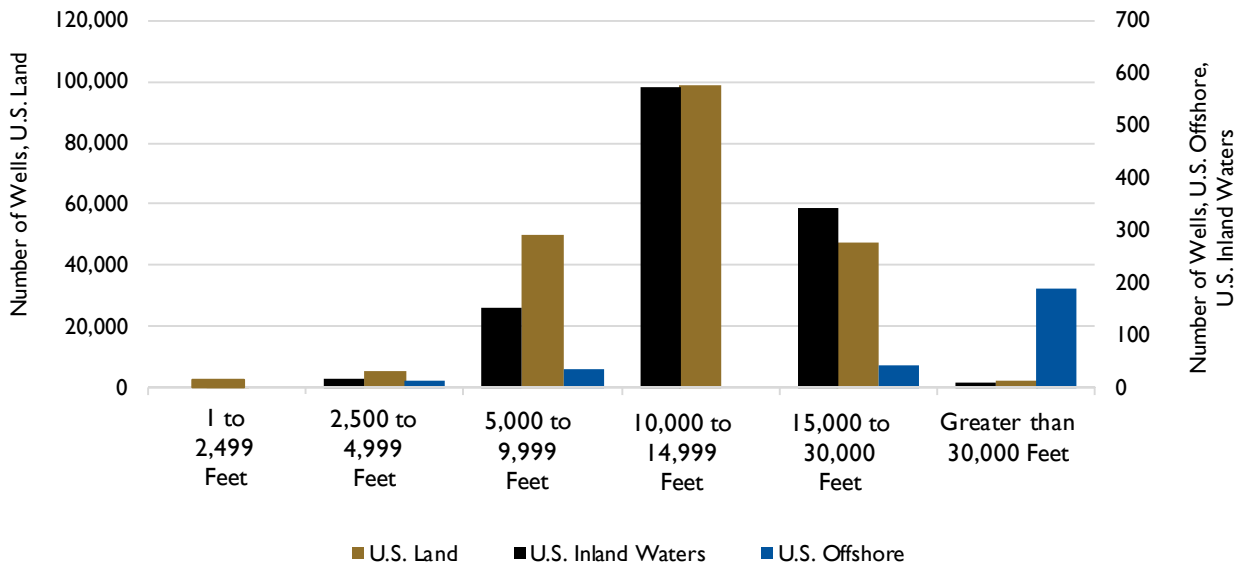
U.S. LAND WELL COUNT, RIG COUNT AND WELLS PER RIG (QUARTERLY) ⁽³²⁾



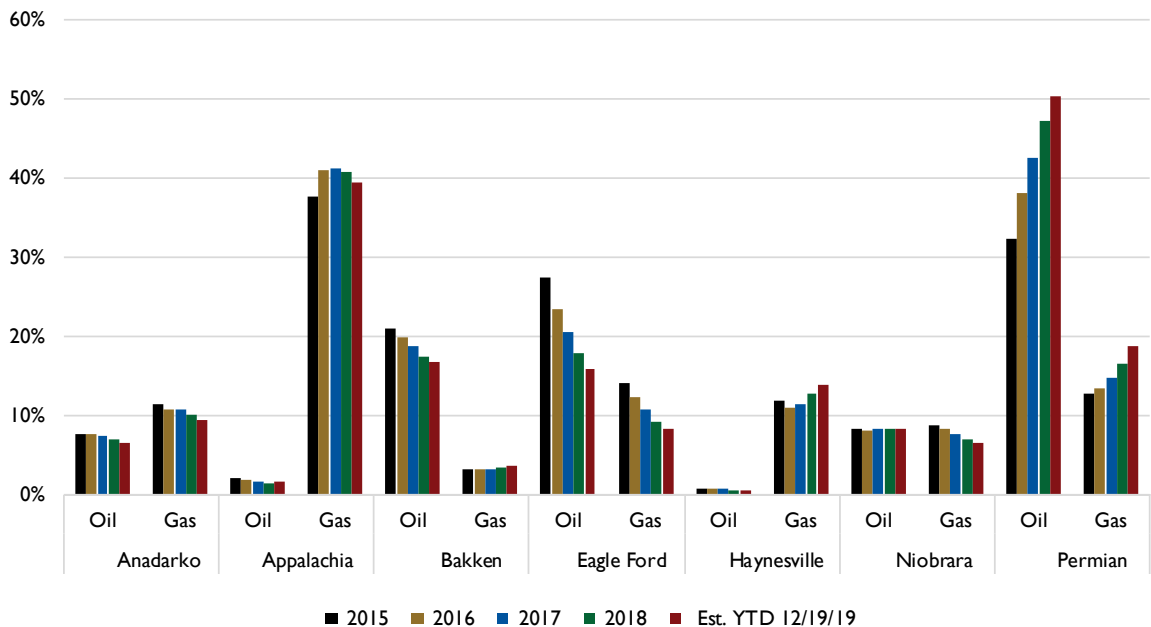
DATA CENTER

DRILLING ACTIVITY

U.S. WELL STARTS BY DEPTH (YEAR TO DATE NOVEMBER 30, 2019) (33)



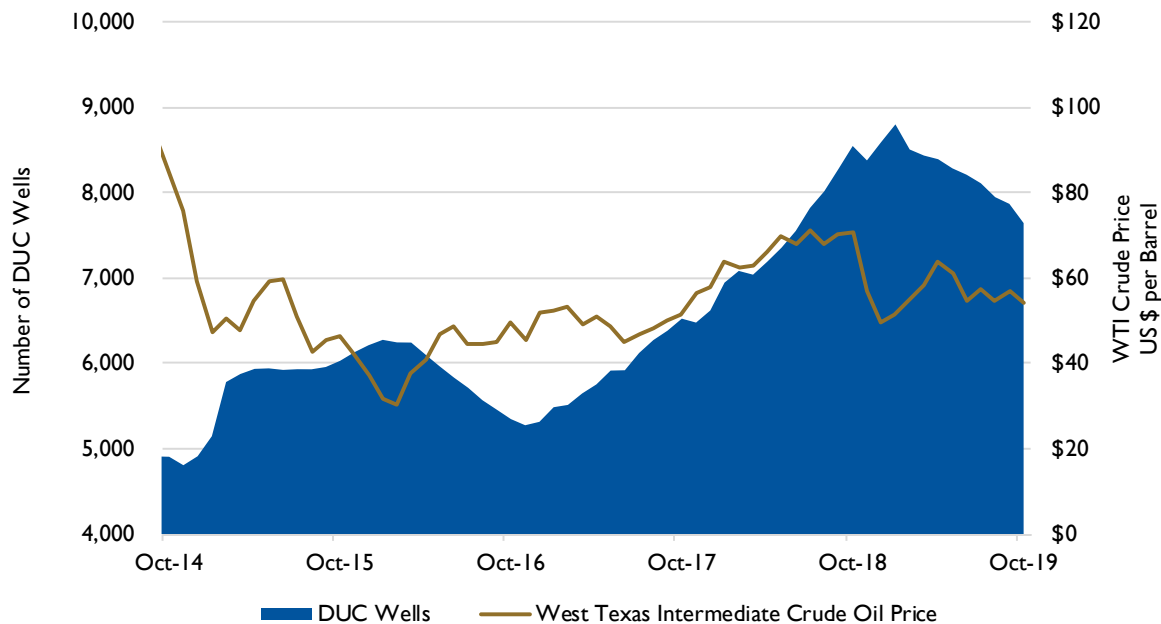
PERCENTAGE OF CRUDE OIL AND NATURAL GAS PRODUCTION PER SHALE REGION (MONTHLY) (34)



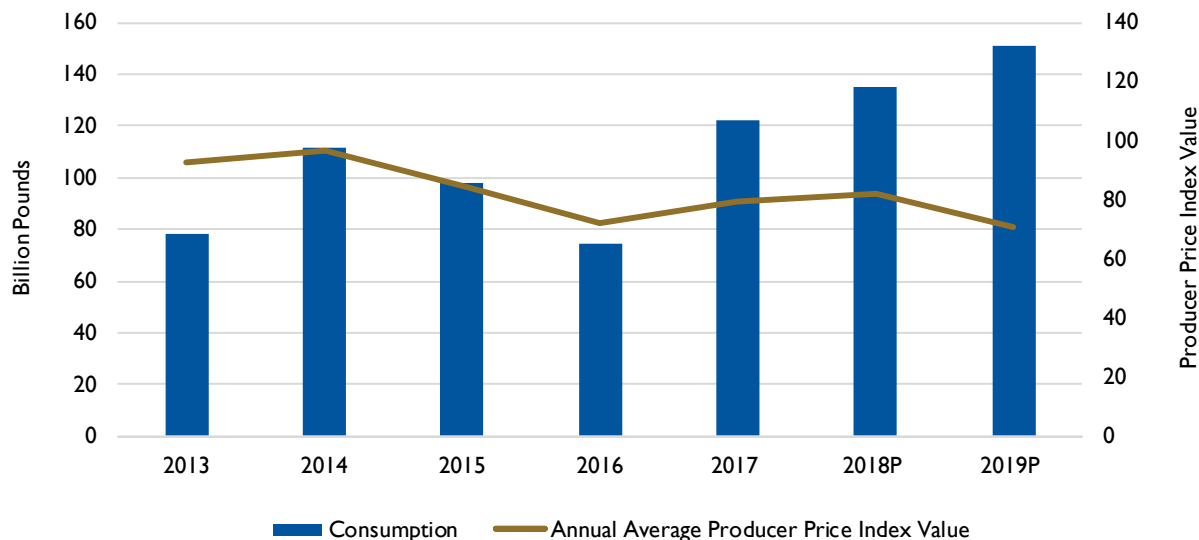
DATA CENTER

DRILLING ACTIVITY

DRILLED BUT UNCOMPLETED (DUC) WELLS VS. CRUDE OIL PRICE (MONTHLY) ⁽³⁵⁾



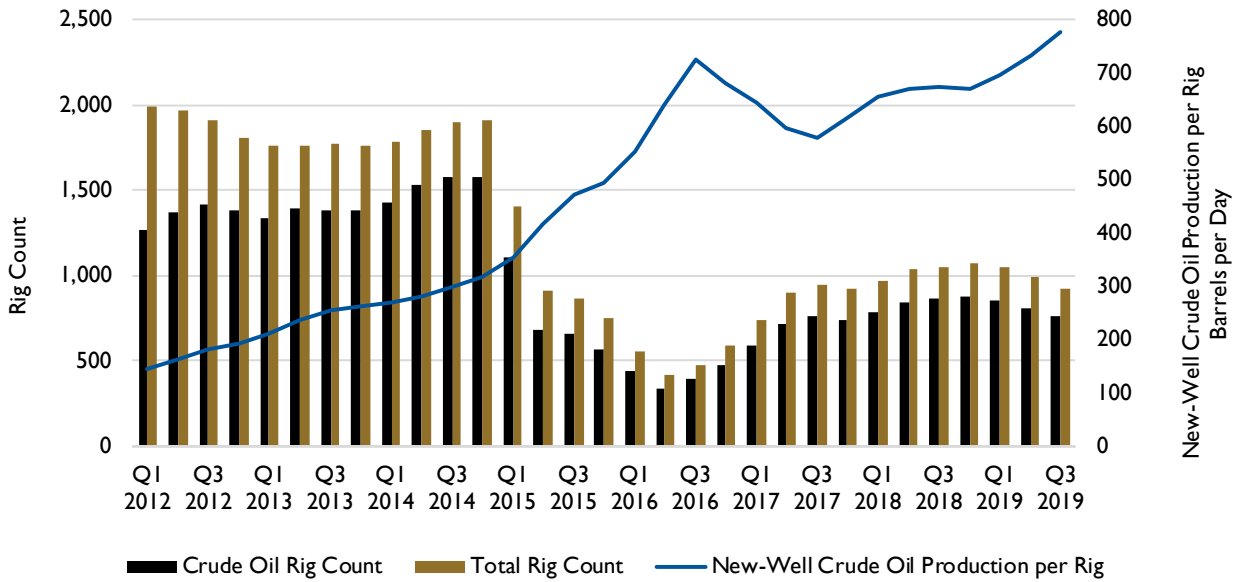
HYDRAULIC FRACTURING SAND CONSUMPTION AND PRODUCER PRICE INDEX (ANNUAL) ⁽³⁶⁾



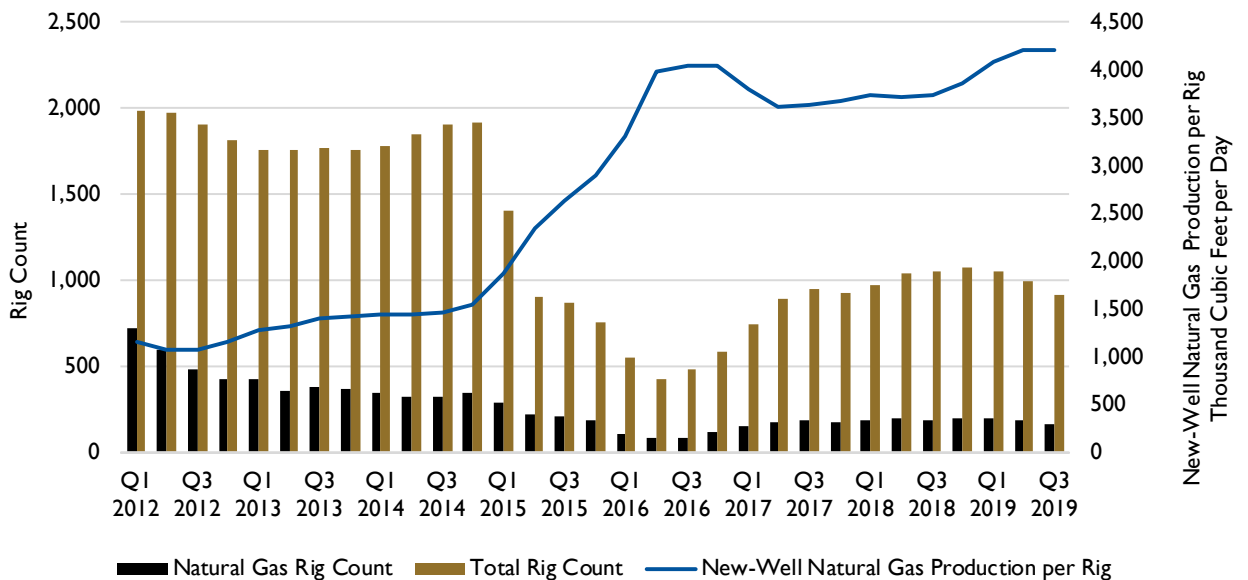
DATA CENTER

DRILLING ACTIVITY

CRUDE OIL PRODUCTION, RIG COUNT AND PRODUCTION PER RIG (QUARTERLY) ⁽³⁷⁾

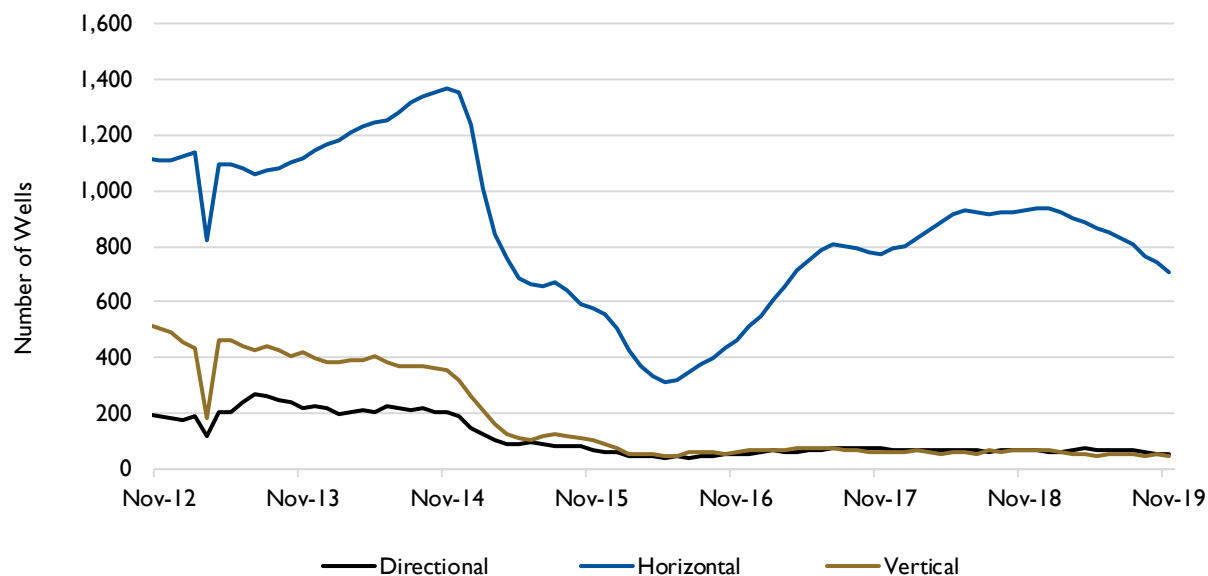


NATURAL GAS PRODUCTION, RIG COUNT AND PRODUCTION PER RIG (QUARTERLY) ⁽³⁸⁾



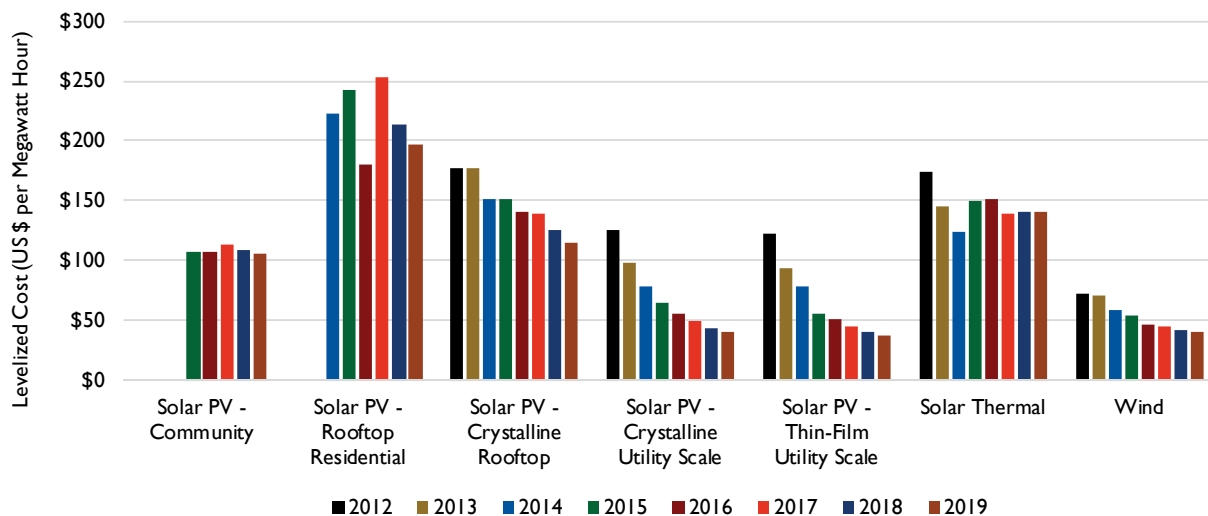
DATA CENTER DRILLING ACTIVITY

U.S. DRILLING RIGS BY TYPE (MONTHLY) (39)



RENEWABLES

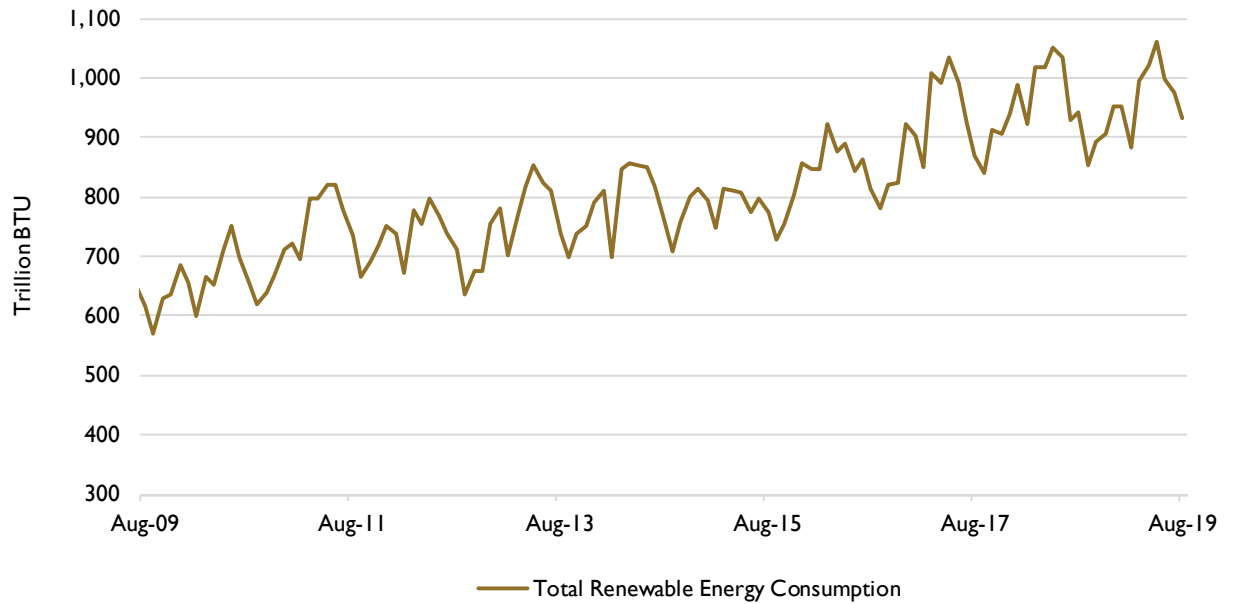
WIND AND SOLAR PRICES (ANNUAL AVERAGE) (40)



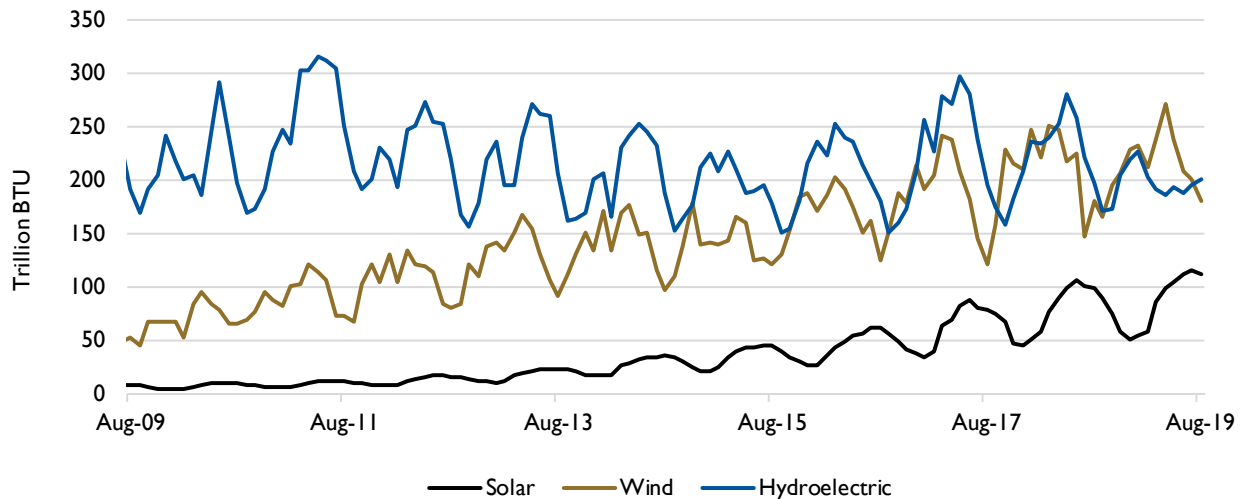
DATA CENTER

RENEWABLES

U.S. TOTAL RENEWABLE ENERGY CONSUMPTION (MONTHLY) (41)



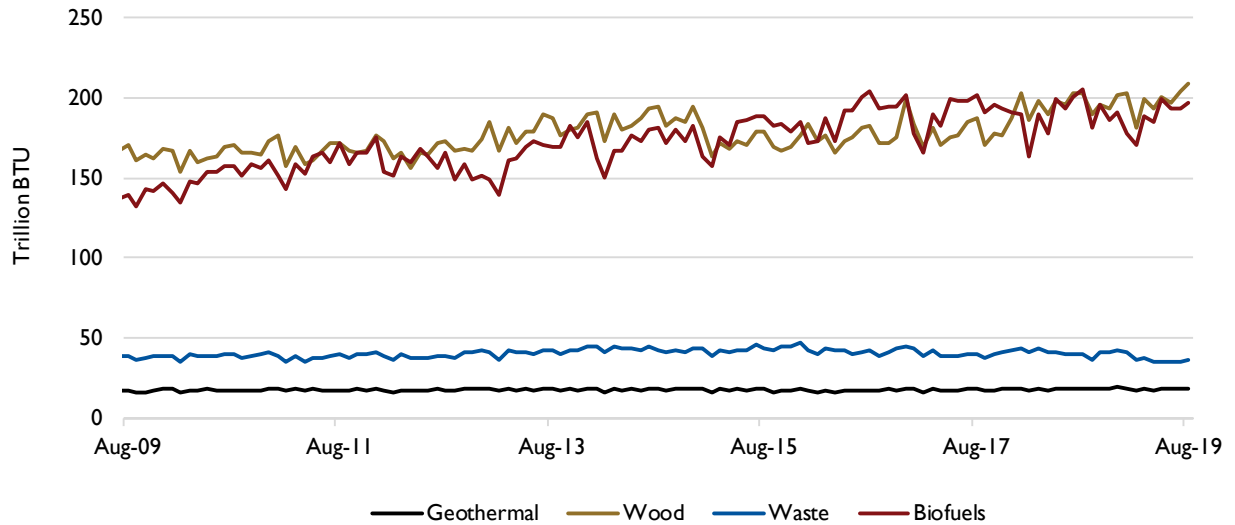
U.S. SOLAR, WIND AND HYDROELECTRIC ENERGY CONSUMPTION (MONTHLY) (42)



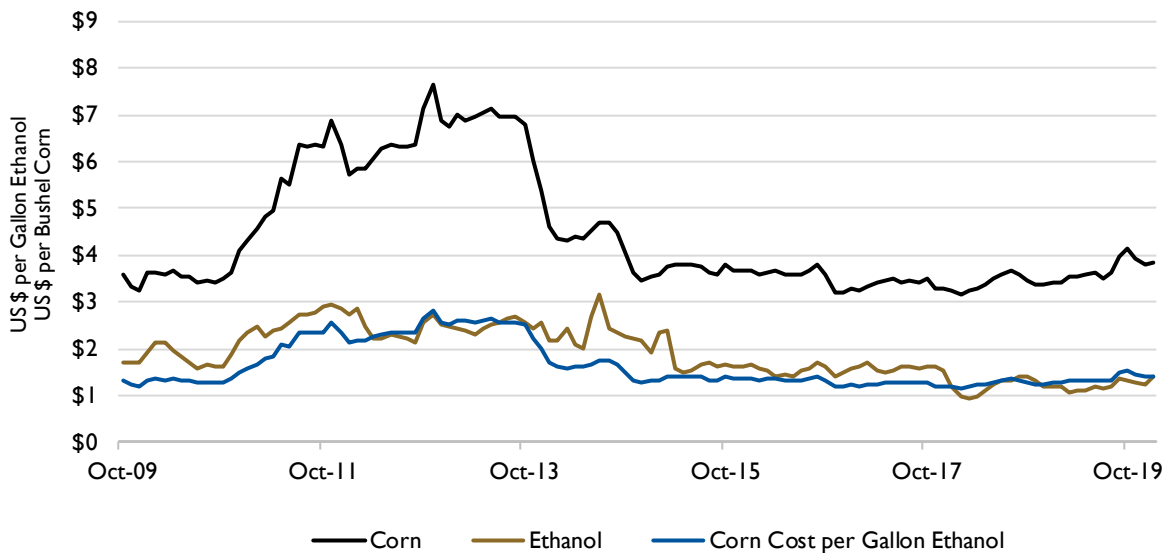
DATA CENTER

RENEWABLES

U.S. WOOD, WASTE, BIOFUELS AND GEOTHERMAL ENERGY CONSUMPTION (MONTHLY) (43)

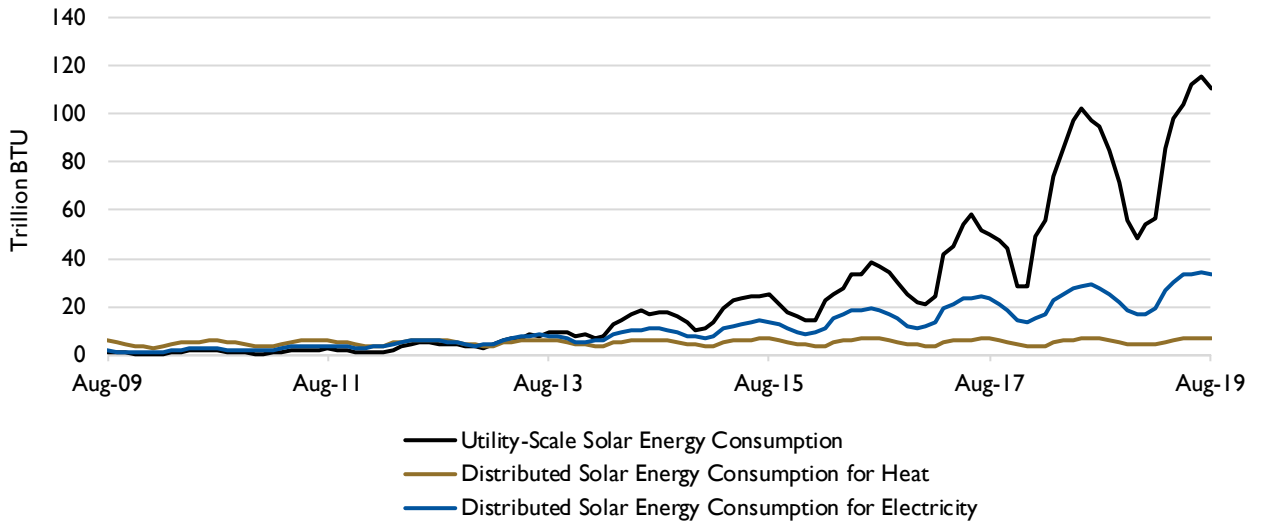


CORN AND ETHANOL PRICES AND CORN COST PER GALLON OF ETHANOL (MONTHLY AVERAGE) (44)

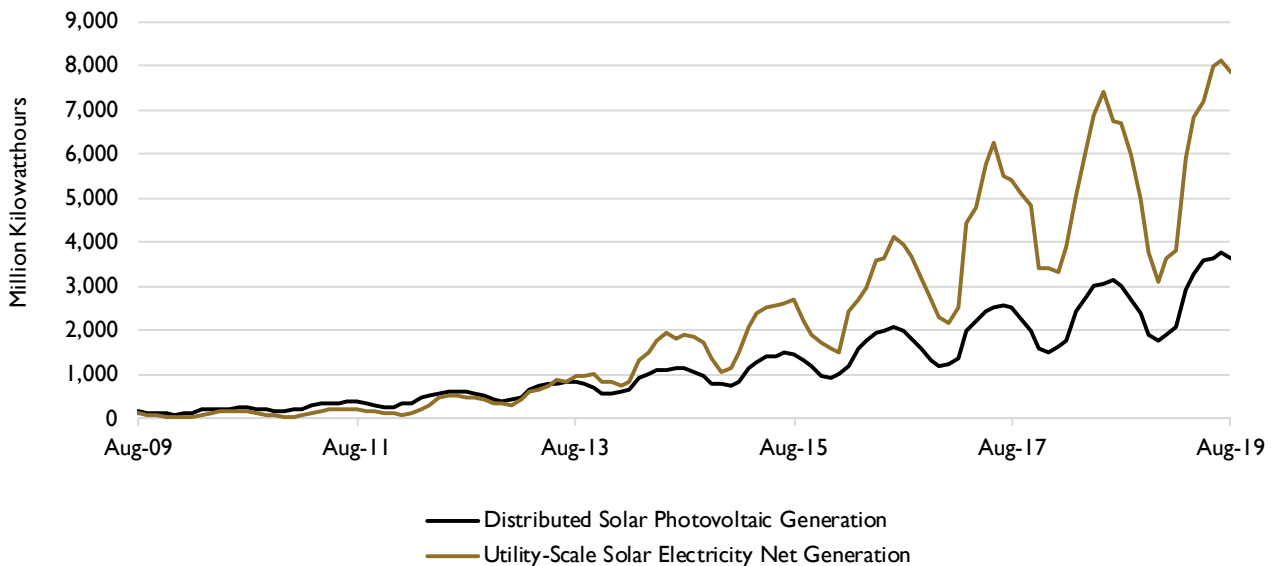


DATA CENTER RENEWABLES

U.S. SOLAR ENERGY CONSUMPTION (MONTHLY) ⁽⁴⁵⁾



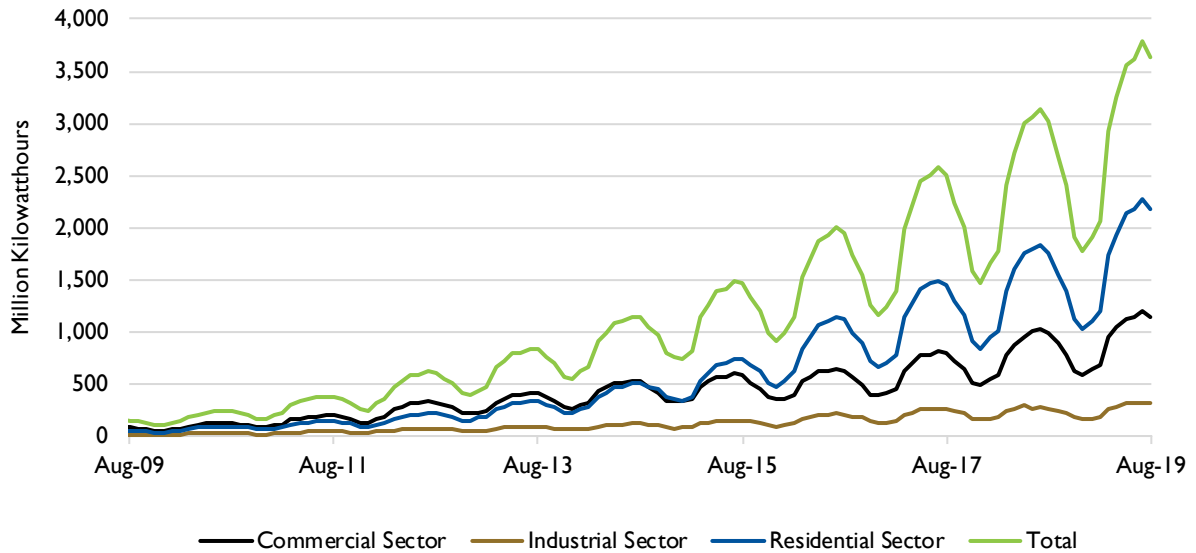
U.S. SOLAR ENERGY NET GENERATION (MONTHLY) ⁽⁴⁶⁾



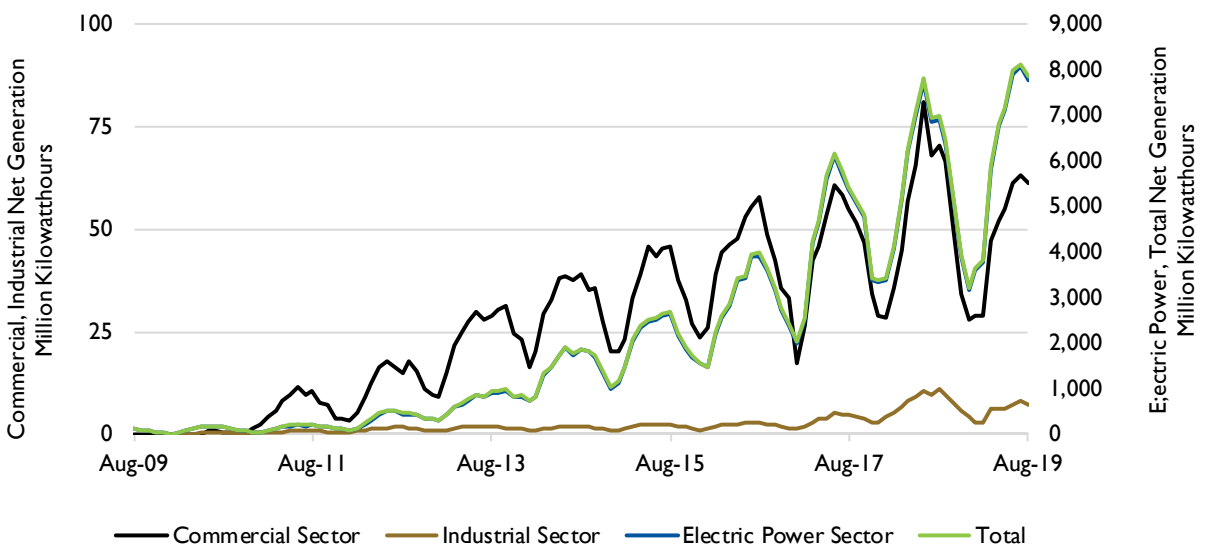
DATA CENTER

RENEWABLES

DISTRIBUTED SOLAR PHOTOVOLTAIC GENERATION BY SECTOR (MONTHLY) (47)

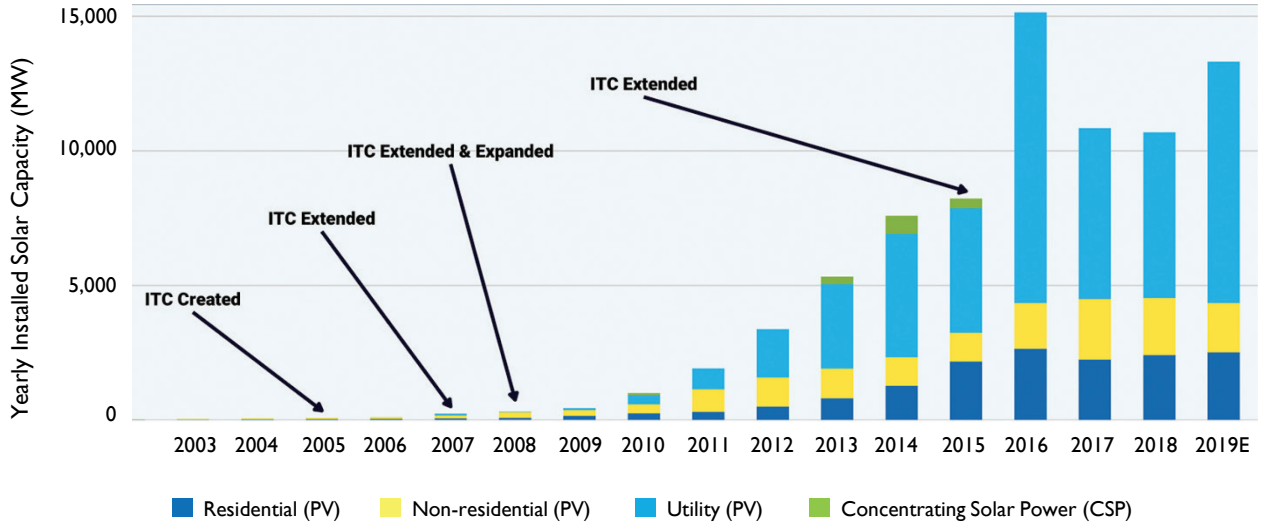


UTILITY-SCALE SOLAR ELECTRICITY NET GENERATION BY SECTOR (MONTHLY) (48)

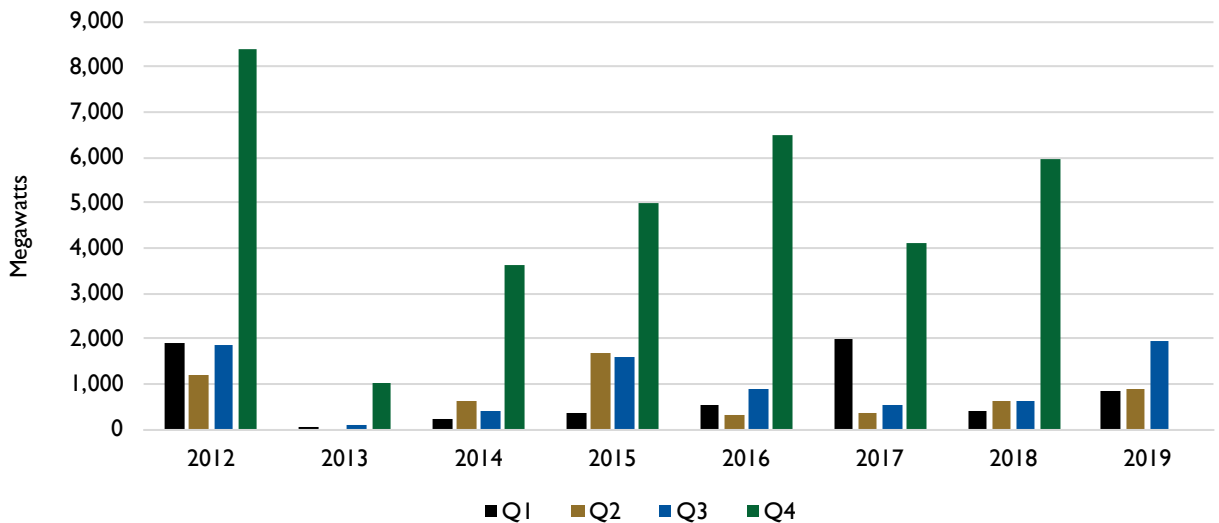


DATA CENTER RENEWABLES

U.S. SOLAR CAPACITY INSTALLATIONS (ANNUAL) (49)

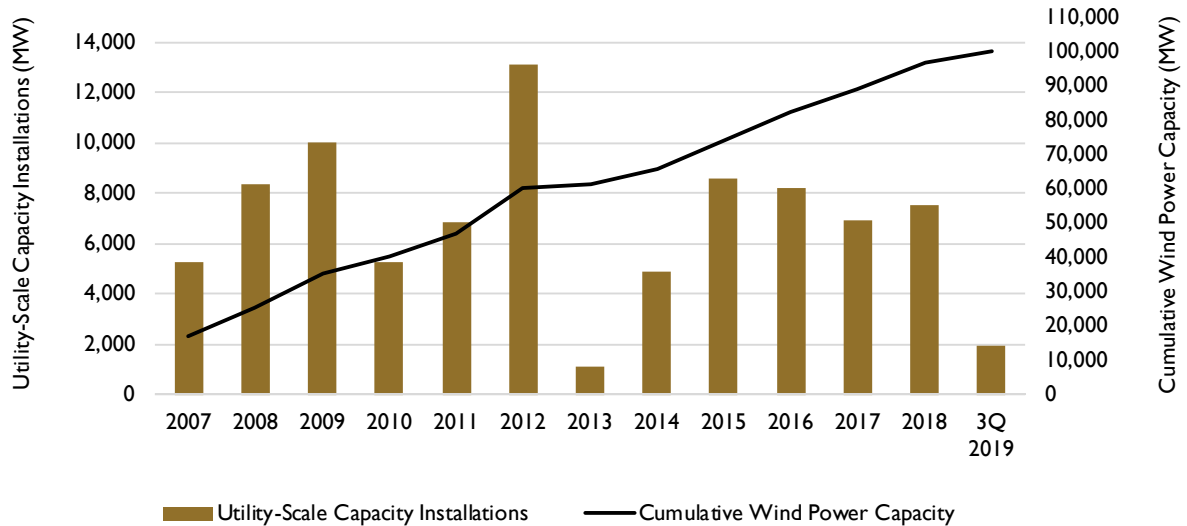


U.S. WIND POWER CAPACITY INSTALLATIONS (QUARTERLY) (50)

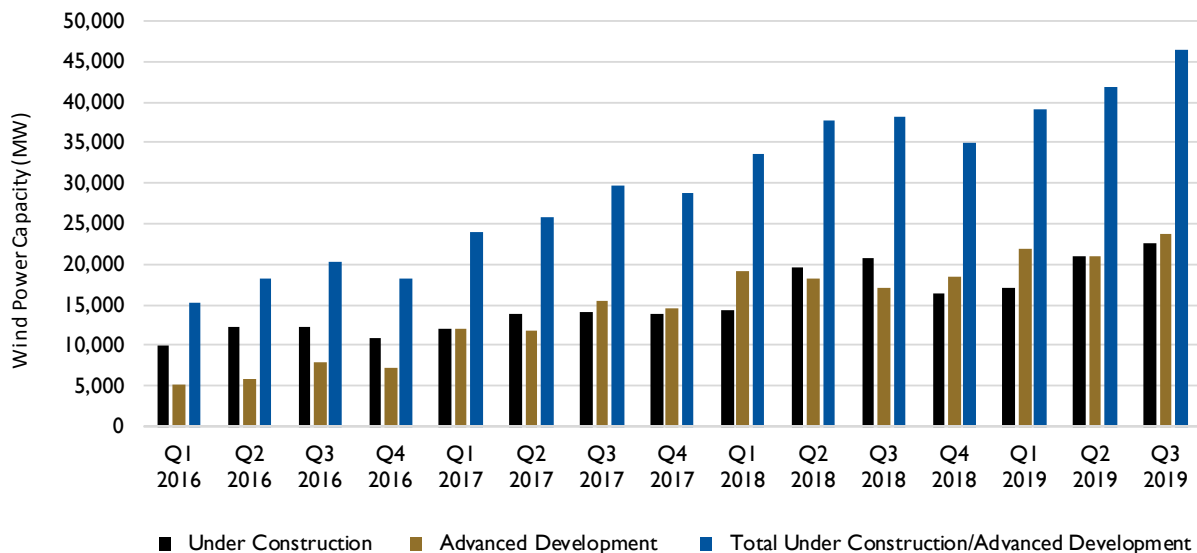


DATA CENTER RENEWABLES

UTILITY-SCALE WIND POWER CAPACITY INSTALLATIONS (ANNUAL) ⁽⁵¹⁾



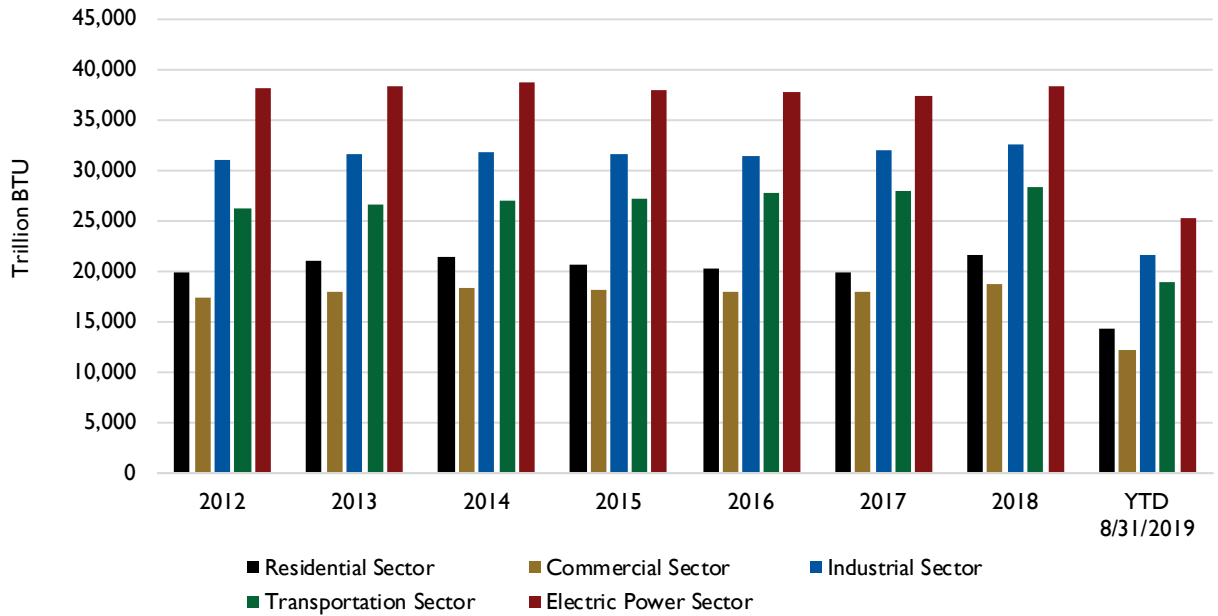
WIND POWER UNDER CONSTRUCTION OR IN ADVANCED DEVELOPMENT (QUARTERLY) ⁽⁵²⁾



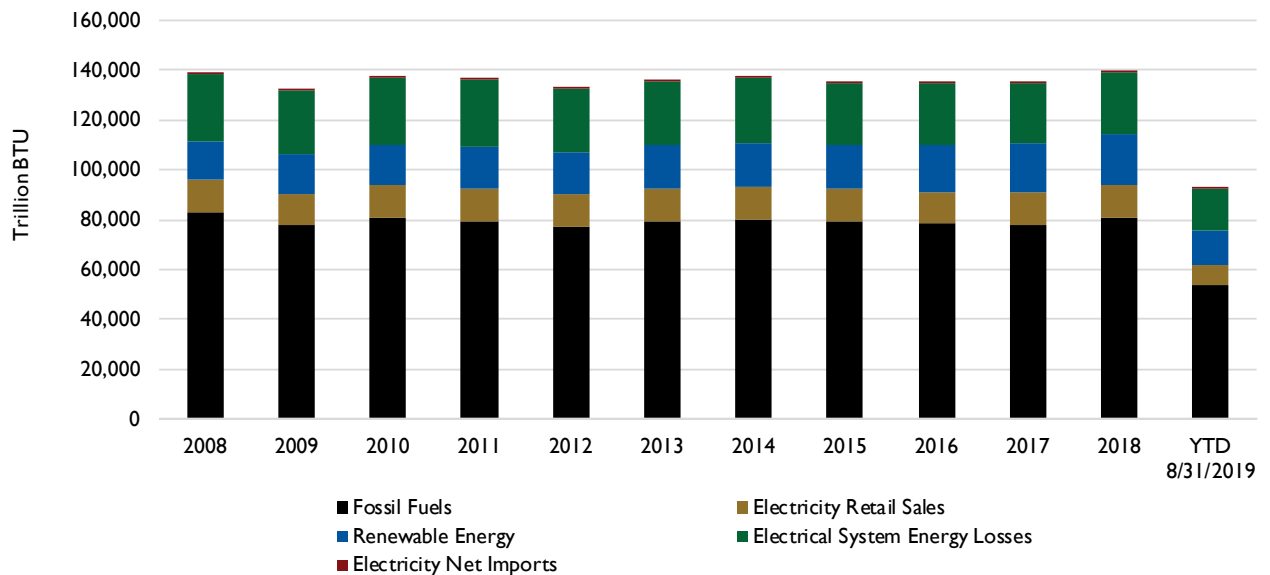
DATA CENTER

U.S. AGGREGATED ENERGY CONSUMPTION

ENERGY CONSUMPTION BY SECTOR (ANNUAL) ⁽⁵³⁾



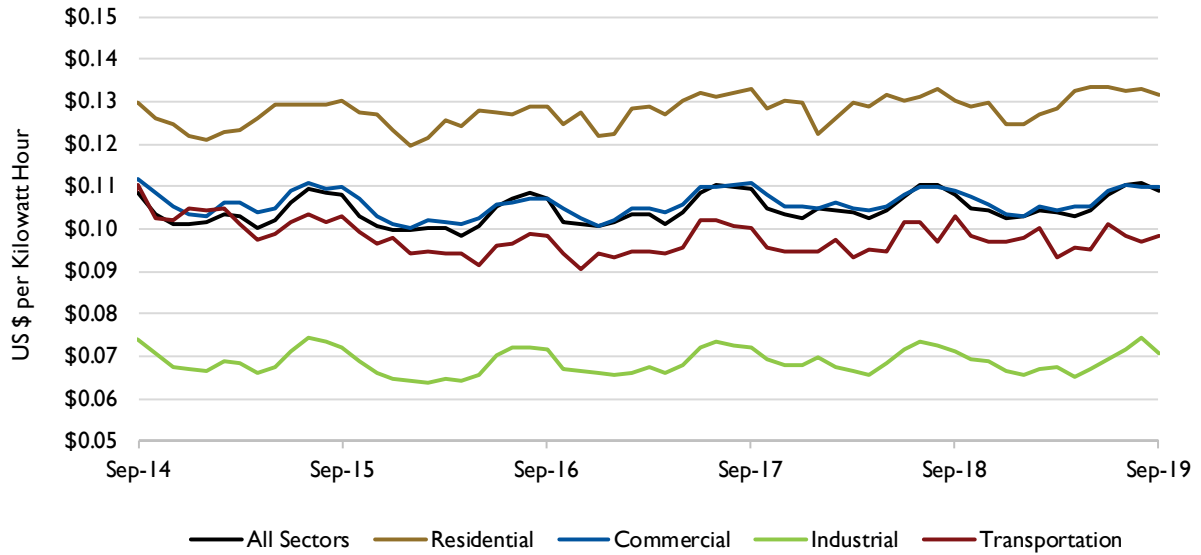
ENERGY CONSUMPTION BY SOURCE (ANNUAL) ⁽⁵⁴⁾



DATA CENTER

U.S. AGGREGATED ENERGY CONSUMPTION

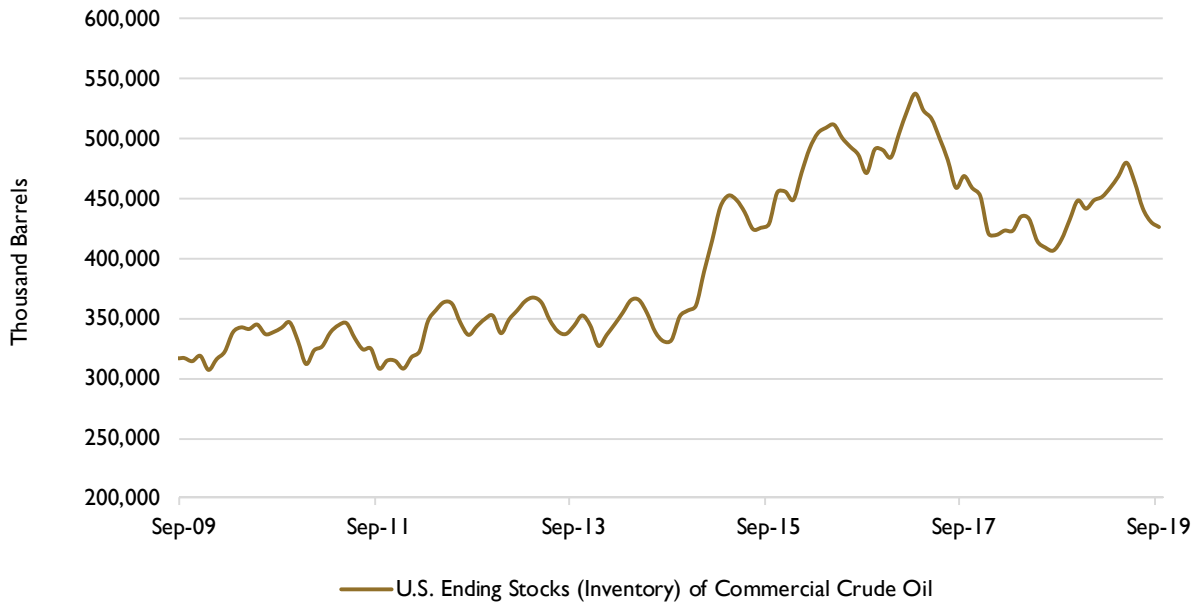
ELECTRICITY PRICES BY SECTOR (MONTHLY AVERAGE) (55)



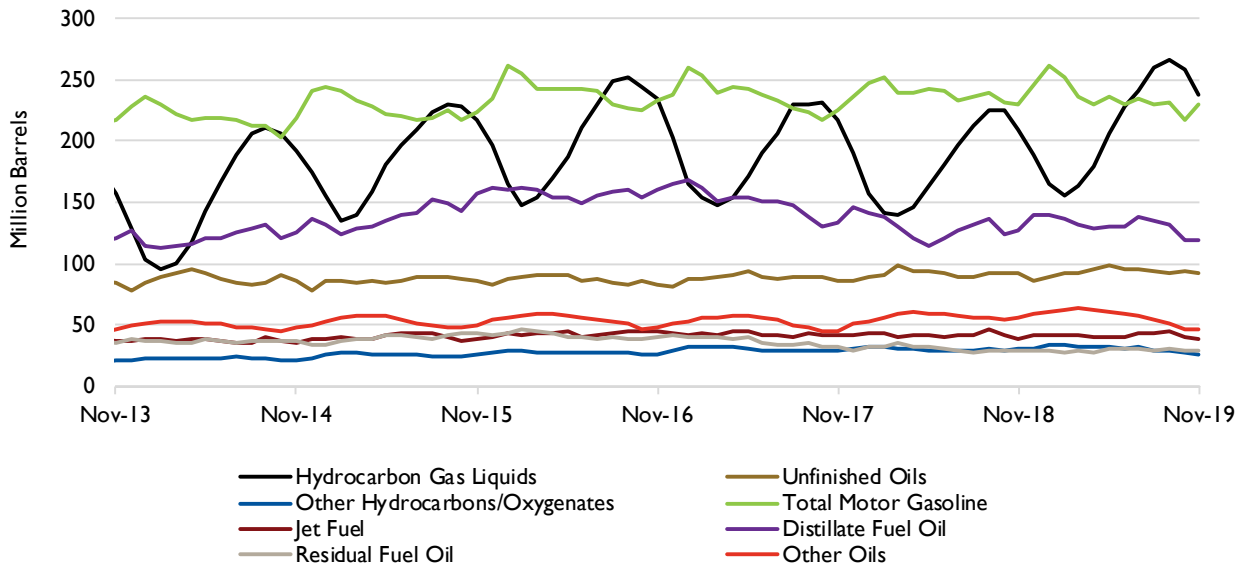
DATA CENTER

LOGISTICS - STORAGE AND TERMINALS

COMMERCIAL CRUDE OIL INVENTORY (MONTHLY) ⁽⁵⁶⁾



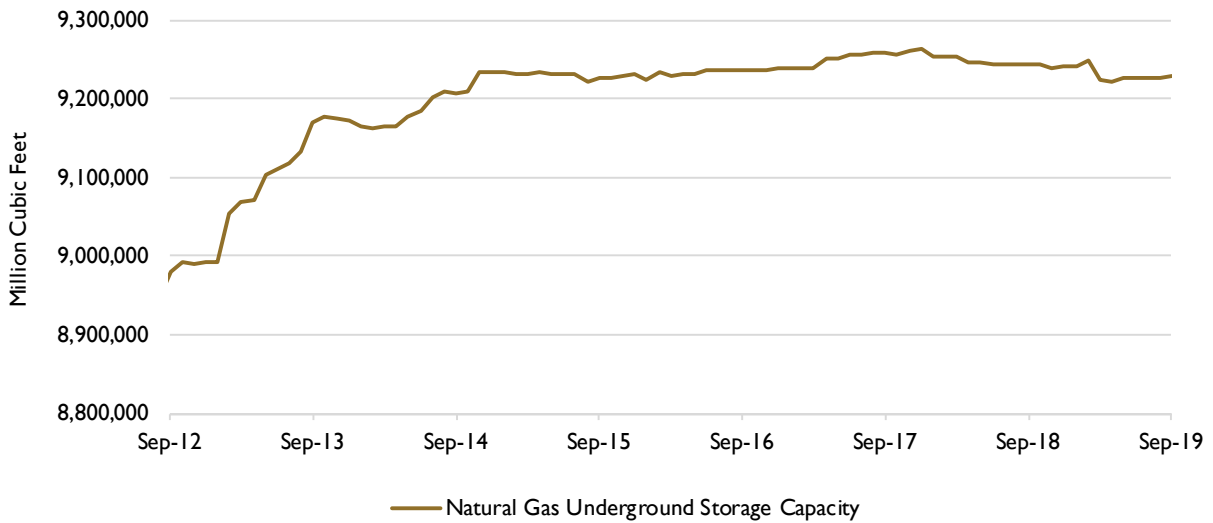
PETROLEUM AND OTHER LIQUIDS COMMERCIAL INVENTORY (MONTHLY) ⁽⁵⁷⁾



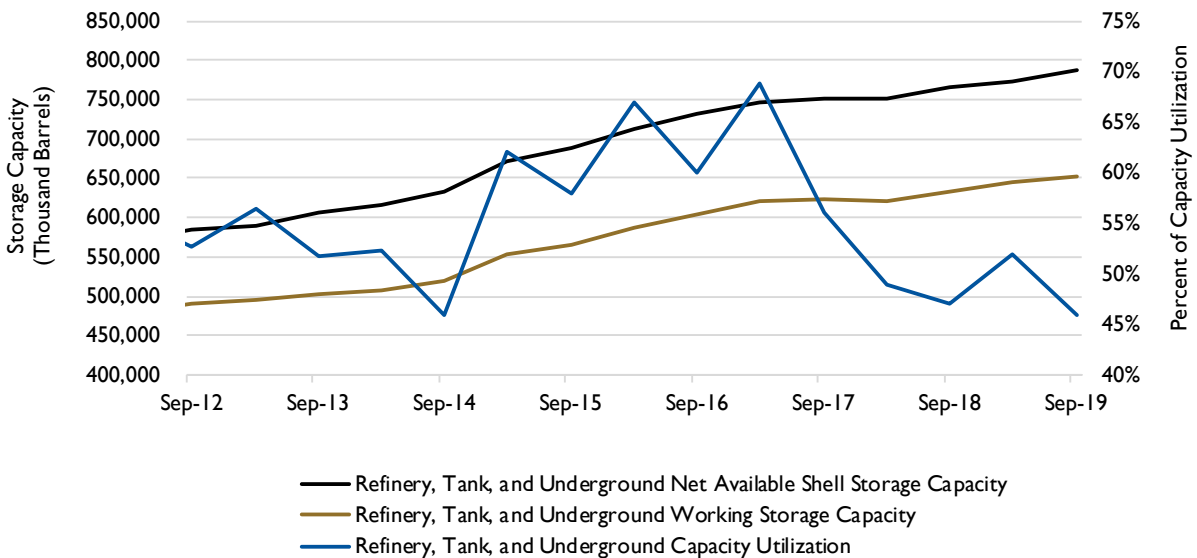
DATA CENTER

LOGISTICS - STORAGE AND TERMINALS

NATURAL GAS UNDERGROUND STORAGE CAPACITY (MONTHLY) (58)



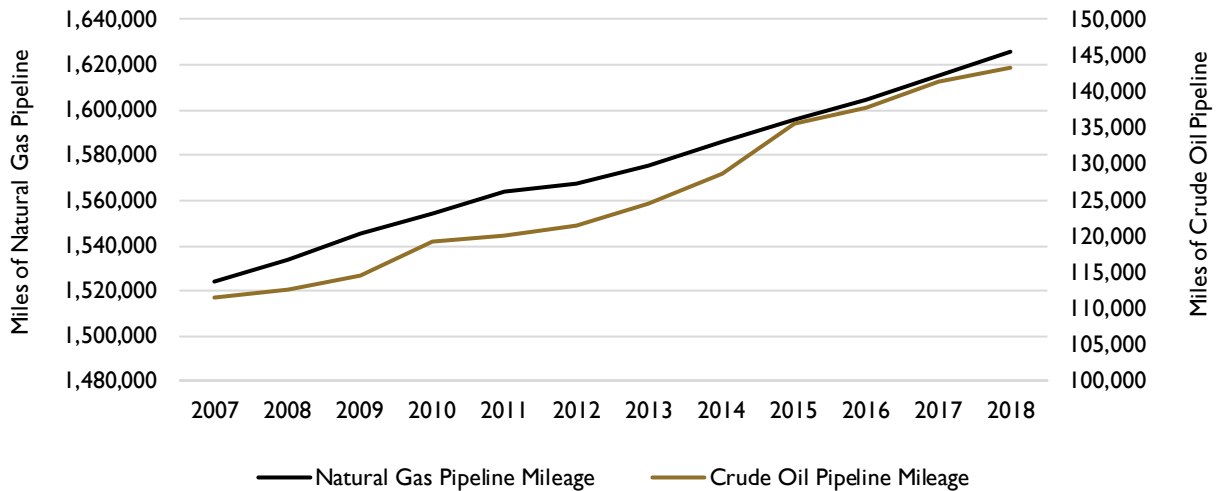
COMMERCIAL CRUDE OIL REFINERY, TANK AND UNDERGROUND STORAGE CAPACITY AND UTILIZATION (MONTHLY) (59)



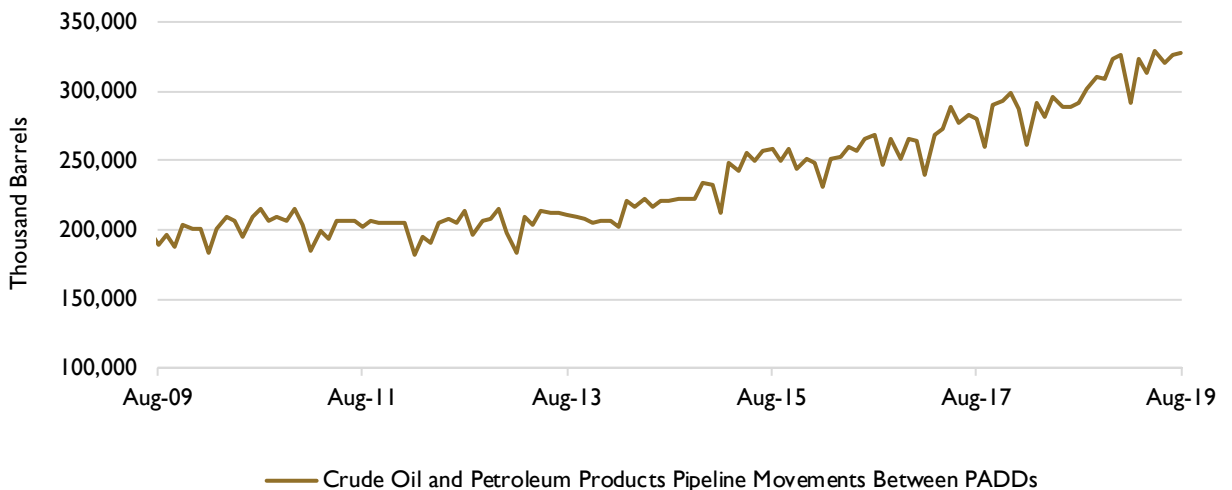
DATA CENTER

LOGISTICS - PIPELINES

CRUDE OIL AND NATURAL GAS PIPELINE MILEAGE (ANNUAL) (60)



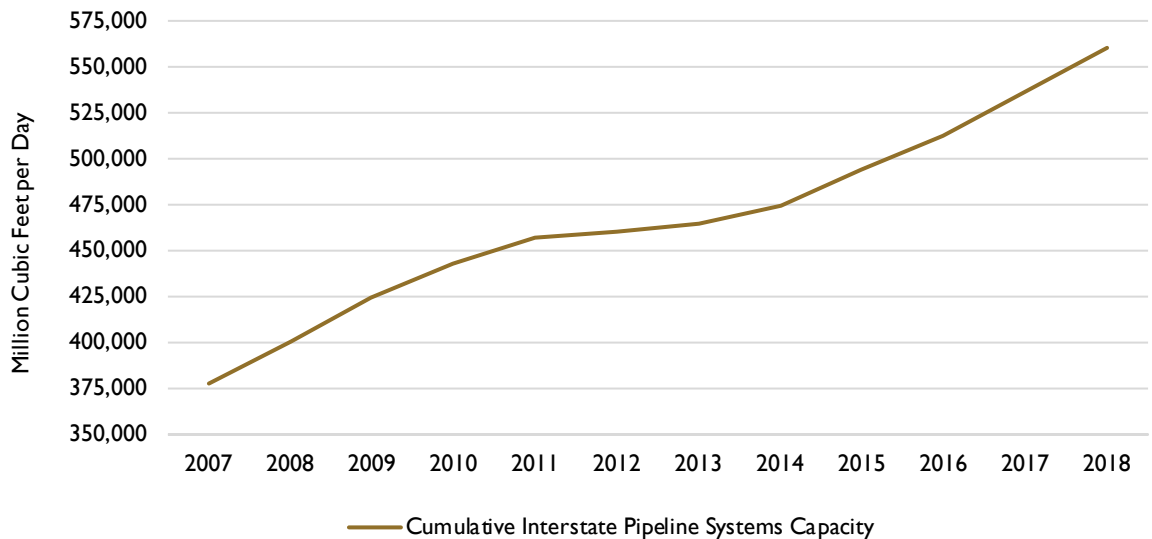
CRUDE OIL AND PETROLEUM PRODUCTS PIPELINE MOVEMENTS BETWEEN PETROLEUM ADMINISTRATION FOR DEFENSE DISTRICTS (PADDs) (MONTHLY) (61)



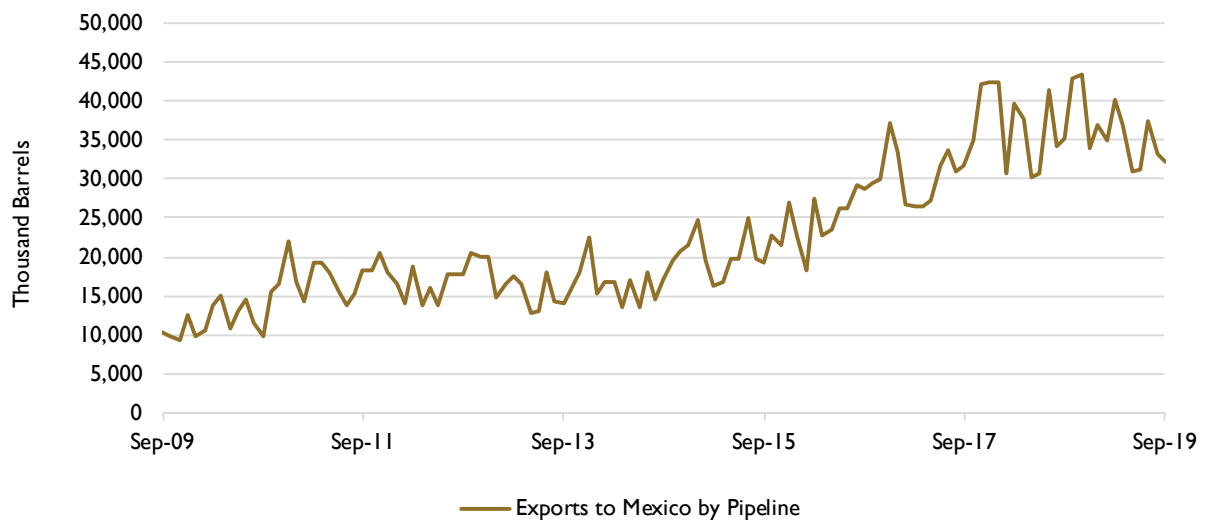
DATA CENTER

LOGISTICS - PIPELINES

NATURAL GAS CUMULATIVE INTERSTATE PIPELINE SYSTEMS CAPACITY (ANNUAL) (62)



CRUDE OIL AND PETROLEUM PRODUCTS EXPORTS TO MEXICO (MONTHLY) (63)

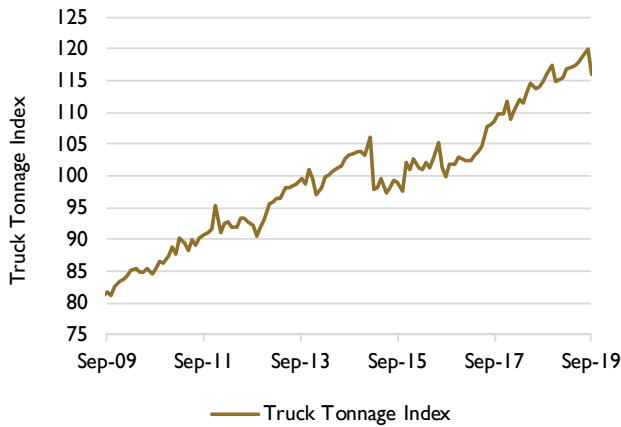


DATA CENTER

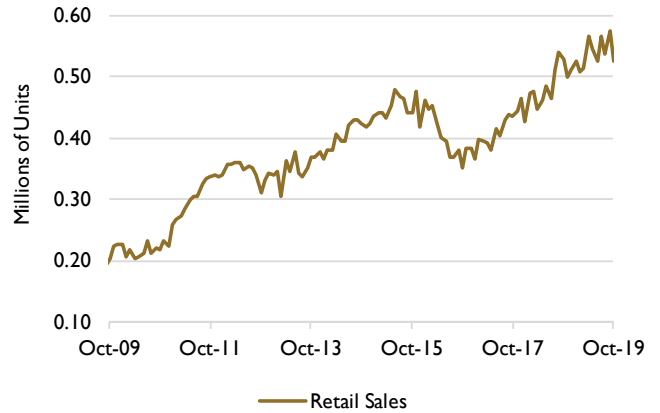
LOGISTICS - TRUCKERS

TRUCK TONNAGE INDEX (MONTHLY) (64)

MEASURES GROSS TONNAGE OF FREIGHT

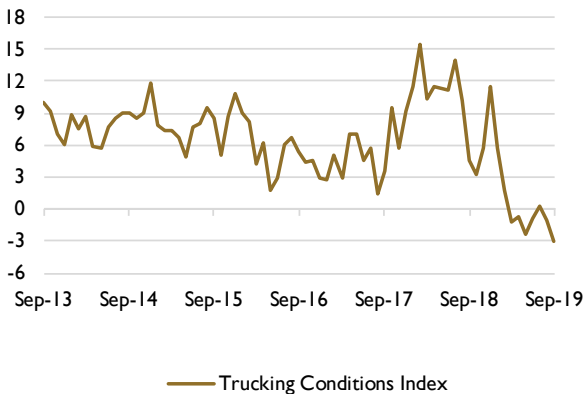


HEAVY TRUCK SALES (MONTHLY) (65)



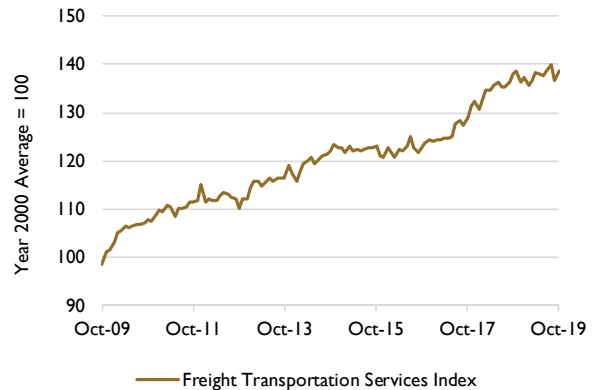
TRUCKING CONDITIONS INDEX (MONTHLY) (66)

INCLUDES FREIGHT VOLUMES, RATES, FLEET CAPACITY, BANKRUPTCIES, FUEL PRICE AND FINANCING



FREIGHT TRANSPORTATION SERVICES INDEX (MONTHLY) (67)

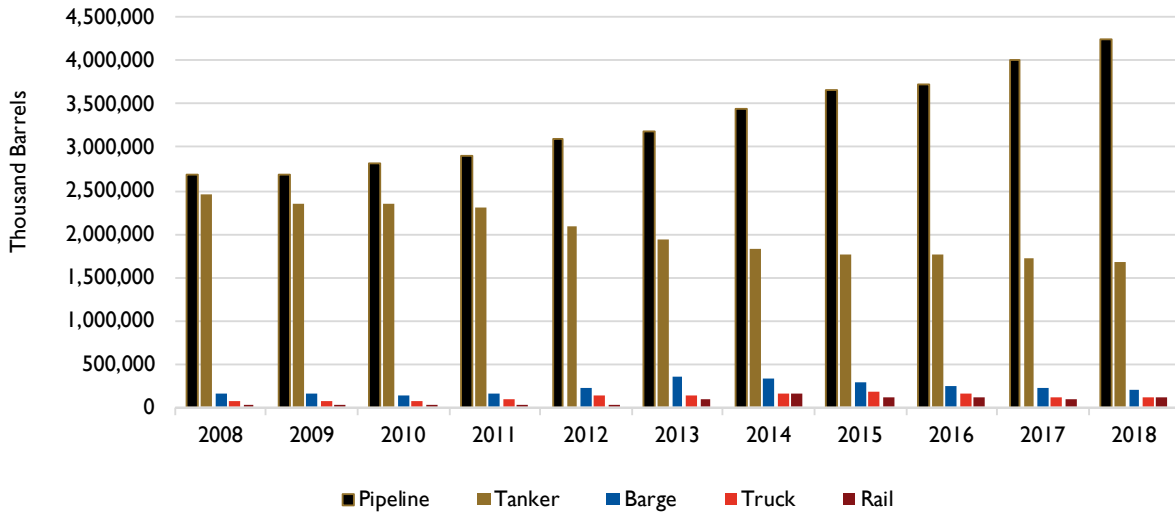
INCLUDES TRUCKING, RAIL, WATERWAYS, PIPELINES AND AIR FREIGHT



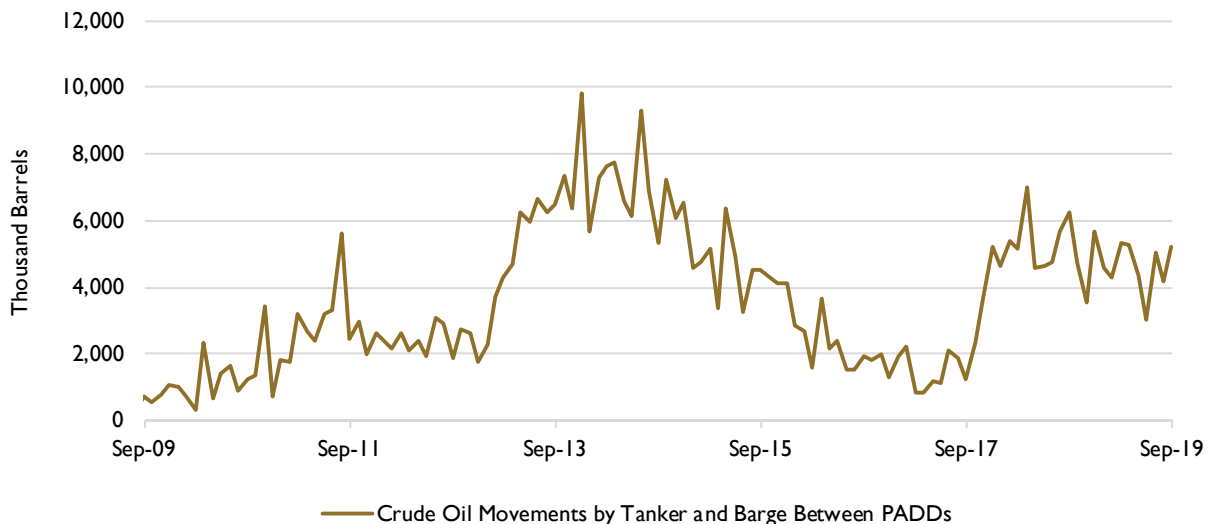
DATA CENTER

LOGISTICS - SHIPPING

CRUDE OIL REFINERY RECEIPTS BY TRANSPORTATION METHOD (ANNUAL) ⁽⁶⁸⁾



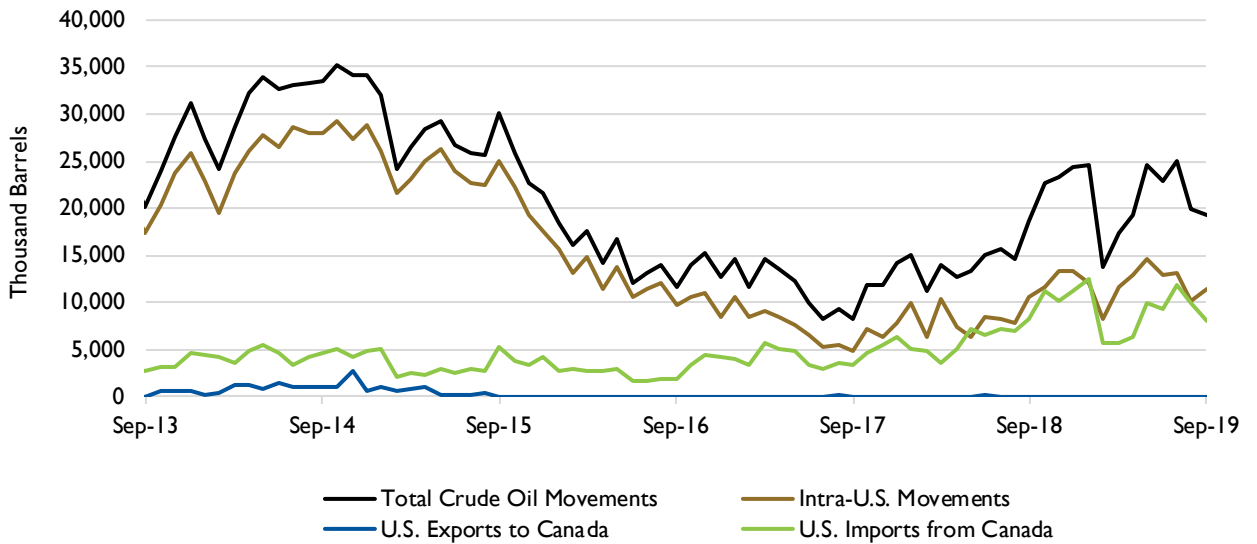
CRUDE OIL MOVEMENTS BY TANKER AND BARGE BETWEEN PETROLEUM ADMINISTRATION FOR DEFENSE DISTRICTS (PADDs) (MONTHLY) ⁽⁶⁹⁾



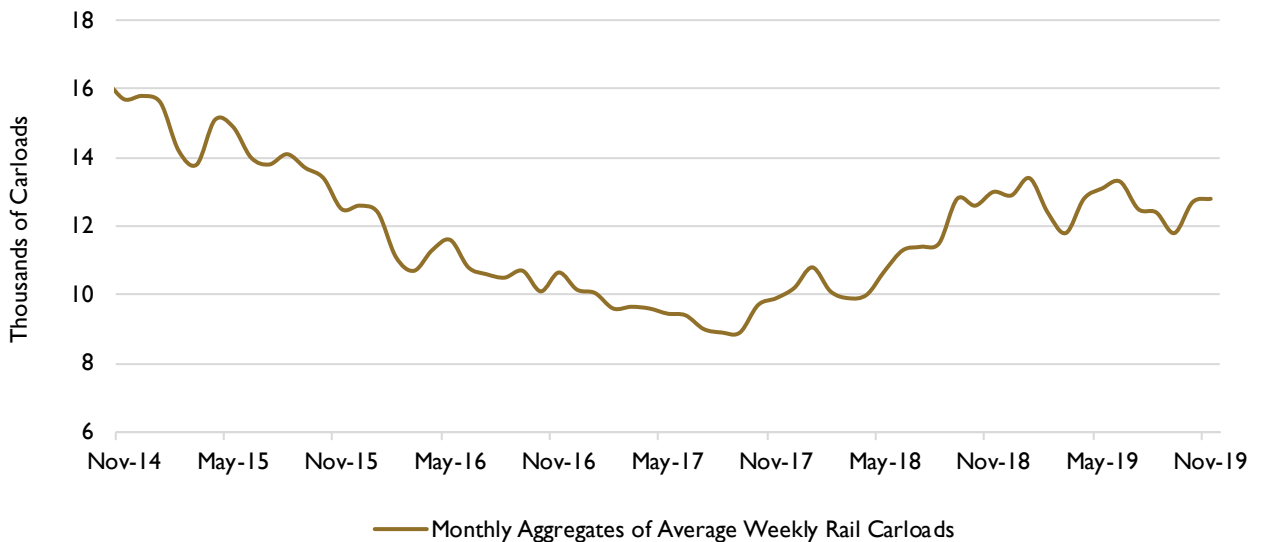
DATA CENTER

LOGISTICS - RAIL

MOVEMENTS OF CRUDE OIL BY RAIL (MONTHLY) (70)



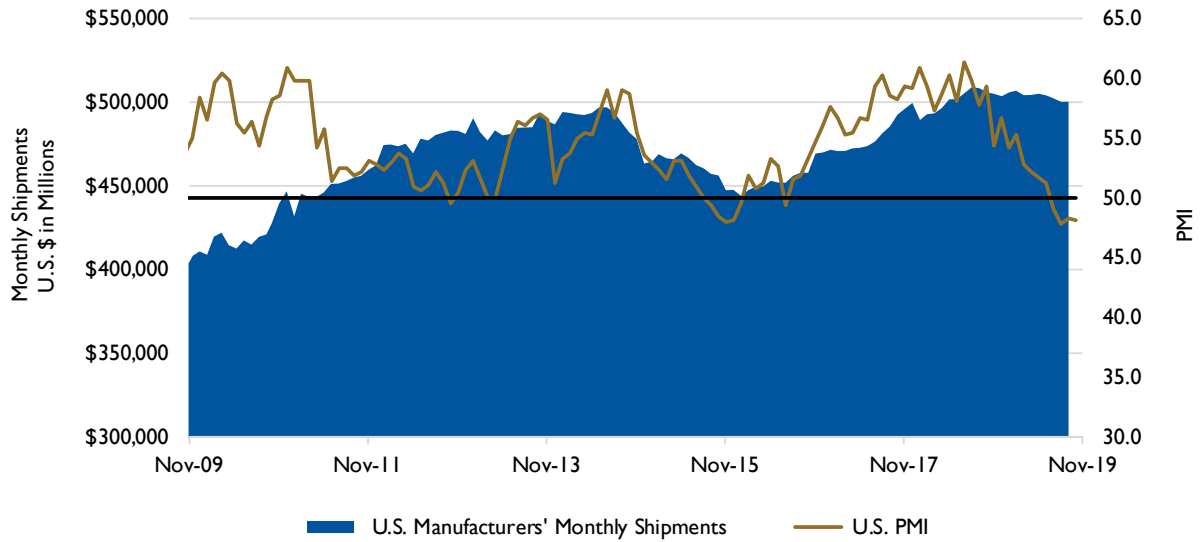
AVERAGE WEEKLY RAIL CARLOADS OF PETROLEUM AND PETROLEUM PRODUCTS (MONTHLY AGGREGATE) (71)



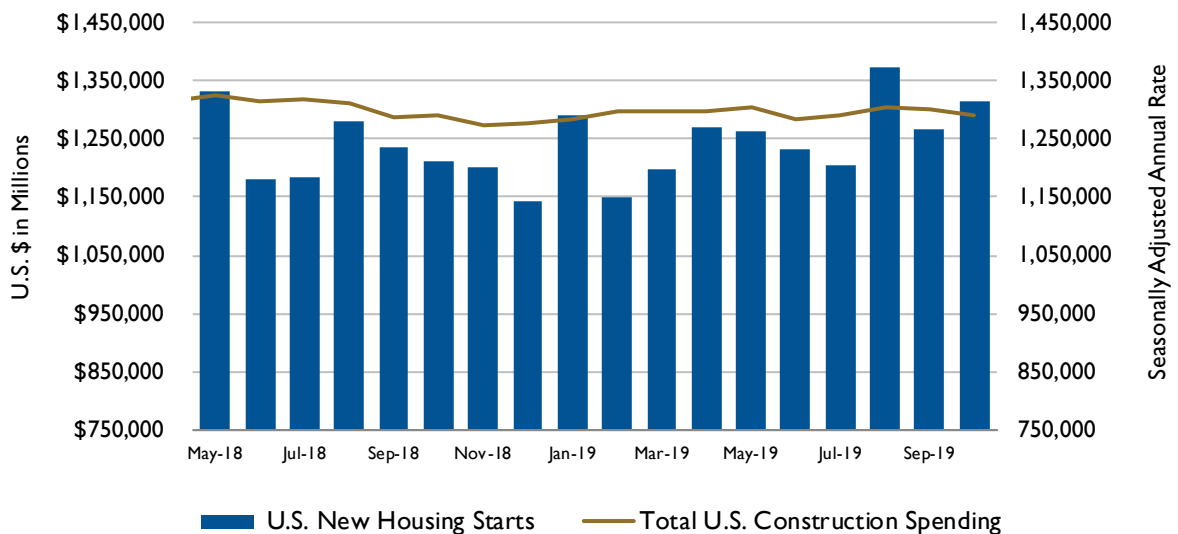
DATA CENTER

ECONOMIC / FINANCIAL

U.S. MANUFACTURERS' MONTHLY SHIPMENTS AND U.S. PURCHASING MANAGERS' INDEX (PMI) (MONTHLY) (72)



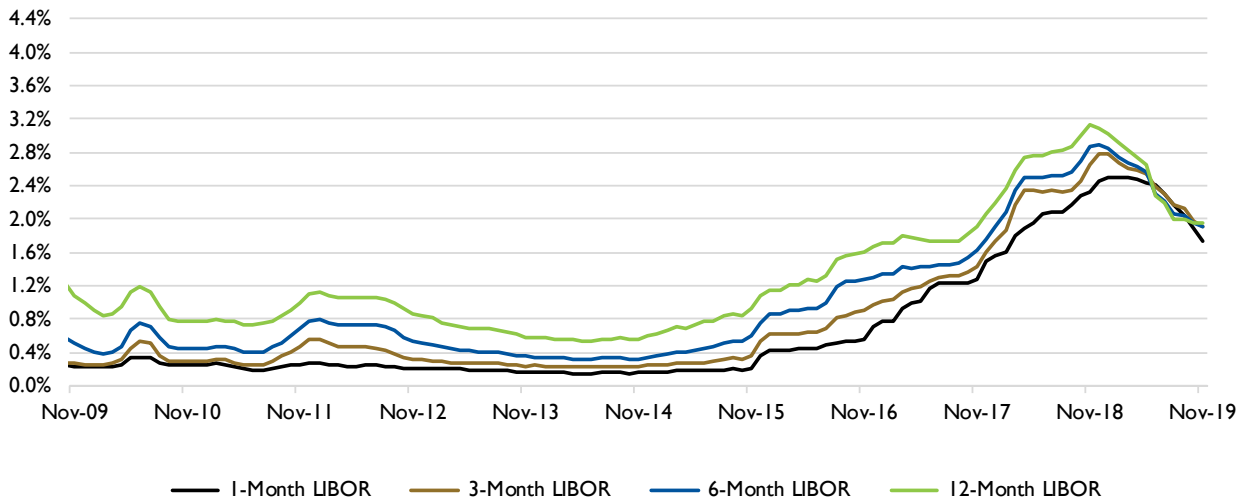
U.S. NEW HOUSING STARTS AND TOTAL U.S. CONSTRUCTION SPENDING (MONTHLY) (73)



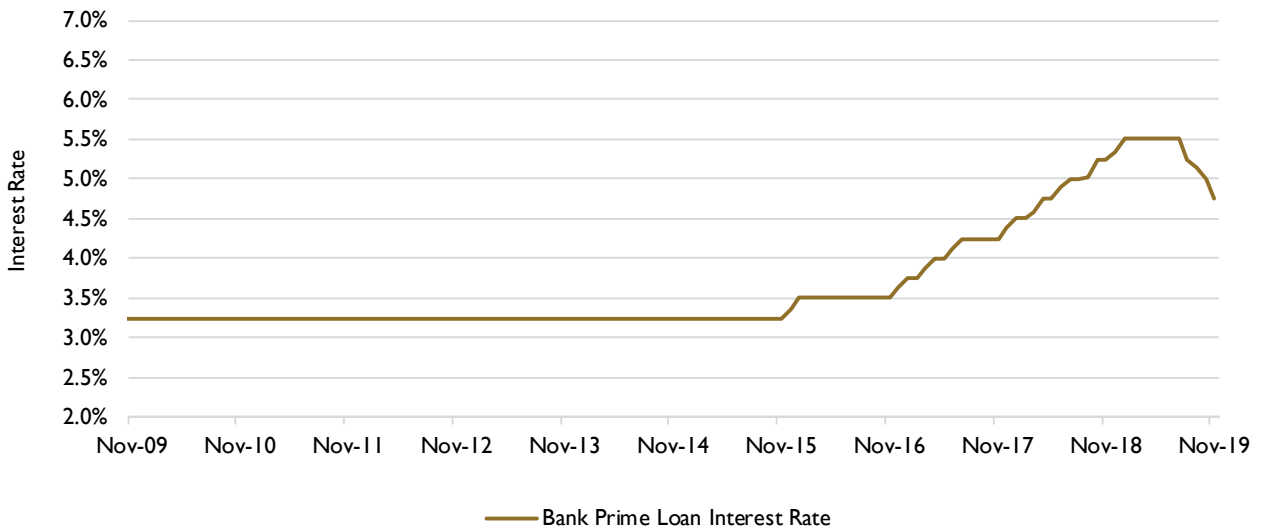
DATA CENTER

ECONOMIC / FINANCIAL

LONDON INTERBANK OFFERED RATE (LIBOR) (MONTHLY AVERAGE) BASED ON U.S. DOLLAR ⁽⁷⁴⁾



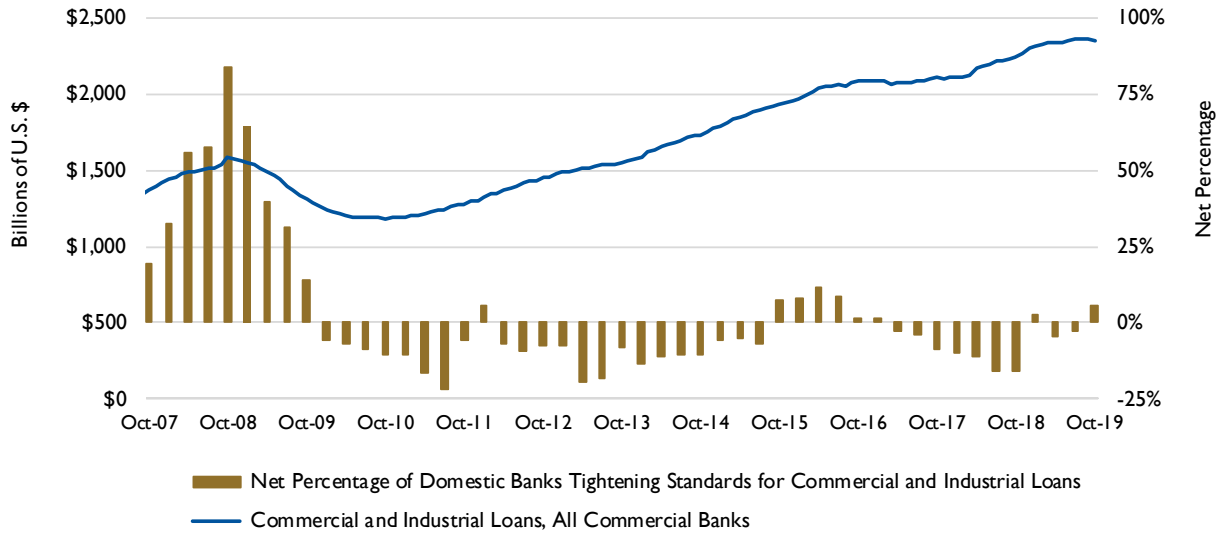
BANK PRIME LOAN INTEREST RATES (MONTHLY AVERAGE) ⁽⁷⁵⁾



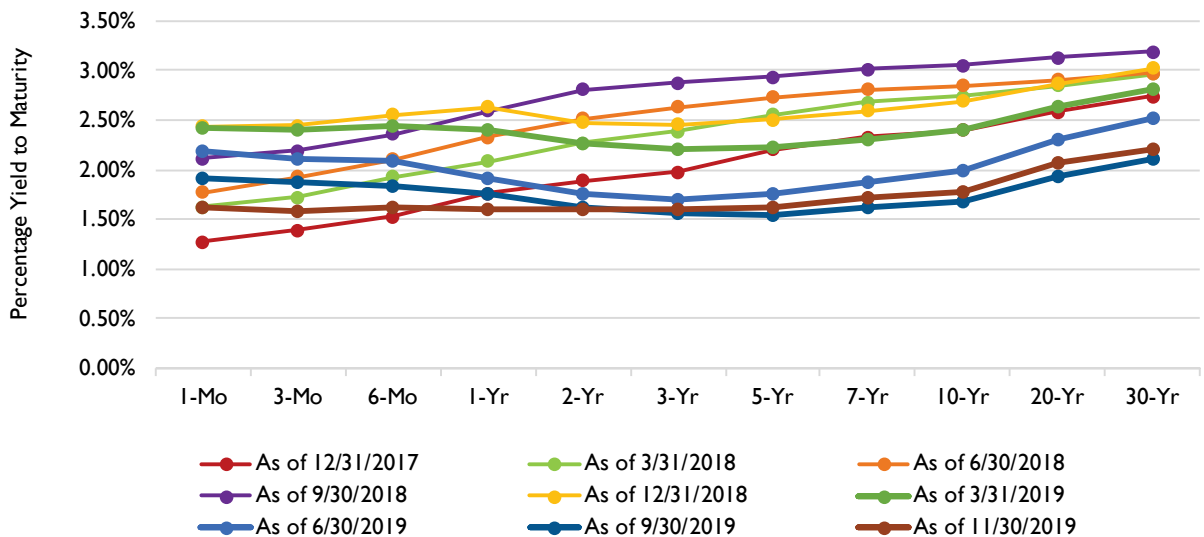
DATA CENTER

ECONOMIC / FINANCIAL

COMMERCIAL AND INDUSTRIAL LOANS VS. BANKING STANDARDS (QUARTERLY, MONTHLY) ⁽⁷⁶⁾



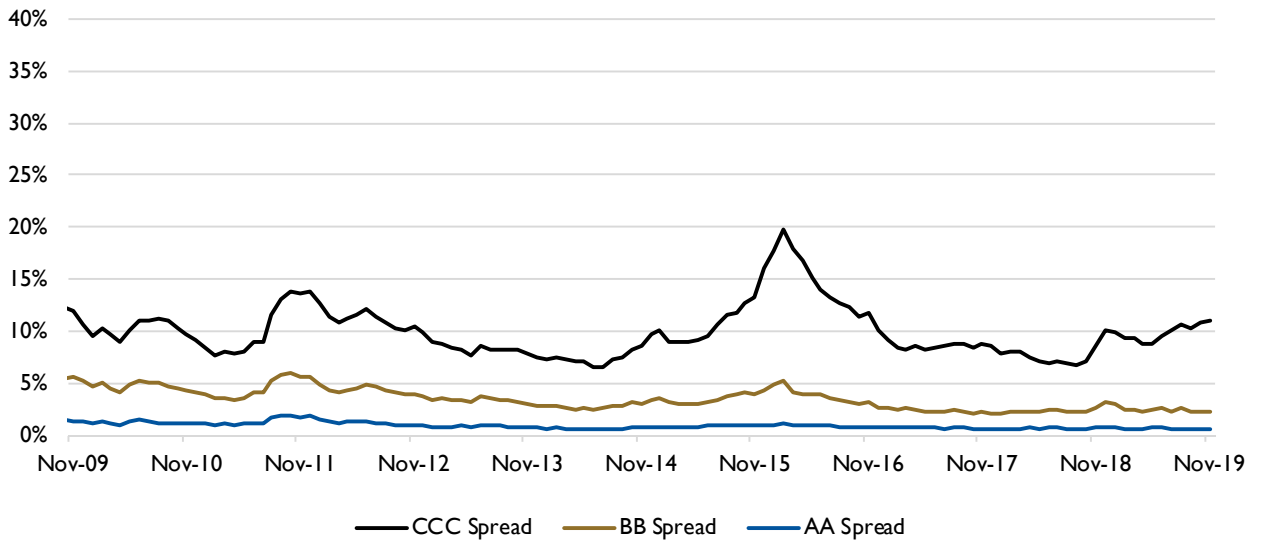
U.S. TREASURY YIELD CURVE (MONTHLY, ANNUAL) ⁽⁷⁷⁾



DATA CENTER

ECONOMIC / FINANCIAL

CORPORATE SPREADS TO TREASURIES BY QUALITY (MONTHLY AVERAGE) ⁽⁷⁸⁾



DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

ABBREVIATIONS & ACRONYMS

AECO – Alberta Energy Company
ARAMCO – Saudi Arabian Oil Company, formerly the Arabian-American Oil Company
BCF – Billion cubic feet
BTU – British thermal unit
CIF – Costs, insurance and freight
CMT – Constant maturity treasury
DUC – Drilled but uncompleted wells
EBITDA – Earnings before interest, taxes, depreciation and amortization
IFO – Intermediate fuel oil
ITC – Investment Tax Credit
LCOE – Levelized cost of energy
LIBOR – London Interbank Offered Rate
LNG – Liquefied natural gas
LPG – Liquefied petroleum gas
mmBTU – Millions of British Thermal Units
MTBE – Methyl tertiary butyl ether
MW – Megawatt
NBP – National Balancing Point
NGPL – Natural gas plant liquids
NYMEX – New York Mercantile Exchange
OAS – Option-adjusted spread
OPEC – The Organization of Petroleum Exporting Countries
PADD – Petroleum Administration for Defense District
PG&E – Pacific Gas & Electric
PMI – U.S. Purchasing Managers Index
PV – Photovoltaic
SoCal – Southern California
SPR – Strategic Petroleum Reserve
TETCO-M3 – Texas Eastern Transmission Corporation Pipeline Zone M3
TTF – Title Transfer Facility
UAE – United Arab Emirates
WTI – West Texas Intermediate crude oil

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

DEFINITIONS

Biofuels – liquid fuels and blending components produced from biomass feedstocks, used primarily for transportation.

British Thermal Unit (BTU) – A traditional unit of heat; it is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

Ending Stocks – A proxy for inventory, defined as the total volume of a given commodity held in storage (leases, refineries, processing plants, pipelines, terminals, tank farms) at the end of the last day of a given month.

Distillate Fuel Oil – A general classification for a variety of petroleum fractions produced in petroleum distillation operations. Included within this classification are No. 1, No. 2 and No. 4 diesel fuels (used in on-highway and off-highway diesel engines), as well as No. 1, No. 2 and No. 4 fuel oils (used primarily for space heating and electric power generation).

Distributed Solar Energy – Refers to solar energy generated by small-scale photovoltaic generation plants. Small-scale is defined as a plant with capacity below one megawatt.

Index – A figure in a system or scale representing the average value of specified prices, shares, or other items as compared with some reference figure.

Intermediate Fuel Oil – Also known as IFO and Bunker Fuel, fuel utilized by ships and barges to facilitate international exchange of various commodities across an array of industries.

Investment Tax Credit – A federal policy tax incentive that supports the deployment of solar energy in the United States.

LIBOR – The London Interbank Offered Rate is the average interest rate at which leading banks borrow funds of a sizeable amount from other banks in the London market.

Liquefied Natural Gas – Natural gas that has been cooled to a liquid state, at about -260°Fahrenheit, for shipping and storage.

Liquefied Petroleum Gas – A group of hydrocarbon gases, primarily propane, normal butane and isobutene, derived from crude oil refining or natural gas processing.

Natural Gas Liquids – A group of hydrocarbons including ethane, propane, normal butane, isobutene and natural gasoline. Generally include natural gas plant liquids and all liquefied refinery gases except olefins.

Natural Gas Plant Liquids – Ethane, propane, butane, isobutane, pentane and pentane plus.

Petroleum Administration for Defense District (PADD) – A geographic aggregation of the 50 States and the District of Columbia into five Districts. PADD 1 is the East Coast region, PADD 2 is the Midwest region, PADD 3 is the Gulf Coast region and PADD 5 is the West Coast region.

Petroleum Products – Obtained from the processing of crude oil (including lease condensate), natural gas and other hydrocarbon compounds. Petroleum products include unfinished oils, liquefied petroleum gases, pentanes plus, aviation gasoline, motor gasoline, naphtha-type jet fuel, kerosene-type jet fuel, kerosene, distillate fuel oil, residual fuel oil, petrochemical feedstocks, special naphthas, lubricants, waxes, petroleum coke, asphalt, road oil, still gas and miscellaneous products.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

DEFINITIONS

Product Supplied – A widely utilized proxy for consumption of petroleum products, measuring the disappearance of said products from primary sources. Primary sources include, among others, refineries, processing plants, blending plants, pipelines and bulk terminals.

Propylene – Petrochemical feedstock that is recovered from refinery or petrochemical processes. It is an olefinic hydrocarbon that is gaseous at standard temperature and pressure.

Residual Fuel Oil – The general classification for heavy oils that remain after lighter oils are distilled away in the process of petroleum refining.

Spot vs. Wholesale Price – “Spot” prices are defined by the U.S. Energy Information Administration as, “the price for a one-time open market transaction for immediate delivery of a specific quantity of a product at a specific location where the commodity is purchased ‘on the spot’ at current market rates.”

In this report, certain charts contain both “spot” and “wholesale” prices for given commodities alongside each other within the same chart. In these instances, the wholesale prices shown are, in fact, wholesale market “spot” prices. Thus, the terms are interchangeable in charts where both terms are present in describing respective price series.

Strategic Petroleum Reserve (SPR) – An emergency fuel storage of crude oil maintained by the United States Department of Energy for use during periods of major supply interruption.

Virtual Trading Point – Commodity trading center created to service a specific geographic region but does not have a physical location.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

DESCRIPTIONS

General Conversion Information

- International pricing data for various commodities were converted by JKC from the units utilized by the original data source (in the form of currency value per unit of energy content or volume) to appropriate domestic units (in the form of U.S. dollars per common domestic unit of energy content or volume) in order to allow for convenient, informative comparison of international and domestic commodity price series through displaying them on a singular chart in consistent units. Appropriate domestic units for a given commodity are determined by whatever units are most commonly utilized in the United States to denote prices of that commodity, per the U.S. Energy Information Administration.
- International currency units were converted to U.S. dollars using historical exchange rates published by x-rates.com.
- Energy content and volume conversion factors differ by commodity. International energy content or volume units were converted using the various sources listed below:
 - Google.com In-Browser Unit Converter
 - Alberta Energy Co. Hub Natural Gas – gigajoules to mmBTU
 - Dutch TTF Hub Natural Gas – megawatt hours to mmBTU
 - Houston; Los Angeles; Rotterdam; Singapore; Port of Fujairah, UAE IFO 380, IFO 180 Bunker Fuel – liters/kilogram to gallons per metric ton
 - Iowa State University Liquid Fuel Measurements and Conversions
 - Netherlands Retail LPG – liters to metric tons, metric tons to barrels
 - Saudi ARAMCO Propane – metric tons to barrels
 - Japan Propane Imports – metric tons to barrels
 - Holland Retail Gasoline – liters to gallons
 - Singapore Retail Gasoline – liters to gallons
 - UAE Gasoline – liters to gallons
 - Edmonton Diesel Fuel – liters to gallons
 - Singapore Retail Diesel – liters to gallons
 - Holland Retail Diesel – liters to gallons
 - UAE Diesel – liters to gallons
 - Official Nebraska Government Website
 - Netherlands Retail LPG – barrels to gallons
 - Saudi ARAMCO Propane – barrels to gallons
 - Japan Propane Imports – barrels to gallons
 - Lanka IOC Oil Company
 - Houston; Los Angeles; Rotterdam; Singapore; Port of Fujairah, UAE IFO 380, IFO 180 Bunker Fuel – density, in liters per kilogram

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

CHART NOTES

All charts in this report are updated to the latest information available at the time of publication. Due to differing reporting dates for various data used throughout the report, all charts are not updated to the same ending period.

(1) Crude Oil Prices

- Sources: U.S. Energy Information Administration (Brent, West Texas Intermediate), IndexMundi via WorldBank (Dubai Fateh), Alberta.ca Economic Dashboard (Western Canadian Select), OPEC.org and Quandl.com (OPEC Reference Basket).
- The Organization of Petroleum Exporting Countries (OPEC) reference basket is a composite of the following blends of crude oil: Saharan Blend (Algeria), Girassol (Angola), Oriente (Ecuador), Zafiro (Equatorial Guinea), Rabi Light (Gabon), Iran Heavy (Islamic Republic of Iran), Basra Light (Iraq), Kuwait Export (Kuwait), Es Sider (Libya), Bonny Light (Nigeria), Qatar Marine (Qatar), Arab Light (Saudi Arabia), Murban (United Arab Emirates), Merey (Venezuela).
- All prices are spot or wholesale.

(2) Gasoline Prices

- Sources: U.S. Energy Information Administration (New York Harbor, U.S. Gulf Coast), Trading Economics (Singapore, Netherlands Retail), United Arab Emirates Ministry of Energy (UAE Retail).
- New York Harbor Spot, U.S. Gulf Coast Spot, Netherlands Retail and Singapore Retail all represent the price history of conventional gasoline in their respective locations. United Arab Emirates Retail represents an aggregate of unleaded 95, unleaded 98 and unleaded 91 prices in the United Arab Emirates.

(3) Diesel Prices

- Sources: U.S. Energy Information Administration (U.S. Gulf Coast, New York Harbor, Los Angeles, CA), Ec.europa.eu European Commission (Netherlands Retail), Knoema.com (Singapore Retail), United Arab Emirates (UAE Retail).
- New York Harbor, U.S. Gulf Coast and Los Angeles, CA prices represent ultra-low sulfur No. 2 diesel.
- Edmonton, Canada price represents low-sulfur diesel.
- Singapore Retail, United Arab Emirates Retail and Netherlands Retail prices represent conventional gasoil found at the pump. Gasoil is an alternative term for diesel commonly used throughout Europe.
- Netherlands Retail prices exclude taxes, Singapore Retail prices include taxes.

(4) Jet Fuel Prices

- Source: U.S. Energy Information Administration.
- All prices are spot or wholesale prices.

(5) U.S. Crude Oil and Petroleum Products Supply, Inventory and Consumption

- Source: U.S. Energy Information Administration.
- Crude Oil and Petroleum Products consist of natural gas plant liquids (ethane, propane, butane, isobutane, pentane), other liquids (hydrogen, oxygenates and renewable fuels like fuel ethanol, motor and aviation gasoline blending components, unfinished oils) and finished petroleum products (motor gasoline, aviation gasoline, kerosene-type jet fuel, kerosene, distillate fuel oil, residual fuel oil, petrochemical feedstocks, naphthas, lubricants, waxes, petroleum cokes, asphalt and road oil, still gas, miscellaneous products).
- Supply is comprised of field production, renewable fuels and oxygenate plant net production, refinery and blender net production, imports and net Petroleum Administration for Defense District (PADD) receipts. Net PADD receipts represent the net volume of product movement into and out of each PADD by tanker, barge and pipeline.
- Ending Stocks is a proxy for inventory and is defined as primary stocks held in storage as of midnight on the last day of the month. Primary stocks include products held in storage at, or in, leases, refineries, natural gas processing plants, pipelines, tank farms and bulk terminals with the capacity to store at least 50,000 barrels or that can receive product by tanker, barge or pipeline. Ending Stocks include volumes in the Strategic Petroleum Reserve (SPR) maintained by the Federal Government for use during periods of major supply interruption.
- Product Supplied is a proxy for consumption as it measures the disappearance of said product from primary sources, including refineries, processing plants, blending plants, pipelines and bulk terminals.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(6) U.S. Refinery Volumes and Wholesale Prices of Petroleum Products

- Source: U.S. Energy Information Administration Petroleum Marketing Monthly.

(7) U.S. Crude Oil Refinery Input, Distillation Capacity and Refinery Utilization

- Source: U.S. Energy Information Administration Petroleum Supply Weekly.
- Net Input is defined as gross inputs less gross production. Crude Oil Refinery Net Input values are monthly aggregates of weekly net input averages, measured in thousands of barrels per day. The resulting values are represented as monthly average refinery inputs, measured in thousands of barrels per day.
- Refinery Capacity refers to the maximum amount of crude oil designed to flow into the distillation (or crude) unit of the refinery. Operable Capacity is equal to the sum of operating and idle capacity. Idle Capacity is capacity that is not in operation, not under active repair, and can be placed in operation within 30 days.

(8) U.S. Crude Oil and Petroleum Products Imports and Exports

- Source: U.S. Energy Information Administration Petroleum Supply Monthly.
- U.S. Net Imports of Petroleum Products data fall below zero at which point the U.S. becomes a net exporter.

(9) Domestic Natural Gas Citygate Prices per Region

- Source: U.S. Energy Information Administration.
- The prices shown are “Citygate” prices. A Citygate is defined as “a point or measuring station at which a distributing gas utility receives gas from a natural gas pipeline company or transmission system.” The Citygate price represents the benchmark price for a given region, accounting for all costs of acquisition, storage, and transportation of gas as well as other charges associated with local distribution companies obtaining the gas for sale to end-users.
- The Western market contains Oregon, Washington, California, Nevada, Arizona, New Mexico, Utah, Wyoming, Colorado, Montana, and Idaho.
- The Midwestern market contains North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Minnesota, Iowa, Missouri, Arkansas, Wisconsin, Michigan, Illinois, and Indiana.
- The Gulf market contains Texas and Louisiana; the Southeastern market contains Florida, Mississippi, Alabama, Georgia, Tennessee, North Carolina, and South Carolina.
- The Northeastern market contains Kentucky, Virginia, West Virginia, Ohio, Pennsylvania, New York, Vermont, New Hampshire, Maine, Massachusetts, Rhode Island, Connecticut, Delaware, New Jersey, and Maryland.

(10) International Natural Gas Prices

- Sources: U.S. Energy Information Administration (Henry Hub), NGX Clearinghouse (AECO Hub), BP Statistical Review of World Energy 2017 (United Kingdom NBP), World Bank via Index Mundi (Russian NG European Import Price), Knoema via World Bank (Japan LNG Import), my.Elexys.be Market Information (Dutch TTF).
- Henry Hub serves as the primary global pricing benchmark.
- Alberta Energy Company (AECO) Hub serves North America.
- United Kingdom National Balancing Point (NBP) serves the British Isles.
- Dutch Title Transfer Facility (TTF) serves continental Europe.
- Virtual Trading Point (Virtual) does not have a physical location and was created to serve a specific region.
- Japan LNG Import Price represents aggregate import prices of liquefied natural gas in Japan and is a price benchmark serving the Asia-Pacific region. The price includes costs, insurance and freight (CIF).
- All price benchmarks above represent gaseous state natural gas transported by pipeline, with the exception of Japan LNG Import Price, which represents liquid state natural gas transported by ship.
- All prices are spot or wholesale.

(11), (12), (13) and (14) Liquefied Natural Gas Prices

- Sources: Federal Energy Regulatory Commission (U.S., Mexico, Belgium, India), World Bank via Bluegold Research (Brazil/Argentina, Japan/Korea, China, United Kingdom).
- All prices are “landed” prices. Landed price is the price received at the regasification terminal and is based on a netback calculation that removes the costs of pipeline transportation, regasification, waterborne shipping and liquefaction, so as to best represent the effective price to the producer or seller at a specific location or defined point.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(15) U.S. Import / Export Liquefied Natural Gas Prices

- Source: U.S. Energy Information Administration.
- All prices are spot or wholesale.

(16) Natural Gas Plant Liquids Prices

- Source: U.S. Energy Information Administration.
- Natural gas liquids spot prices at Mont Belvieu, TX.
- Natural Gas Plant Liquids (NGPL) Composite price includes ethane, propane, butane, isobutane and natural gasoline. Daily closing spot prices for each component are averaged into a monthly series, then weighted according to the portion of a representative natural gas plant liquids barrel that they occupy. The NGPL Composite price excludes natural gas liquids produced at crude oil refineries.

(17) U.S. Natural Gas Production and Consumption

- Source: U.S. Energy Information Administration.
- Marketed Production is equal to gross withdrawals of natural gas from production reservoirs, less gas used for reservoir repressuring, nonhydrocarbon gases removed in treating and processing operations, and quantities vented and flared (gas that is disposed of by release into the atmosphere).

(18) U.S. Natural Gas Supply and Inventory

- Source: U.S. Energy Information Administration.
- Working Gas is defined as the total amount of natural gas in storage less the amount of base gas. Base gas is the amount of gas intended as permanent inventory.

(19) U.S. Natural Gas Consumption by End Use

- Source: U.S. Energy Information Administration.

(20) U.S. Natural Gas Plant Liquids Production

- Source: U.S. Energy Information Administration.
- Natural Gas Plant Liquids Production refers to the sum of all production of ethane, propane, butane, isobutane, pentane and pentane plus.

(21) U.S. Liquefied Natural Gas Import and Export Volumes

- Source: U.S. Energy Information Administration.

(22), (23) and (24) North American LNG Import / Export Terminals – Proposed, Approved and Existing

- Source: Federal Energy Regulatory Commission.

(25) Heating Oil Prices

- Source: U.S. Energy Information Administration.
- Spot prices of No 2. heating oil at New York Harbor, alongside the spot prices of West Texas Intermediate crude oil for comparison purposes.

(26) Intermediate Fuel Oil aka “Bunker Fuel” Prices

- Source: Ship & Bunker.
- Intermediate Fuel Oil, also known as IFO and Bunker Fuel, is fuel utilized by ships and barges to facilitate international exchange of various commodities across an array of industries, including energy. It is classified in the maritime field by its viscosity, measured in centistokes. IFO 380 has a maximum viscosity of 380 centistokes, while IFO 180 has a maximum viscosity of 180 centistokes. IFO 380 is comprised of 98% residual fuel oil and 2% distillate fuel oil. IFO 180 is comprised of 88% residual fuel oil and 12% distillate fuel oil.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(27) Propane Prices

- Sources: U.S. Energy Information Administration (Conway, KS and Mont Belvieu, TX spot prices), Government of Canada National Energy Board (Edmonton, Canada trading hub prices), Ec.europa.eu European Commission (Netherlands Retail prices), LPG Australia and news articles (Saudi ARAMCO contract prices), Knoema.com and Petroleum Association of Japan (Japan Imports prices).
- Conway, KS and Mont Belvieu, TX retail prices are propane prices, while Saudi ARAMCO Contracts and Japan Imports are liquefied petroleum gas (LPG) prices. Netherlands Retail and Edmonton, Canada retail prices are auto propane and exclude taxes.
- Propane and LPG prices are represented on the same chart due to the fact that propane is dealt in international marketplaces as LPG, and is referred to as LPG in many European and Asian countries. LPG is comprised of a mixture of propane and butane.
- Conway, KS wholesale prices are typically available only for the winter months (October through March), during which propane demand is driven by cold weather, therefore, the data series displayed is intermittent.

(28) No. 1 Distillate Fuel Oil, Residual Fuel Oil Wholesale, Retail Sales Volume by Refiners

- Source: U.S. Energy Information Administration.
- No. 1 Distillate Fuel Oil consists of No. 1 diesel fuel and No. 1 fuel oil. The former is used in high-speed diesel engines, including those used by metropolitan buses and smaller automobiles. No. 1 fuel oil is utilized primarily as fuel for portable outdoor stoves and heaters.
- Residual Fuel Oil is the general classification for heavy oils that remain after lighter oils are distilled away in the process of petroleum refining. Residual Fuel Oil includes No. 5 and No. 6 fuel oils. The former is used in steam-powered vessels, and the latter is used for electric power generation, space heating, vessel bunkering and industrial processes.
- All wholesale and retail sales volumes refer to those sold by refiners only.

(29) No. 2 Distillate Fuel Oil Wholesale, Retail Sales Volume by Refiners

- Source: U.S. Energy Information Administration.
- No. 2 Distillate Fuel Oil consists of No. 2 diesel fuel and No. 2 fuel oil (heating oil). No. 2 diesel fuel is utilized in on-and-off highway diesel engines, including those used by railroad locomotives, trucks, automobiles and agricultural machinery. No. 2 fuel oil (heating oil) is used for space heating and moderate capacity industrial/commercial burner units.
- All wholesale and retail sales volumes refer to those sold by refiners only.

(30) Propane & Propylene and Distillate Fuel Oil Production and Consumption

- Source: U.S. Energy Information Administration.
- Distillate Fuel Oil is a general classification for a variety of petroleum fractions produced in petroleum distillation operations. Included within this classification are No. 1, No. 2 and No. 4 diesel fuels (used in on-highway and off-highway diesel engines), as well as No. 1, No. 2 and No. 4 fuel oils (used primarily for space heating and electric power generation).
- Propylene is an important petrochemical feedstock that is recovered from refinery or petrochemical processes. It is an olefinic hydrocarbon that is gaseous at standard temperature and pressure.
- Product Supplied is a proxy for consumption as it measures the disappearance of said product from primary sources, including refineries, processing plants, blending plants, pipelines and bulk terminals.

(31) U.S. Ending Stocks of Propane & Propylene and Distillate Fuel Oil

- Source: U.S. Energy Information Administration.
- Distillate Fuel Oil is a general classification for a variety of petroleum fractions produced in petroleum distillation operations. Included within this classification are No. 1, No. 2 and No. 4 diesel fuels (used in on-highway and off-highway diesel engines), as well as No. 1, No. 2 and No. 4 fuel oils (used primarily for space heating and electric power generation).
- Propylene is an important petrochemical feedstock that is recovered from refinery or petrochemical processes. It is an olefinic hydrocarbon that is gaseous at standard temperature and pressure.
- Ending Stocks are defined as the total volume of a propane and propylene/distillate fuel oil held in storage as of the last day of the period. Ending Stocks are monthly averages of Ending Stocks reported at the end of each week during that month, not the amount of Ending Stocks reported at the end of the month. The resulting values are represented as monthly average inventory levels.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(32) U.S. Land Well Count, Rig Count and Wells per Rig

- Source: Platts S&P Global Quarterly Well Count Report.
- Well and rig count data include only those on United States land. Thus, no offshore data is included.
- Platts RigData U.S. Land Rig Count methodology states that a rig is added to the count every time a new oil platform, or rig, is set up on a given site, or every time an existing rig moves to a new location and drills on that site.
- Platts RigData derives U.S. Land Well Count data through tracking new drilling permits and drilling activity only. Thus, the wells comprising the U.S. Land Well Count do not necessarily have to be completed or produce oil or gas in order to be included. For this reason, the well count represented overstates the amount of completed and producing wells that exist on U.S. land.

(33) U.S. Well Starts by Depth

- Source: Platts RigData.
- Total number of well starts by depth on U.S. Land, U.S. Inland Waters and U.S. Offshore, respectively.

(34) Percentage of Crude Oil and Natural Gas Production per Shale Region

- Source: U.S. Energy Information Administration Drilling Productivity Report.
- Percentage of total U.S. crude oil and natural gas production from each of the shale regions.

(35) Drilled but Uncompleted Wells vs. Crude Oil Price

- Source: U.S. Energy Information Administration Drilling Productivity Report.
- Drilled but Uncompleted (DUC) Wells are oil and gas wells that have been drilled but haven't gone through the process of completion (the process of installing well casing, tubing and other equipment that prepares a well for production). The number of DUC wells has significant implications on the domestic supply response to crude oil price changes. If crude oil prices decrease, it is theoretically likely that the amount of DUC wells will increase, and vice versa in an increasing crude oil price scenario. Therefore, the West Texas Intermediate Crude price is tracked for comparative purposes.

(36) Hydraulic Fracturing Sand Consumption and Producer Price Index

- Sources: IHS Markit (consumption), U.S. Bureau of Labor Statistics (producer price index).
- Hydraulic Fracturing Sand is sand utilized as a proppant in the process of hydraulic fracturing to help facilitate the extraction of oil and gas from subsurface rock formations.
- Total 2017 Hydraulic Fracturing Sand Consumption contains actual data for January through April 2017, while May through December 2017 consumption data is projected based on IHS Markit's ProppantIQ research.
- The Producer Price Index for Hydraulic Fracturing Sand measures the weighted average period-to-period change in the selling prices received by domestic producers of hydraulic fracturing sand.
- 2017 Producer Price Index shows annual average as of 9/29/2017.
- Hydraulic Fracturing Sand Producer Price Index Base = 100 at December 2012.

(37) and (38) Crude Oil and Natural Gas Production, Rig Count and Production per Rig

- Sources: U.S. Energy Information Administration Drilling Productivity Report (new-well crude oil and natural gas production per rig), Baker Hughes Inc. (rig count).
- New-Well Crude Oil or Natural Gas Production per Rig in each quarter represents the average of each month's value. New-well production per rig is estimated by dividing several trailing months of data on total production from new wells in each region by that region's monthly rig count, lagged by two months. New-well production per rig is intended to indicate an average rig's contribution to total crude oil production from new wells.
- The determination between a crude oil rig and a natural gas rig is made by the operating company at the time of issuance of the rig permit by the relevant state's permitting authority. The classification of a given rig as an oil or gas rig is based solely upon the operator's judgment after drilling an appraisal well and determining its specific hydrocarbon content. For example, if a well's production comes 50% from gas, 20% from Natural Gas Liquids and 30% from oil, it could either be listed as a gas rig, because gas comprises the largest share of hydrocarbons, or an oil rig because oil drives the well's economics. This determination is at the judgment of the operator.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(39) U.S. Drilling Rigs by Type

- Source: Baker Hughes North America Rotary Rig Count.
- A vertical well is a well that penetrates the earth vertically below the surface-mounted drilling platform, or the surface location of the well.
- A directional well is classified as one in which the surface location of the well is not vertically above the target reservoir. Thus, the well deviates horizontally from its surface location in order to reach the target reservoir, at a specific azimuth and incline. Azimuth measures the cardinal direction of the well's path relative to the surface location, and incline measures degrees of deviation from vertical.
- Per Baker Hughes methodology, a horizontal well is a type of directional well that deviates from vertical by greater than 80 degrees, or one in which the lower part of the wellbore is parallel to the "pay zone." The pay zone is the section of a reservoir that contains hydrocarbons that can be produced economically.

(40) Wind and Solar Prices

- Source: Lazard's Levelized Cost of Energy Analysis 2012-2016.
- The Levelized Cost of Energy (LCOE) is the net present value of the per-megawatt hour cost of building and operating a generating plant over an assumed financial life and duty cycle. It is utilized as a means of comparing the cost-competitiveness of various energy-generating technologies of unequal life spans, project sizes, capital profiles and capacities.
- The respective levelized costs of each generation technology for each year are a simple average of the high and low values of the cost range associated with that generating technology during that year.
- Solar PV refers to solar photovoltaic.
- Solar PV – Community refers to a solar power plant whose electricity is shared by more than one household.
- Solar PV – Rooftop Residential refers to a Solar PV system that has its solar panels mounted on the rooftop of a residential structure.
- Solar PV – Crystalline Rooftop refers to crystalline solar panels mounted on rooftops. Crystalline panels are a type of solar panel that achieves the photoelectric effect, the chemical process that converts solar (light) energy to electricity, through use of crystalline silicone solar cells.
- Solar PV – Crystalline Utility-Scale refers to a solar power plant that uses crystalline panels to generate power that is fed into the grid, supplying a utility with energy.
- Solar PV – Thin Film Utility-Scale refers to a solar power plant that uses thin-film solar panels to generate power that is fed into the grid, supplying a utility with energy. Thin-film panels differ from crystalline panels in that the photoemissive materials, those which produce an electric current when contacted by sufficient solar energy, are not cut from crystals.
- Solar Thermal refers to solar technology that generates thermal energy to heat water or other fluids, rather than generating electricity.

(41) U.S. Total Renewable Energy Consumption

- Source: U.S. Energy Information Administration Monthly Energy Review.
- Total Renewable Energy Consumption is comprised of hydroelectric, geothermal, solar, wind, wood, waste and biofuels.
- Waste refers to biomass waste and is organic non-fossil material of biological origin that is a byproduct or a discarded product. Biomass waste includes municipal solid waste from biogenic sources, landfill gas, sludge waste, agricultural crop byproducts, straw and other biomass solids, liquids and gases.
- Biofuels are liquid fuels and blending components produced from biomass feedstocks, used primarily for transportation. Biomass is organic, non-fossil material comprised of decayed biological matter.

(42) U.S. Solar, Wind and Hydroelectric Energy Consumption

- Source: U.S. Energy Information Administration Monthly Energy Review.

(43) U.S. Wood, Waste, Biofuels and Geothermal Energy Consumption

- Source: U.S. Energy Information Administration Monthly Energy Review.
- Biofuels are liquid fuels and blending components produced from biomass feedstocks, used primarily for transportation. Biomass is organic, non-fossil material comprised of decayed biological matter.

(44) Corn and Ethanol Prices and Corn Cost per Gallon of Ethanol

- Source: U.S. Department of Agriculture Economic Research Service (corn and ethanol price).

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(45) U.S. Solar Energy Consumption

- Source: U.S. Energy Information Administration Monthly Energy Review.
- Utility-scale solar energy refers to solar energy generated by plants with a capacity of at least one megawatt that is transmitted via the transmission grid to a high volume of consumers. Thus, Utility-Scale Solar Energy Consumption represents consumption of solar energy generated at plants with capacity of at least one megawatt.
- Distributed solar energy refers to solar energy generated by small-scale generating plants with capacity below one megawatt that is distributed over a specific locality with a small volume of consumers relative to utility-scale energy consumers. Thus, Distributed Solar Energy Consumption represents consumption of solar energy generated at small-scale generating plants.

(46) U.S. Solar Energy Net Generation

- Source: U.S. Energy Information Administration Monthly Energy Review.
- Distributed Solar Photovoltaic Generation refers to energy generated by small-scale photovoltaic generation plants. Small-scale is defined as a plant with capacity below one megawatt. Photovoltaic generation refers to solar energy generated by photovoltaic solar panels.
- Utility-Scale Solar Electricity Net Generation refers to generation of solar energy by plants with capacity equal to or above one megawatt. Net generation is defined as the amount of gross generation less electrical energy consumed by the generating plant for service or auxiliaries.

(47) Distributed Solar Photovoltaic Generation by Sector

- Source: U.S. Energy Information Administration Monthly Energy Review.
- Distributed Solar Photovoltaic Generation refers to energy generated by small-scale photovoltaic generation plants. Small-scale is defined as a plant with capacity below one megawatt. Photovoltaic generation refers to solar energy generated by photovoltaic solar panels.

(48) Utility-Scale Solar Electricity Net Generation by Sector

- Source: U.S. Energy Information Administration Monthly Energy Review.
- Utility-Scale Solar Electricity Net Generation refers to generation of solar energy by plants with capacity equal to or above one megawatt. Net generation is defined as the amount of gross generation less electrical energy consumed by the generating plant for service or auxiliaries.
- Gaps in the data represent periods for which there was no data reported, or the data value was trivially small and thus deemed unnecessary to report.

(49) U.S. Solar Capacity Installations

- Source: Solar Energy Industries Association Q1 2017 Solar Market Insight Report.
- The Investment Tax Credit (ITC) is a federal policy tax incentive that supports the deployment of solar energy in the United States. The ITC allows those who install a solar system to claim up to 30% of the price paid to install the system as a tax credit when filing Federal taxes, thereby significantly discounting the cost associated with transitioning to solar energy.

(50) U.S. Wind Power Capacity Installations

- Source: American Wind Energy Association U.S. Wind Energy Quarterly Market Report.
- Wind Power Generation Capacity Installations refers to non-utility-scale wind power capacity additions. Utility-scale is defined as installations of wind turbines larger than 100 kilowatts.

(51) Utility-Scale Wind Power Capacity Installations

- Source: American Wind Energy Association U.S. Wind Energy Quarterly Market Report.
- Utility-Scale Wind Capacity includes installations of wind turbines larger than 100 kilowatts. Capacity installations may not always equate to an equal increase in cumulative wind power capacity due to decommissioned, uprated and repowered wind turbines.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(52) Wind Power Under Construction or in Advanced Development

- Source: American Wind Energy Association (AWEA) U.S. Wind Energy Quarterly Market Report.
- AWEA defines projects as being “in advanced development” if it has not yet begun construction, but has either signed a power purchase agreement, announced a firm turbine order, or been announced to proceed under utility ownership.

(53) U.S. Aggregated Energy Consumption by Sector

- Source: U.S. Energy Information Administration.
- Energy consumed by the electric power sector is primary energy only. Primary energy is energy in its original form, before any transformation to secondary or tertiary forms of energy. For example, coal can be converted to synthetic gas and then to electricity. Under these circumstances, coal is primary energy, synthetic gas is secondary energy and electricity is tertiary energy.

(54) U.S. Aggregated Energy Consumption by Source

- Source: U.S. Energy Information Administration.
- Total consumption of each category of energy is as accurate as possible. However, some data is unavailable or unreported and, thus, some total consumption values may be understated.
- Fossil Fuels includes coal, petroleum-based products, natural gas and natural gas-based products.
- Renewable Energy includes conventional hydroelectric, solar, biomass, nuclear, geothermal and wind.
- Biomass is a renewable energy source derived from organic matter such as wood, crop waste, or garbage, with wood being the largest contributor.
- Fossil Fuels and Renewable Energy consumption represent consumption of primary energy, which is energy in its original form, before transformation to secondary or tertiary forms of energy. Thus, to arrive at total energy consumption, Electricity Retail Sales (representing consumption of secondary and tertiary forms of energy) is added alongside consumption of Fossil Fuels and Renewable Energy.
- Electrical System Energy Losses are a deduction from total energy consumption, and are incorrectly represented as positively contributing to total energy consumption. Thus, total energy consumption figures in each year are overstated by the amount of electrical system energy losses.

(55) Electricity Prices by Sector

- Source: U.S. Energy Information Administration.

(56) Commercial Crude Oil Inventory

- Source: U.S. Energy Information Administration.
- U.S. Ending Stocks of Commercial Crude Oil represents stocks (inventory) of crude oil held in storage for commercial use. This figure excludes both lease stock and volumes in the Strategic Petroleum Reserve (SPR). Lease stock is crude oil stored in tanks at sites where producers are drilling on leased land. They're excluded from total commercial crude oil inventory because they aren't yet available for commercial use. The SPR is petroleum maintained by the Federal Government for use during periods of major supply interruption.
- Ending stocks (inventory) are primary stocks of crude oil held in storage as of midnight on the last day of the month. Primary stocks include crude oil held in storage at, or in, leases, refineries, natural gas processing plants, pipelines, tank farms and bulk terminals with the capacity to store a minimum of 50,000 barrels of petroleum products or that can receive petroleum products by tanker, barge or pipeline.

(57) Petroleum and Other Liquids Commercial Inventory

- Source: U.S. Energy Information Administration.
- Hydrocarbon Gas Liquids (HGLs) are molecules of carbon and hydrogen in various combinations. HGLs include alkanes, or paraffins (ethane, propane, butane, isobutene, natural gasoline) and alkenes, or olefins (ethylene, propylene, butylene, isobutylene).
- Unfinished Oils are all oils that require further processing and are produced by partial refining of crude oil. Unfinished Oils include naphthas and lighter oils, kerosene and light gas oils, heavy gas oils and residuum.
- Other Hydrocarbons/Oxygenates are substances that increase the amount of oxygen in various gasoline blends when added to them. This category includes fuel ethanol, methanol and methyl tertiary butyl ether (MTBE).
- Total Motor Gasoline includes finished motor gasoline and motor gasoline blending components.

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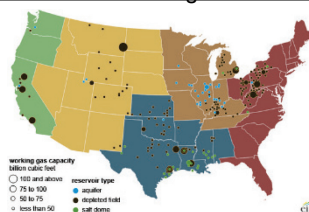
(57) Petroleum and Other Liquids Commercial Inventory (continued)

- Distillate Fuel Oil is a general classification for a variety of petroleum fractions produced in petroleum distillation operations. Included within this classification are No. 1, No. 2 and No. 4 diesel fuels (used in on-highway and off-highway diesel engines), as well as No. 1, No. 2 and No. 4 fuel oils (used primarily for space heating and electric power generation).
- Residual Fuel Oil is the general classification for heavy oils that remain after lighter oils are distilled away in the process of petroleum refining. Residual Fuel Oil includes No. 5 and No. 6 fuel oils. The former is used in steam-powered vessels, and the latter is used for electric power generation, space heating, vessel bunkering and industrial processes.
- Other Oils include aviation gasoline blending components, finished aviation gasoline, kerosene, petrochemical feedstocks, special naphthas, lubricants, waxes, petroleum coke, asphalt and road oil, still gas and miscellaneous products.

(58) Natural Gas Underground Storage Capacity

- Source: U.S. Energy Information Administration.
- Underground Storage Capacity refers to total natural gas storage capacity in underground storage facilities called “salt domes,” which are caverns hollowed out in subsurface salt formations. Salt domes are the primary means of natural gas storage in the United States.

U.S. Underground Natural Gas Storage Facilities by Type (July 2015)



(59) Commercial Crude Oil Refinery, Tank and Underground Storage Capacity and Utilization

- Source: U.S. Energy Information Administration.
- Commercial Crude Oil Storage Capacity refers to working storage capacity. Working capacity is the volume difference between a crude oil storage tank’s maximum safe fill capacity and the volume below which pump suction is ineffective, called tank bottoms.
- Crude Oil Shell Storage Capacity is the design capacity of a petroleum storage tank. It includes tank bottoms, working storage capacity and contingency space. Contingency space is defined as available storage space above the defined maximum operating inventory level that remains empty during normal operations. Shell Storage Capacity is always greater than or equal to working storage capacity.
- Crude Oil Storage Capacity data is released only twice per year for the months of March and September. Thus, the data series excludes inventory levels for all months other than March and September of each year.

(60) Crude Oil and Natural Gas Pipeline Mileage

- Source: Pipeline and Hazardous Materials Safety Administration.
- The chart includes information from only Federal Energy Regulatory Commission-regulated pipeline companies.
- Crude Oil Pipeline Mileage represents total mileage of pipelines dedicated to the transport of crude oil and those dedicated to the transport of petroleum products. Pipeline Mileage for crude oil includes trunk lines only.
- Pipeline Mileage for natural gas includes both trunk and gathering lines.
- Trunk lines are synonymous with transmission lines, which are large, cross-country pipelines that move oil or gas from producing areas to refineries. Gathering lines are pipelines that transport oil or gas from the area in which it was produced to a storage facility which acts as an intermediate stop before transportation by truck, railcar, or trunk line.

(61) Crude Oil and Petroleum Products Pipeline Movements Between Petroleum Administration for Defense Districts (PADDs)

- Source: Federal Reserve Bank of St. Louis, with data provided by the U.S. Energy Information Administration.
- Crude Oil and Petroleum Products Pipeline Movements Between PADDs represents the total volume of crude oil and petroleum products transported between each PADD. The data does not include movements within each PADD.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(62) Natural Gas Cumulative Interstate Pipeline Systems Capacity

- Source: U.S. Energy Information Administration.
- Cumulative Interstate Capacity refers to capacity of natural gas pipelines crossing between states. Thus, capacity of intrastate pipelines is not included and the data should not be interpreted as representing total capacity of natural gas pipelines.

(63) Crude Oil and Petroleum Products Exports to Mexico

- Source: U.S. Energy Information Administration.
- Petroleum Products include pentanes plus, liquefied petroleum gases, unfinished oils, finished motor gasoline, motor gasoline blending components, oxygenates, fuel ethanol, distillate fuel oil, kerosene, kerosene-type jet fuel, special naphthas, residual fuel oil, waxes, petroleum coke, asphalt and road oil, lubricants and miscellaneous products.

(64) Truck Tonnage Index

- Source: U.S. Department of Transportation, Bureau of Transportation Statistics.
- The Truck Tonnage Index measures the gross tonnage of freight that is transported by motor carriers for a given month. The Index serves as an indicator of shipping activity in the United States.
- Created by the U.S. Department of Transportation, Bureau of Transportation Statistics via information published in the American Trucking Association (ATA) Monthly Truck Tonnage Report.
- In January 2018, ATA revised the seasonally adjusted index back five years as part of its annual revision. In addition, ATA re-indexed the seasonally adjusted and not seasonally adjusted tonnage indexes to 2015 = 100 back to 1973.

(65) Heavy Truck Sales

- Source: Federal Reserve Bank of St. Louis.
- Heavy Trucks are trucks with more than 14,000 pounds gross vehicle weight.

(66) Trucking Conditions Index

- Source: FTR Transportation Intelligence.
- The Trucking Conditions Index summarizes the status of the trucking industry through tracking changes in six major conditions including freight volumes, freight rates, fleet capacity, fleet bankruptcies, fuel price and financing.
- An index value greater than zero represents a positive environment in the truck market, and an index value below zero represents a negative environment. An index value above 10 is a sign that volumes, prices and margin are in a solidly favorable range.

(67) Freight Transportation Services Index

- Source: Federal Reserve Bank of St. Louis.
- The Freight Transportation Services Index measures the output of the for-hire freight transportation industry and consists of data from for-hire trucking, rail, inland waterways, pipelines and air freight.

(68) Crude Oil Refinery Receipts by Transportation Method

- Source: U.S. Energy Information Administration.
- Refinery Receipts by Pipeline, Tanker, Barge, Truck and Rail refer to total volumes of crude oil of domestic and international origin that are in transit to, or received by, domestic refineries. Volumes of crude oil in transit via pipeline are excluded from receipts. Foreign crude oil is included in receipts only after entry through customs.
- Refinery inputs track volumes of crude oil that are entered into refining processes (e.g., distillation units, cokers, etc.).
- The volume difference between refinery receipts and refinery inputs is that which is in transit but not yet received by refineries plus that which has been received and is held in bonded storage, awaiting entry into refining processes.

(69) Crude Oil Movements by Tanker and Barge Movements Between Petroleum Administration for Defense Districts (PADDs)

- Source: U.S. Energy Information Administration.
- The data series shown on the chart is an aggregate of all crude oil movements between Petroleum Administration for Defense Districts (PADDs). This includes crude oil movement from PADD 1 to PADD 2 and PADD 3; PADD 2 to PADD 1 and PADD 3; and PADD 3 to PADD 1, PADD 2 and PADD 5.
- PADD 1 is the East Coast region, PADD 2 is the Midwest region, PADD 3 is the Gulf Coast region and PADD 5 is the West Coast region.

DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES

(70) Movements of Crude Oil by Rail

- Source: U.S. Energy Information Administration.

(71) Average Weekly Rail Carloads of Petroleum and Petroleum Products

- Source: Association of American Railroads.
- Monthly aggregates of the average weekly number of rail carloads transporting petroleum and petroleum products in the United States.
- Excludes the U.S. operations of Canadian railroads.

(72) U.S. Manufacturers' Monthly Shipments and U.S. Purchasing Managers' Index (PMI)

- Sources: For Manufacturers' Monthly Shipments - U.S. Census Bureau Manufacturers' Shipments, Inventories and Orders Survey; and for U.S. Purchasing Managers' Index (PMI) – Institute for Supply Management Manufacturing Report on Business®.
- A PMI above 50 represents expansion within the manufacturing sector compared with the prior month.

(73) U.S. New Housing Starts and Total U.S. Construction Spending

- Source: U.S. Census Bureau.

(74) London Interbank Offered Rate (LIBOR), Based on U.S. Dollar

- Source: ICE Benchmark Administration Limited via the Federal Reserve Bank of St. Louis.
- The London Interbank Offered Rate is the average interest rate at which leading banks borrow funds of a sizeable amount from other banks in the London market. LIBOR is the most widely used benchmark or reference rate for short term interest rates. The chart values are monthly percent averages of daily figures and are not seasonally adjusted.

(75) Bank Prime Loan Interest Rates

- Source: Federal Reserve Bank of St. Louis.
- The Bank Prime Loan Interest Rate is that posted by a majority of top 25 (by assets in domestic offices) insured, U.S.-chartered commercial banks. Prime is one of several base rates used by banks to price short-term business loans.
- The chart values are monthly percent averages of daily figures and are not seasonally adjusted.

(76) Commercial and Industrial Loans vs. Banking Standards

- Source: Federal Reserve Bank of St. Louis.
- Net Percentage of Domestic Banks Tightening Standards for Commercial and Industrial Loans to large and middle-market firms. Quarterly, not seasonally adjusted.
- Commercial and Industrial Loans, All Commercial Banks. Monthly, seasonally adjusted.

(77) U.S. Treasury Yield Curve

- Source: U.S. Treasury.
- U.S. Treasury Yield Curve rates are commonly referred to as Constant Maturity Treasury (CMT) rates. Yields are interpolated by the U.S. Treasury from the daily yield curve.
- The curve, which relates the yield on a security to its time to maturity, is based on the closing market bid yields on actively traded U.S. Treasury securities in the over-the-counter market.

(78) Corporate Spreads to Treasuries by Quality

- Source: Federal Reserve Bank of St. Louis.
- Corporate Spreads to Treasuries represent the spread, or difference, between the yield curve of an index of corporate bonds of a given rating category and the spot rate U.S. Treasury curve. The spot rate U.S. Treasury curve is a yield curve that uses U.S. Treasury spot rates rather than yields, and represents the rate for a zero-coupon U.S. Treasury bond.
- The corporate bond yield indexes are Bank of America Merrill Lynch Option-Adjusted Spread (OAS) Indexes for all bonds with a given investment rating of AA, BB or CCC or below that are publically issued in the U.S. domestic market. Each respective OAS index is calculated using each constituent bond's OAS, weighted by market capitalization. A bond's OAS is the bond's yield spread relative to the risk-free rate of return, typically the U.S. Treasury securities yield, adjusted to account for an embedded option.

HOT TOPICS

FRACKING BAN? NOT A PRETTY PICTURE

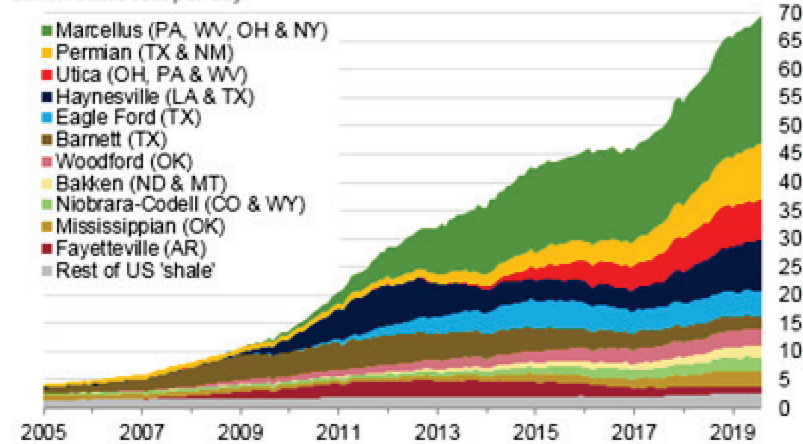
A ban on fracking has been proposed by leading candidates for President, the House and the Senate. So far none have defined what that might mean for Americans, our economy and our national security. Drawing from previously published data sources, we have compiled a picture of what a fracking ban might mean.

Banning fracking would mean the end of all U.S. production of oil, natural gas and natural gas liquids from shale within about four years, the time it would take from the start of the ban until existing shale wells are depleted.

A ban would result in the loss of 70%, or 9 out of 13 million barrels per day, of U.S. crude oil production; 70% or 70 out of 100 billion cubic feet per day (bcf/d) of natural gas production; and 60%, or over 4 out of 6.5 million barrels per day of natural gas liquids such as propane, ethane and butane.

Monthly dry shale gas production

billion cubic feet per day



Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through August 2019 and represent EIA's official tight gas estimates, but are not survey data. State abbreviations indicate primary state(s).

Here are some of the potential major impacts we see.

Workers

- There will be massive loss of jobs in crude oil production, infrastructure construction and the supply chain. In the construction and production supply chains alone, more than 1.6 million jobs will be lost, or 200,000 jobs per each million barrels of oil per day not produced. Jobs will be lost in all 50 states.
- In natural gas production and related infrastructure and its supply chain, over 600,000 jobs would be lost at a rate of 10,000 jobs per bcf/d not produced.
- Over 750,000 jobs would be lost from cancelled shale gas-dependent chemical industry production facilities, along with \$57 billion of lost payroll annually.
- Hundreds of thousands more construction jobs would be lost from cancelled pipeline, liquefied natural gas (LNG) and crude oil export terminal projects now planned or under construction.

HOT TOPICS

FRACKING BAN? NOT A PRETTY PICTURE (CONTINUED)

Consumers

- World crude oil prices will likely rise to pre-shale levels of \$100 - \$150 per barrel or higher. This will cause fuel prices to at least double, with gasoline prices rising to the vicinity of \$5 per gallon. About 70% of the price of gasoline is in the cost of crude oil.
- Natural gas prices for home heating and cooking will quadruple, driven by market prices now under \$2.50 per thousand cubic feet (mcf) rising back to the vicinity of \$10.00 that was typical in the 2003 - 2008 pre-shale timeframe.
- Electricity prices will follow suit as the cost of fuels rise.
- Rising household energy costs will reduce consumer purchasing power.
- Increased energy costs to business and industry will add to the price of food, goods and services and the overall cost of living.
- The cost of everything that arrives by ship, train, plane or truck will rise and be passed through to consumers in the price of goods.
- Airline ticket prices will rise. About 20% to 30% of airlines' operating cost is jet fuel. Expect ticket prices to jump by a similar amount.

The Environment

- Until far more renewable capacity can be brought online, America will likely be more reliant on coal for a greater portion of our power generation. In 2006, coal supplied 50% of power versus 20% for natural gas, compared to 27% and 35% respectively today. That positive trend will be reversed.
- Returning a larger share of power generation to coal would add up to 1 billion tons annually of carbon dioxide emissions into the atmosphere, reversing the historic gains in CO2 reduction achieved over the past two decades from fuel switching.
- Developing Asian countries, by far the greatest source of greenhouse gas emissions, will be deprived of natural gas from U.S. LNG, and will pay higher prices for LNG from other nations in the absence of American supplies. This will drive greater dependency on coal for power generation with resulting greatly increased carbon emissions.
- Without access to affordable U.S. LNG, growing populations in the poorest nations - particularly in South Asia and Africa - will continue to burn wood and other biomass resulting in higher carbon emissions and ongoing deforestation.

Industry

- Recent and planned investments in the vicinity of \$200 billion in U.S. shale gas-dependent petrochemical manufacturing capacity will be stranded or cancelled.
- The same will occur with LNG and crude oil export infrastructure in place, under construction or planned - with loss of another \$200 billion of investment - because of unavailability of natural gas and crude oil for export.
- Hundreds of billions of dollars of production infrastructure investments - well complexes, gathering systems, storage and separation assets would be stranded.

HOT TOPICS

FRACKING BAN? NOT A PRETTY PICTURE (CONTINUED)

Industry (continued)

- Large fleets of well drilling, pumping, hauling and storage equipment and specialized pipeline construction equipment would be devalued.
- In all such cases, investors large and small would see their investments - both in physical assets and equities, greatly devalued or rendered worthless.

The U.S. Economy

- Loss of employment, investment, purchasing power and household wealth would likely tip the economy into recession.
- Before fracking, in 2008 the U.S. imported over \$400 billion dollars of crude oil and petroleum products more than we exported. A ban will result in an early return to that greatly increased trade deficit, and along with it upward pressure on interest rates.

America's Geopolitical Standing

- We will return to dependency for oil on the Middle East and particularly the Persian Gulf. This will again make us hostage to the geopolitical instability of the region, and reliant on our military to defend Middle Eastern producing allies and sea lanes.
- We would rely heavily on imported LNG from Russia and the Middle East, at substantially higher cost than U.S. shale gas, and produced under much less careful environmental controls.
- Without access to U.S. LNG, Europe will remain completely dependent on Russia for natural gas.

Loss of Local, State and Federal Tax and Royalty Revenue

- Billions of state severance tax and impact fee revenues will be lost, negatively affecting producing states' budgets and public services.
- State and federal income tax revenues will be lost from laid off energy workers' incomes and loss of energy producer and infrastructure company corporate incomes.
- Royalty revenues from oil and gas production on federal or state-owned land will be lost to federal and state governments.
- Property tax revenues will be lost resulting from stranded, abandoned or removed physical energy infrastructure.
- Royalty income to private mineral rights owners will be lost, along with income taxes on those royalties.

Taken together, these frack-ban outcomes paint a picture of profoundly negative impact on the American people, our economy and our national security.

HOT TOPICS

MIDEAST TURMOIL HITS SAUDI ARAMCO

Oil giant Saudi Aramco (Aramco) launched the world's largest initial public offering (IPO) on December 11, 2019. The Saudi government sold 1.5% of its stake in the state-owned company raising \$25.6 billion. The company, considered the most profitable in the world, was valued at \$1.8 trillion. The initial public offering provided much-needed funds for Crown Prince Muhammad bin Salman's plan to reform the Saudi Arabian economy to make it more competitive in the global economy and less dependent on oil revenues.

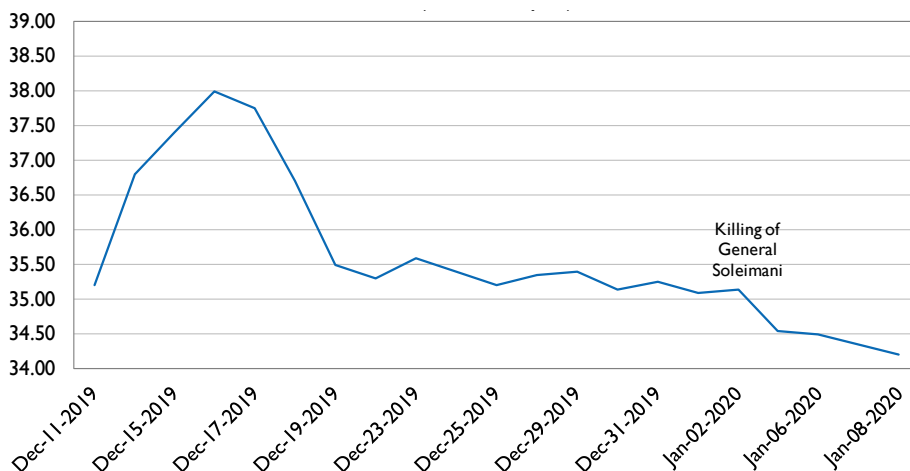
The company's market value has fallen by \$200 billion since its mid-December peak, and the stock's downtrend is accelerating in the wake of heightened tensions between the U.S. and Iran. The company's shares have dropped despite a surge in crude oil prices of as much as 6% to near \$70 per barrel, which suggests that rising oil prices aren't necessarily a boost for the energy giant.

As of January 8, shares of Aramco have fallen 10% from their peak on December 16, a few days after they began trading on Saudi Arabia's Tadawul exchange. Over the same period, BP PLC has gained 5.6%, Royal Dutch Shell PLC (U.K.-listed Class B shares) climbed 6% and ExxonMobil shares have fallen 1.1%.

Aramco shares have dropped further since the January 2nd killing of Iran's most prominent general, Quds Force commander Qassem Soleimani, by the United States. On January 8th, Aramco fell 0.4% to close at 34.20 Saudi riyals, or about \$9.12, a share. At that level, Aramco shares are down 2.8% from where they closed on their first day of trading on December 11th, but still 6.9% above the IPO price of 32 riyals (or \$8.53).

Saudi Aramco Share Pricing (in Saudi Riyals)

As of January 8, 2020



HOT TOPICS

MIDEAST TURMOIL HITS SAUDI ARAMCO (CONTINUED)

The attack on General Soleimani is a reminder of the risks of investing in the region. Investors are worried that Iran, one of Saudi Arabia's regional foes, could target Aramco's production facilities or its computer networks. In September of last year, the company's oil production was cut in half after explosive-armed drones struck some of its most important production facilities. The U.S. and Saudi Arabia suspect Iran of launching the attack. A month after the attack, Aramco was able to resume its normal production level of 9.9 million barrels per day.

Iran has strong cyber capabilities and it has previously been linked to attacks on major banks like JPMorgan Chase, Bank of America and Wells Fargo. In 2012, Aramco suffered one of the worst cyberattacks when 35,000 of its computers were partially wiped or totally destroyed by hackers.

Aramco's stock price depends on continued support from local and regional investors, as most of the investors who participated in the \$25.6 billion IPO were Saudi Arabian individuals, companies and institutions, along with the funds of neighboring Gulf Arab monarchies. Saudi Arabian government institutions invested about \$2.3 billion in the IPO.

Through its IPO and the company's numerous business ventures, Aramco is a national oil company that wants to become a global energy company. Much of the company's expansion plans focus on developing countries in Asia, where demand for oil is likely to grow in the coming years. The U.S. is also a target for growth especially in the areas of refining, petrochemicals and liquefied natural gas. Aramco already owns the largest oil refinery in the U.S., the Motiva Enterprises plant in Port Arthur, Texas. It also has research centers and technology offices in Boston and Houston, as well as an office in New York that organizes scheduling, storage and transportation of crude oil in the U.S. and Canada.

Despite its recent drop, Aramco remains the world's most valuable listed company with a valuation of \$1.8 trillion. The second-most valuable listed company, Apple Inc., is worth about \$1.3 trillion. Aramco earned \$111 billion in 2018 while producing 13.6 million barrels of oil per day. Its reserves are five times larger than its rivals – ExxonMobil, Chevron, Shell, Total and BP – combined.

Flare-ups of tension in the Middle East tend to benefit energy stocks because they generally boost the price of oil. However, Aramco is more exposed to the U.S.-Iran conflict than its peers around the world due to the concentration of infrastructure within the reach of Iran's military capabilities. The prospect of a wider conflict between Iran and the U.S./Saudi Arabia jeopardizes Aramco oil exports and also risks driving away the overseas investors Saudi Arabia needs to provide fresh capital and diversify its economy.

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- 1) The Wall Street Journal, "Saudi Aramco shares take hit from Mideast conflict," January 8, 2020.
 - 2) CNN, "Saudi Aramco has lost \$200 billion in value since its post-IPO peak. Iran fears aren't helping," January 6, 2020.
 - 3) Bloomberg, "Saudi Aramco faces tough test less than a month after IPO," January 6, 2020.
 - 4) Business Insider, "Saudi Aramco has seen \$200 billion of market value erased since its record-shattering IPO as Mideast tensions drag it lower," January 6, 2020.
 - 5) PBS News Hour, "What Americans should know about Saudi Aramco's IPO," December 11, 2019.
 - 6) MarketWatch, "The most important thing to know about the Saudi Aramco IPO," December 9, 2019.
 - 7) The Wall Street Journal, "Saudi Arabia seeks to ease tensions with Iran," December 12, 2019.

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PETROLEUM PRODUCTS EQUITY COMPARABLES (1)

Petroleum Products (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Calumet Specialty Products Partners, LP	\$3,526	\$273	7.7%	\$3.64	54.7%	\$282	\$1,850	0.5x	6.8x	5.5x
Chevron Corporation	145,629	31,133	21.4	118.60	92.9	225,152	252,334	1.7x	8.1x	0.8x
CVR Energy, Inc.	6,532	911	13.9	44.03	79.3	4,426	5,449	0.8x	6.0x	0.6x
EnLink Midstream, LLC	6,914	1,072	15.5	8.50	48.3	4,142	10,455	1.5x	9.8x	4.4x
Gibson Energy Inc.	5,276	326	6.2	17.18	93.1	2,498	3,503	0.7x	10.7x	2.9x
Exxon Mobil Corporation	260,812	32,862	12.6	70.61	81.3	298,758	352,301	1.4x	10.7x	1.4x
HollyFrontier Corporation	17,449	1,859	10.7	53.64	74.7	8,763	11,290	0.6x	6.1x	1.0x
Keyera Corp.	2,851	698	24.5	24.30	89.5	5,218	7,359	2.6x	10.5x	3.2x
Marathon Petroleum Corporation	125,366	9,641	7.7	60.75	70.2	39,993	79,695	0.6x	8.3x	3.1x
Parkland Fuel Corporation	12,977	917	7.1	32.10	89.5	4,727	7,612	0.6x	8.3x	2.9x
Phillips 66	107,266	6,204	5.8	102.40	85.9	45,931	59,389	0.6x	9.6x	1.8x
NuStar Energy LP	1,914	686	35.9	28.32	94.2	3,052	7,934	4.1x	11.6x	5.0x
Valero Energy Corporation	103,682	5,648	5.4	85.24	70.6	35,324	44,619	0.4x	7.9x	1.5x
Median			10.7%		81.3%			0.7x	8.3x	2.9x
Mean			13.4%		78.8%			1.2x	8.8x	2.6x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
4/24/2019	Anadarko Petroleum Corporation (NYSE:APC)	Occidental Petroleum Corporation (NYSE:OXY)	\$57,809.2	4.4x	7.6x
10/22/2018	EnLink Midstream Partners, LP (NYSE:ENLK)	EnLink Midstream, LLC (NYSE:ENLC)	\$12,923.5	1.7x	12.2x
8/27/2018	Blue Ridge Mountain Resources, Inc. (OTCPK:BRMR)	Eclipse Resources Corporation (NYSE:ECR)	\$348.0	3.6x	12.8x
8/1/2018	Energy Transfer Operating, LP	Energy Transfer, LP (NYSE:ET)	\$69,430.8	2.1x	10.9x
5/17/2018	Enbridge Energy Partners, LP (NYSE:EEP)	Enbridge Inc. (TSX:ENB)	\$15,925.8	6.6x	10.1x
4/30/2018	Andeavor (NYSE:ANDV)	Marathon Petroleum Corporation (NYSE:MPC)	\$35,103.0	0.9x	12.7x
11/8/2017	Alon USA Partners, LP	Delek US Holdings, Inc. (NYSE:DK)	\$1,050.4	0.5x	5.9x
4/5/2017	Houghton International Inc.	Quaker Chemical Corporation (NYSE:KWR)	\$1,415.4	-	11.8x
2/2/2017	ONEOK Partners, LP	ONEOK, Inc. (NYSE:OKE)	\$23,722.4	2.7x	12.9x

- (1) Matching public companies to middle-market companies is an imperfect comparable analysis due to the variables of size, equipment, markets, etc. Nonetheless JKC's research has yielded this list as the closest available.
- (2) LTM is defined as last twelve months.
- (3) Total Enterprise Value is defined as market capitalization plus total debt less cash and cash equivalents.
- (4) Net Debt is defined as total debt less cash and cash equivalents.

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

NATURAL GAS

EQUITY COMPARABLES (1)

Natural Gas (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Alliant Energy Corporation	\$3,641	\$1,286	35.3%	\$53.93	98.8%	\$12,810	\$19,392	5.3x	15.1x	4.9x
AltaGas Ltd.	4,296	840	19.5	14.69	88.0	4,083	11,414	2.7x	13.6x	7.1x
Atmos Energy Corporation	2,902	1,141	39.3	113.89	98.9	13,462	17,145	5.9x	15.0x	3.5x
Avista Corporation	1,353	428	31.6	48.44	91.9	3,202	5,384	4.0x	12.6x	5.2x
Baytex Energy Corp.	1,054	773	73.3	1.48	48.6	826	2,307	2.2x	3.0x	1.9x
Calumet Specialty Products Partners, LP	3,526	273	7.7	3.64	54.7	282	1,850	0.5x	6.8x	5.5x
Cenovus Energy Inc.	15,023	3,056	20.3	9.39	86.9	11,538	18,060	1.2x	5.9x	2.1x
Chesapeake Utilities Corporation	709	158	22.3	95.32	98.3	1,564	2,222	3.1x	14.1x	4.3x
Corning Natural Gas Holding Corporation	36	9	24.5	18.60	79.1	57	112	3.1x	12.8x	5.8x
Crestwood Equity Partners LP	3,111	384	12.3	36.51	91.3	2,639	5,878	1.9x	15.3x	6.1x
Dominion Energy, Inc.	15,458	6,682	43.2	81.04	99.5	65,106	109,583	7.1x	16.4x	6.3x
EnLink Midstream, LLC	6,914	1,072	15.5	8.50	48.3	4,142	10,455	1.5x	9.8x	4.4x
Enbridge Inc.	37,224	8,736	23.5	35.13	90.8	71,088	129,763	3.5x	14.9x	5.8x
Enterprise Products Partners LP	33,966	7,734	22.8	28.58	92.6	62,562	90,110	2.7x	11.7x	3.5x
Epsilon Energy Ltd.	28	17	61.6	4.12	88.3	105	89	3.1x	5.1x	(1.1)x
Eversource Energy	8,511	2,691	31.6	85.47	99.5	27,658	43,012	5.1x	16.0x	5.8x
Genesis Energy, LP	2,566	600	23.4	21.47	84.5	2,632	7,075	2.8x	11.8x	5.9x
National Fuel Gas Company	1,693	767	45.3	46.92	76.0	4,050	6,095	3.6x	7.9x	2.8x
New Jersey Resources Corporation	2,592	246	9.5	45.22	87.2	4,069	5,478	2.1x	22.3x	6.4x
Northwest Natural Holding Company	726	223	30.7	71.34	97.1	2,172	3,046	4.2x	13.7x	4.3x
MDU Resources Group, Inc.	5,168	717	13.9	28.19	97.8	5,611	8,128	1.6x	11.3x	3.4x
OGE Energy Corp.	2,271	826	36.4	45.38	99.1	9,084	12,533	5.5x	15.2x	4.1x
ONE Gas, Inc.	1,665	463	27.8	96.11	99.6	5,068	6,673	4.0x	14.4x	3.7x
ONEOK, Inc.	10,637	2,356	22.1	73.69	95.4	30,432	41,522	3.9x	17.6x	5.2x
RGC Resources, Inc.	68	19	28.2	29.24	94.3	236	326	4.8x	17.0x	5.3x
South Jersey Industries, Inc.	1,755	326	18.6	32.91	89.6	3,033	5,993	3.4x	18.4x	9.8x
Southwest Gas Holdings, Inc.	3,058	645	21.1	91.04	98.0	4,946	7,466	2.4x	11.6x	4.0x
Summit Midstream Partners, LP	464	235	50.6	4.86	28.8	402	2,069	4.5x	8.8x	5.9x
Targa Resources Corp.	8,795	1,285	14.6	40.17	67.8	9,351	19,789	2.3x	15.4x	5.7x
TC Energy Corporation	10,497	6,638	63.2	51.82	97.7	48,336	89,856	8.6x	13.5x	5.5x

Median	24.0%	91.6%	3.3x	13.6x	5.2x
Mean	29.7%	85.6%	3.5x	12.9x	4.8x

(1) Matching public companies to middle-market companies is an imperfect comparable analysis due to the variables of size, equipment, markets, etc. Nonetheless JKC's research has yielded this list as the closest available.

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

NATURAL GAS

SELECTED TRANSACTIONS (1)

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
10/21/2019	AltaGas Canada Inc. (TSX:ACI)	Alberta Teachers' Retirement Fund Board; Public Sector Pension Investment	\$1,278.2	5.2x	15.2x
9/16/2019	SemGroup Corporation	Energy Transfer LP (NYSE:ET)	\$5,007.4	1.9x	11.2x
8/27/2019	Tallgrass Energy, LP (NYSE:TGE)	The Blackstone Group Inc. (NYSE:BX)	\$9,337.3	9.9x	9.9x
5/8/2019	Andeavor Logistics LP	MPLX LP (NYSE:MPLX)	\$14,804.7	5.6x	10.6x
4/24/2019	Anadarko Petroleum Corporation (NYSE:APC)	Occidental Petroleum Corporation (NYSE:OXY)	\$57,809.2	4.4x	7.6x
11/8/2018	Western Gas Partners, LP (NYSE:WES)	Western Gas Equity Partners, LP (NYSE:WGP)	\$13,427.9	6.5x	12.0x
10/22/2018	EnLink Midstream Partners, LP (NYSE:ENLK)	EnLink Midstream, LLC (NYSE:ENLC)	\$12,923.5	1.7x	12.2x
10/9/2018	Antero Midstream Partners LP (NYSE:AM)	Antero Midstream GP LP (NYSE:AMGP)	\$7,359.7	7.7x	11.5x
9/28/2018	American Midstream Partners, LP (NYSE:AMID)	ArcLight Capital Partners, LLC	\$1,595.1	2.0x	14.2x
8/27/2018	Blue Ridge Mountain Resources, Inc. (OTCPK:BRMR)	Eclipse Resources Corporation (NYSE:ECR)	\$348.0	3.6x	12.8x
8/1/2018	Energy Transfer Operating, LP	Energy Transfer, LP (NYSE:ET)	\$69,430.8	2.1x	10.9x
5/17/2018	Williams Partners LP (NYSE:WPZ)	The Williams Companies, Inc. (NYSE:WMB)	\$57,052.1	7.0x	14.1x
4/25/2018	Rice Midstream Partners LP (NYSE:RMP)	EQM Midstream Partners, LP (NYSE:EQM)	\$2,443.1	7.7x	9.9x
11/1/2017	Southcross Energy Partners, LP (NYSE:SXE)	American Midstream Partners, LP (NYSE:AMID)	\$624.1	1.0x	14.8x
7/19/2017	Avista Corporation (NYSE:AVA)	Hydro One Limited (TSX:H)	\$5,332.4	3.7x	11.3x
5/15/2017	Ceiba Energy Services Inc. (TSXV:CEB)	Secure Energy Services Inc. (TSX:SES)	\$28.2	4.3x	30.3x
4/3/2017	Rockies Express Pipeline LLC	Tallgrass Energy Partners, LP (NYSE:TEP)	\$4,043.9	-	7.3x
2/21/2017	Delta Natural Gas Company, Inc. (NasdaqGS:DGAS)	PNG Companies LLC	\$260.2	3.7x	13.7x
2/1/2017	ONEOK Partners, LP	ONEOK, Inc. (NYSE:OKE)	\$23,721.4	2.3x	12.9x
1/25/2017	WGL Holdings, Inc. (NYSE:WGL)	AltaGas Ltd. (TSX:ALA)	\$6,634.5	2.7x	15.3x

(1) Total Enterprise Value is defined as market capitalization plus total debt less cash and cash equivalents.

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PROPANE AND HEATING/FUEL OIL EQUITY COMPARABLES (1)

Propane and Heating/Fuel Oil (United States & Canada)

Company	LTM ⁽²⁾			Stock Price	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ / EBITDA
	Revenues	EBITDA	Margin	09/30/19				Revenues	EBITDA	EBITDA
Ferrellgas Partners, LP	\$1,625	\$215	13.2%	\$1.06	48.0%	\$103	\$2,127	1.3x	9.9x	10.2x
NGL Energy Partners LP	24,098	550	2.3	13.91	88.5	1,781	5,110	0.2x	9.3x	5.4x
Spire Inc.	1,952	492	25.2	87.24	99.1	4,433	7,310	3.7x	14.9x	5.8x
Star Group, LP	1,754	66	3.8	9.47	92.4	467	624	0.4x	9.4x	2.2x
Suburban Propane Partners, LP	1,268	272	21.4	23.63	94.9	1,459	2,697	2.1x	9.9x	4.5x
UGI Corporation	7,320	1,104	15.1	50.27	84.8	10,504	15,013	2.1x	13.6x	5.6x
Median			14.2%		90.5%			1.7x	9.9x	5.5x
Mean			13.5%		84.6%			1.6x	11.2x	5.6x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
11/13/2019	Propane Distribution Assets in New Brunswick and Quebec	Superior Plus Corp. (TSX:SPB)	\$3.7	-	-
11/13/2019	Propane Distribution Assets in North Carolina	Superior Plus Corp. (TSX:SPB)	\$1.2	-	-
5/9/2019	Sheldon Gas Company/Sheldon Oil Company	Superior Plus Corp. (TSX:SPB)	\$15.9	-	-
4/2/2019	AmeriGas Partners, LP (NYSE:APU)	UGI Corporation (NYSE:UGI)	\$6,149.2	2.2x	10.5x
3/26/2019	Substantially all of the Propane Distribution Assets of Phelps Sungas, Inc. and BMK of Geneva, Inc.	Superior Plus Corp. (TSX:SPB)	\$19.5	-	-
2/7/2019	Propane Assets and Operations of Propane Retailer in West Coast	Suburban Propane, LP	\$12.0	-	-
1/30/2019	Wholesale Propane Business of Gas Supply Resources LLC	NGL Energy Partners LP (NYSE:NGL)	\$90.0	-	-
10/18/2018	Propane Distribution Assets of Musco Fuel & Propane LLP	Superior Plus Corp. (TSX:SPB)	\$14.5	-	-
10/11/2018	Salathe Gas Company, LLC/North Star Exchange, Inc.	Ferrellgas Partners, LP (NYSE:FGP)	-	-	-
9/18/2018	Propane Distribution and Other Assets of Porco Energy Corp	Superior Plus Corp. (TSX:SPB)	\$15.5	-	-
9/14/2018	United Liquid Gas Company	Superior Plus Corp. (TSX:SPB)	-	-	-
7/12/2018	Diamond Propane, Inc.	Ferrellgas Partners, LP (NYSE:FGP)	-	-	-

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

DRILLING

EQUITY COMPARABLES (1)

Drilling (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ / EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
AKITA Drilling Ltd.	\$140	\$20	14.6%	\$0.82	18.2%	\$34	\$92	0.7x	4.5x	3.2x
Baker Hughes Company	23,755	3,046	12.8	23.20	68.1	15,060	37,294	1.6x	12.2x	1.6x
CES Energy Solutions Corp.	989	112	11.3	1.55	46.6	408	738	0.7x	6.6x	2.8x
Diamond Offshore Drilling, Inc.	902	82	9.1	5.56	26.7	766	2,598	2.9x	31.7x	23.4x
Ensign Energy Services Inc.	1,180	290	24.5	2.31	47.0	370	1,617	1.4x	5.6x	4.2x
Halliburton Company	23,153	3,714	16.0	18.85	44.3	16,511	26,787	1.2x	7.2x	2.7x
Helmerich & Payne, Inc.	2,798	768	27.4	40.07	54.3	4,385	4,496	1.6x	5.9x	0.1x
Independence Contract Drilling, Inc.	221	54	24.3	1.20	23.8	91	212	1.0x	3.9x	2.3x
National Oilwell Varco, Inc.	8,596	146	1.7	21.20	45.5	8,181	10,431	1.2x	71.4x	13.4x
Precision Drilling Corporation	1,206	303	25.2	1.15	33.2	337	1,475	1.2x	4.9x	3.7x
Secure Energy Services Inc.	2,264	119	5.2	4.23	59.3	668	1,052	0.5x	8.9x	3.1x
Unit Corporation	725	311	42.9	3.38	12.1	188	1,164	1.6x	3.7x	2.6x
Valaris plc	1,940	118	6.1	4.81	12.6	952	7,075	3.6x	60.0x	51.9x
Median			14.6%		44.3%			1.2x	6.6x	3.1x
Mean			17.0%		37.8%			1.5x	17.4x	8.8x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
10/8/2018	Rowan Companies plc (NYSE:RDC)	Enso plc (NYSE:ESV) / Valaris plc (NYSE:VAL)	\$3,139.1	3.8x	43.9x
10/1/2018	Sidewinder Drilling LLC	Independence Contract Drilling Inc. (NYSE:ICD)	\$291.8	2.6x	45.1x
8/27/2018	Blue Ridge Mountain Resources, Inc. (OTCPK:BRMR)	Eclipse Resources Corporation (NYSE:ECR)	\$347.9	3.6x	12.8x
8/13/2018	Trinidad Drilling Ltd. (TSX:T DG)	Ensign Energy Services Inc. (TSX:ESI)	\$714.0	1.5x	5.1x
6/5/2018	Xtreme Drilling Corp.	AKITA Drilling Ltd. (TSX:AKT.A)	\$155.0	2.8x	162.4x
2/15/2018	Layne Christensen Company (NasdaqGS:LAYN)	Granite Construction Incorporated (NYSE:GVA)	\$491.9	1.0x	16.5x
5/30/2017	Atwood Oceanics, Inc. (NYSE:ATW)	Enso plc (NYSE:ESV)	\$1,759.6	2.2x	4.7x
5/19/2017	Savanna Energy Services Corp.	Total Energy Services Inc. (TSX:TOT)	\$458.2	1.4x	16.6x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

LUBRICANTS AND GREASES

EQUITY COMPARABLES (1)

Lubricants and Greases (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Albemarle Corporation	\$3,519	\$955	27.1%	\$69.52	63.9%	\$7,368	\$9,159	2.6x	9.6x	1.8x
Ashland Global Holdings Inc.	2,493	509	20.4	77.05	90.8	4,663	7,138	2.9x	14.0x	2.8x
Clean Harbors, Inc.	3,399	516	15.2	77.20	96.4	4,313	5,821	1.7x	11.3x	2.8x
CSW Industrials, Inc.	373	75	20.2	69.03	91.2	1,037	1,065	2.9x	14.1x	0.0x
FMC Corporation	4,954	1,352	27.3	87.68	94.5	11,436	14,860	3.0x	11.0x	2.5x
Ingevity Corporation	1,268	375	29.5	84.84	70.5	3,551	4,946	3.9x	13.2x	3.5x
Kraton Corporation	1,844	277	15.0	32.29	67.7	1,024	2,605	1.4x	9.4x	5.3x
NewMarket Corporation	2,194	452	20.6	472.09	96.5	5,282	5,953	2.7x	13.2x	1.4x
Ocean Bio-Chem, Inc.	41	5	11.9	3.28	77.0	31	35	0.8x	7.2x	0.6x
Quaker Chemical Corporation	954	134	14.1	158.14	70.5	2,804	2,756	2.9x	20.6x	5.7x
Stepan Company	1,880	217	11.5	97.06	95.3	2,189	2,186	1.2x	10.1x	(0.1)x
Synalloy Corporation	310	14	4.7	15.95	69.3	143	265	0.9x	18.3x	8.2x
Trecora Resources	272	25	9.2	9.02	62.6	223	332	1.2x	13.3x	2.4x
Valvoline Inc.	2,390	402	16.8	22.03	95.1	4,146	5,360	2.2x	13.3x	3.1x
Median			16.0%		83.9%			2.4x	13.2x	2.6x
Mean			17.4%		81.5%			2.2x	12.8x	2.9x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
7/12/2019	Milacron Holdings Corp. (NYSE:MCRN)	Hillenbrand, Inc. (NYSE:HI)	\$2,051.1	1.7x	12.9x
4/23/2019	Synalloy Corporation (NasdaqGM:SYNL)	Privet Fund Management, LLC	\$308.8	1.0x	10.9x
9/13/2018	MPM Holdings Inc. (OTCPK:MPMQ)	KCC Corporation (KOSE:A002380); SJL Partners; Wonik Qn Corporation (KOSDAQ:A074600)	\$2,664.9	1.0x	7.4x
8/15/2018	KMG Chemicals, Inc.	Cabot Microelectronics Corporation (NasdaqGS:CCMP)	\$1,606.5	3.5x	13.5x
4/5/2017	Houghton International Inc.	Quaker Chemical Corporation (NYSE:KWR)	\$1,415.4	1.8x	11.8x
1/31/2017	Sealweld Corporation	KMG Electronic Chemicals Luxembourg Holdings Sarl; KMG Industrial Lubricants Canada, Inc.	\$17.3	1.4x	6.6x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

SOLAR

EQUITY COMPARABLES ⁽¹⁾

Solar (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Boralex Inc.	\$409	\$253	61.9%	\$17.09	98.9%	\$1,526	\$4,102	10.0x	16.2x	10.0x
Capital Power Corporation	1,111	627	56.4	23.18	94.6	2,478	5,741	5.2x	9.2x	4.1x
NextEra Energy Partners, LP	805	528	65.6	52.84	98.0	2,967	12,257	15.2x	23.2x	8.7x
NRG Energy, Inc.	9,618	1,674	17.4	39.60	90.7	10,018	16,211	1.7x	9.7x	3.8x
TerraForm Power, Inc.	948	600	63.4	18.23	99.2	3,812	10,126	10.7x	16.9x	10.5x
Vivint Solar, Inc.	327	(87)	(26.5)	6.54	66.6	795	2,214	6.8x	NM	NM
Median			59.2%		96.3%			8.4x	16.2x	8.7x
Mean			39.7%		91.3%			8.3x	15.0x	7.4x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
11/4/2019	Pattern Energy Group Inc. (NasdaqGS:PEGI)	Canada Pension Plan Investment Board	\$6,293.7	11.5x	16.1x
2/5/2018	8point3 Energy Partners LP (NasdaqGS:CAFD)	Capital Dynamics, Inc.	\$1,671.3	23.8x	17.0x
5/4/2017	Up to 20 Megawatts of Solar Energy Power Generation Assets	Kontrol Energy Corp. (CNSX:KNR)	\$22.6	-	4.1x
3/7/2017	TerraForm Global, Inc. (NasdaqGS:GLBL)	Orion US Holdings I LP	\$1,651.8	6.6x	17.2x
1/20/2016	Capstone Infrastructure Corporation	Irving Infrastructure Corp.	\$1,435.1	-	12.7x
12/3/2014	Hawaiian Electric Industries, Inc. (NYSE:HE)	NextEra Energy, Inc. (NYSE:NEE)	\$4,398.8	1.3x	8.5x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

WIND

EQUITY COMPARABLES (1)

Wind (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Algonquin Power & Utilities Corp.	\$1,607	\$640	39.8%	\$13.70	98.2%	\$6,791	\$11,638	7.2x	18.2x	6.7x
Avangrid, Inc.	6,394	1,829	28.6	52.25	97.7	16,146	23,726	3.7x	13.0x	4.2x
Boralex Inc.	409	253	61.9	17.09	98.9	1,526	4,102	10.0x	16.2x	10.0x
Brookfield Renewable Partners LP	3,034	1,924	63.4	40.64	99.5	12,648	32,208	10.6x	16.7x	5.4x
Innervex Renewable Energy Inc.	489	332	67.9	11.55	95.8	1,543	5,165	10.6x	15.6x	9.9x
NextEra Energy Partners, LP	805	528	65.6	52.84	98.0	2,967	12,257	15.2x	23.2x	8.7x
Northland Power Inc.	1,210	901	74.5	19.20	96.6	3,464	9,647	8.0x	10.7x	6.3x
Pattern Energy Group Inc.	497	309	62.2	26.93	97.0	2,646	6,170	12.4x	20.0x	8.5x
TerraForm Power, Inc.	948	600	63.4	18.23	99.2	3,812	10,126	10.7x	16.9x	10.5x
TransAlta Renewables Inc.	345	213	61.7	10.30	95.0	2,725	3,452	10.0x	16.2x	3.1x
Median			62.8%		97.9%			10.3x	16.5x	7.6x
Mean			58.9%		97.6%			9.8x	16.7x	7.3x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
11/4/2019	Pattern Energy Group Inc. (NasdaqGS:PEGI)	Canada Pension Plan Investment Board	\$6,293.7	11.5x	16.1x
10/21/2019	AltaGas Canada Inc. (TSX:ACI)	Alberta Teachers' Retirement Fund Board; Public Sector Pension Investment	\$1,278.2	5.2x	15.2x
10/30/2017	Alterra Power Corp. (TSX:AXY)	Innervex Renewable Energy Inc. (TSX:INE)	\$745.0	10.6x	31.0x
7/27/2017	Boralex Inc. (TSX:BLX)	Caisse de dépôt et placement du Québec	\$3,436.5	12.5x	20.3x
6/19/2017	Pattern Energy Group Inc. (NasdaqGS:PEGI)	Public Sector Pension Investment Board	\$4,313.7	12.2x	18.6x
3/7/2017	TerraForm Global, Inc. (NasdaqGS:GLBL)	Orion US Holdings I LP	\$1,651.8	6.6x	17.2x
1/20/2016	Capstone Infrastructure Corporation	Irving Infrastructure Corp.	\$1,435.1	-	12.7x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

OIL AND GAS FIELD SERVICES

EQUITY COMPARABLES ⁽¹⁾

Oil and Gas Field Services (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Archrock, Inc.	\$953	\$380	39.9%	\$9.97	78.0%	\$1,515	\$3,163	3.3x	8.3x	4.9x
Baker Hughes Company	23,755	3,046	12.8	23.20	68.1	15,060	37,294	1.6x	12.2x	1.6x
Blueknight Energy Partners, LP	403	59	14.8	1.12	46.7	46	(59)	(0.1)x	(1.0)x	4.5x
CARBO Ceramics Inc.	184	(33)	(17.9)	2.40	31.3	71	153	0.8x	NM	NM
Cathedral Energy Services Ltd.	109	(3)	(2.4)	0.21	29.8	10	29	0.3x	NM	NM
CES Energy Solutions Corp.	989	112	11.3	1.55	46.6	408	738	0.7x	6.6x	2.8x
Cypress Energy Partners, LP	399	28	7.0	9.00	98.2	109	213	0.5x	7.6x	2.6x
Dawson Geophysical Company	140	2	1.1	2.14	32.6	50	22	0.2x	14.5x	(7.5)x
Eco-Stim Energy Solutions, Inc.	41	(23)	(55.3)	0.01	0.8	0	4	0.1x	NM	NM
ENGlobal Corporation	52	(3)	(5.1)	1.00	75.2	27	20	0.4x	NM	NM
Enservco Corporation	53	4	8.3	0.26	31.7	14	53	1.0x	12.2x	8.4x
Ensign Energy Services Inc.	1,180	290	24.5	2.31	47.0	370	1,617	1.4x	5.6x	4.2x
Enterprise Group, Inc.	15	1	6.9	0.15	44.4	8	13	0.9x	13.0x	7.0x
Essential Energy Services Ltd.	117	11	9.5	0.22	53.7	31	49	0.4x	4.4x	1.8x
High Arctic Energy Services Inc.	144	15	10.4	1.71	54.8	85	82	0.6x	5.5x	(0.1)x
Hyduke Energy Services Inc.	6	(5)	(83.7)	0.01	16.7	1	(0)	(0.0)x	NM	NM
Innospec Inc.	1,518	207	13.6	89.14	91.7	2,183	2,274	1.5x	11.0x	0.3x
Matrix Service Company	1,436	63	4.4	17.14	69.3	465	381	0.3x	6.0x	(1.7)x
McDermott International, Inc.	8,542	(46)	(0.5)	2.02	11.0	367	4,488	0.5x	NM	NM
Mullen Group Ltd.	980	147	15.0	6.59	54.4	691	1,094	1.1x	7.5x	2.8x
Newpark Resources, Inc.	878	89	10.1	7.62	69.9	686	828	0.9x	9.3x	1.6x
North American Construction Group Ltd.	499	108	21.6	11.53	84.7	295	601	1.2x	5.6x	3.2x
Parkland Fuel Corporation	12,977	917	7.1	32.10	89.5	4,727	7,612	0.6x	8.3x	2.9x
Pioneer Energy Services Corp.	587	66	11.2	0.06	1.6	4	449	0.8x	6.8x	6.8x
Precision Drilling Corporation	1,206	303	25.2	1.15	33.2	337	1,475	1.2x	4.9x	3.7x
Profire Energy, Inc.	41	7	15.8	1.89	55.9	91	77	1.8x	11.7x	(1.9)x
ProPetro Holding Corp.	2,043	450	22.0	9.09	35.8	913	1,031	0.5x	2.3x	0.1x
Secure Energy Services Inc.	2,264	119	5.2	4.23	59.3	668	1,052	0.5x	8.9x	3.1x
Select Energy Services, Inc.	1,378	184	13.3	8.66	66.7	758	1,108	0.8x	6.0x	0.3x
Shawcor Ltd.	1,140	74	6.5	11.53	58.9	809	1,138	1.0x	15.3x	4.6x
Smart Sand, Inc.	238	82	34.5	2.83	60.5	117	195	0.8x	2.4x	0.7x
STEP Energy Services Ltd.	537	52	9.7	1.10	24.3	73	281	0.5x	5.4x	3.7x
USA Compression Partners, LP	692	411	59.3	17.27	90.9	1,668	3,962	5.7x	9.6x	4.5x
Median			10.1%		54.4%			0.8x	7.5x	2.8x
Mean			7.8%		51.9%			1.0x	7.8x	2.4x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

EQUIPMENT AND PHYSICAL TECHNOLOGY

EQUITY COMPARABLES (1)

Equipment and Physical Technology (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM			Net Debt ⁽⁴⁾
	Revenues	EBITDA	Margin					Revenues	EBITDA	EBITDA	
AKITA Drilling Ltd.	\$140	\$20	14.6%	\$0.82	18.2%	\$34	\$92	0.7x	4.5x	3.2x	
CSI Compressco LP	491	111	22.5	2.96	49.6	139	799	1.6x	7.2x	5.9x	
Enerflex Ltd.	1,539	217	14.1	8.78	57.0	787	924	0.6x	4.3x	0.9x	
Exterran Corporation	1,377	204	14.8	13.06	47.0	461	940	0.7x	4.6x	2.5x	
Forum Energy Technologies, Inc.	1,030	38	3.7	1.55	13.3	171	679	0.7x	17.9x	11.5x	
Gardner Denver Holdings, Inc.	2,559	581	22.7	28.29	78.1	5,774	7,159	2.8x	12.3x	2.2x	
Geospace Technologies Corporation	96	11	11.9	15.37	90.8	210	194	2.0x	17.0x	(1.7)x	
Gulf Island Fabrication, Inc.	284	(15)	(5.4)	5.35	51.3	82	11	0.0x	NM	NM	
Halliburton Company	23,153	3,714	16.0	18.85	44.3	16,511	26,787	1.2x	7.2x	2.7x	
Hanwei Energy Services Corp.	8	(1)	(6.5)	0.02	57.1	3	6	0.7x	NM	NM	
Helix Energy Solutions Group, Inc.	740	162	21.9	8.06	74.0	1,199	1,599	2.2x	9.9x	2.1x	
ION Geophysical Corporation	207	61	29.3	9.12	52.2	129	273	1.3x	4.5x	2.3x	
Key Energy Services, Inc.	446	1	0.2	1.49	12.6	30	249	0.6x	NA	NA	
McCoy Global Inc.	42	3	7.3	0.48	46.7	13	12	0.3x	4.0x	(0.3)x	
Mitcham Industries, Inc.	42	(7)	(17.3)	3.25	73.5	39	55	1.3x	NM	NM	
Nabors Industries Ltd.	3,111	804	25.8	1.87	28.1	680	4,364	1.4x	5.4x	3.9x	
National Oilwell Varco, Inc.	8,596	146	1.7	21.20	45.5	8,181	10,431	1.2x	71.4x	13.4x	
Natural Gas Services Group, Inc.	75	25	33.1	12.81	60.4	169	140	1.9x	5.7x	(0.8)x	
Parker Drilling Company	603	135	22.5	18.92	78.5	285	375	0.6x	2.8x	0.7x	
PHX Energy Services Corp.	272	33	12.1	2.12	80.0	118	163	0.6x	5.0x	1.3x	
RigNet, Inc.	239	28	11.8	7.75	36.6	155	261	1.1x	9.2x	3.7x	
RPC, Inc.	1,363	169	12.4	5.61	32.5	1,189	1,186	0.9x	7.0x	(0.0)x	
Schlumberger Limited	32,868	6,509	19.8	34.17	53.7	47,257	62,406	1.9x	9.6x	2.2x	
SEACOR Holdings Inc.	821	128	15.6	47.07	91.5	946	1,404	1.7x	10.9x	3.0x	
Solaris Oilfield Infrastructure, Inc.	236	132	55.9	13.42	69.5	425	534	2.3x	4.0x	(0.3)x	
Strad Inc.	93	23	25.2	1.22	90.0	69	85	0.9x	3.6x	0.7x	
Superior Drilling Products, Inc.	18	2	10.2	0.98	19.3	25	31	1.7x	16.9x	3.2x	
TechnipFMC plc	13,005	1,479	11.4	24.14	75.7	10,792	11,082	0.9x	7.5x	0.3x	
TerraVest Industries Inc.	231	37	15.9	9.88	96.9	171	253	1.1x	6.9x	2.3x	
TETRA Technologies, Inc.	1,061	166	15.6	2.01	44.0	252	1,283	1.2x	7.7x	5.3x	
Weatherford International plc	5,398	438	8.1	0.03	1.0	28	8,047	1.5x	18.4x	3.1x	
Median			14.6%		52.2%			1.2x	7.2x	2.3x	
Mean			14.4%		53.8%			1.2x	10.6x	2.7x	

- (1) Matching public companies to middle-market companies is an imperfect comparable analysis due to the variables of size, equipment, markets, etc. Nonetheless JKC's research has yielded this list as the closest available.
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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

OIL AND GAS FIELD SERVICES AND EQUIPMENT AND PHYSICAL TECHNOLOGY

SELECTED TRANSACTIONS ⁽¹⁾

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
6/17/2019	C&J Energy Services, Inc. (NYSE:CJ)	Keane Group, Inc. (NYSE:FRAC)	\$699.2	0.3x	2.9x
3/20/2019	Red Bone Services LLC/Tecton Energy Services Ltd.	KLX Energy Services Holdings, Inc. (NasdaqGS:KLXE)	\$82.5	-	4.8x
1/20/2019	ZCL Composites Inc. (TSX:ZCL)	Shawcor Ltd. (TSX:SCL)	\$233.7	1.7x	12.5x
10/29/2018	Adler Hot Oil Service, LLC.	Enservco Corporation (AMEX:ENSV)	\$12.5	0.7x	4.3x
6/5/2018	Xtreme Drilling Corp.	AKITA Drilling Ltd. (TSX:AKT.A)	\$155.0	2.8x	162.4x
5/1/2018	KLX Inc. (NasdaqGS:KLXI)	Aviall Inc.	\$4,482.9	-	15.7x
4/16/2018	Aveda Transportation and Energy Services Inc. (TSXV:AVE)	Daseke Companies, Inc.	\$2,139.8	0.7x	4.8x
1/16/2018	USA Compression Partners, LP (NYSE:USAC)	Energy Transfer Partners, LP (NYSE:ETP); Energy Transfer Equity, LP (NYSE:ETE)	\$2,033.4	7.3x	14.3x
1/2/2018	Archrock Partners, LP	Archrock, Inc. (NYSE:AROC)	\$2,405.5	4.3x	10.5x
12/11/2017	Pure Technologies Ltd.	Xylem Inc. (NYSE:XYL)	\$395.2	4.0x	26.5x
5/19/2017	Savanna Energy Services Corp.	Total Energy Services Inc. (TSX:TOT)	\$458.2	1.8x	16.6x
5/15/2017	Ceiba Energy Services Inc.	Secure Energy Services Inc. (TSX:SES)	\$27.2	4.5x	29.2x
4/24/2017	Flowchem Ltd.	KMG Chemicals, Inc. (NYSE:KMG)	\$495.0	N/A	11.5x
3/13/2017	Amec Foster Wheeler plc (LSE:AMFW)	John Wood Group PLC (LSE:W.G.)	\$4,032.4	0.6x	10.6x
12/12/2016	Seventy Seven Energy Inc.	Patterson-UTI Energy, Inc. (NasdaqGS:PTEN)	\$1,878.9	3.1x	18.8x
10/13/2016	Critical Flow Solutions Inc.	CIRCOR International, Inc. (NYSE:CIR)	\$214.0	1.8x	8.6x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

STORAGE AND TERMINALS

EQUITY COMPARABLES (1)

Storage and Terminals (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Alliant Energy Corporation	\$3,641	\$1,286	35.3%	\$53.93	98.8%	\$12,810	\$19,392	5.3x	15.1x	4.9x
AltaGas Ltd.	4,296	840	19.5	14.69	88.0	4,083	11,414	2.7x	13.6x	7.1x
Blueknight Energy Partners, LP	403	59	14.8	1.12	46.7	46	(59)	(0.1)x	(1.0)x	4.5x
Chart Industries, Inc.	1,247	182	14.6	62.36	65.2	2,232	2,426	1.9x	13.3x	4.2x
EnLink Midstream, LLC	6,914	1,072	15.5	8.50	48.3	4,142	10,455	1.5x	9.8x	4.4x
EQM Midstream Partners, LP	1,589	1,321	83.1	32.70	60.9	6,555	13,095	8.2x	9.9x	4.1x
Gibson Energy Inc.	5,276	326	6.2	17.18	93.1	2,498	3,503	0.7x	10.7x	2.9x
Green Plains Partners LP	85	57	66.9	13.28	80.6	308	485	5.7x	8.5x	3.1x
Magellan Midstream Partners, LP	2,853	1,315	46.1	66.27	95.4	15,136	19,721	6.9x	15.0x	3.6x
MPLX LP	8,120	4,200	51.7	28.01	78.0	30,059	45,831	5.6x	10.9x	4.7x
NuStar Energy LP	1,914	686	35.9	28.32	94.2	3,052	7,934	4.1x	11.6x	5.0x
Median			35.3%		80.6%			4.1x	10.9x	4.4x
Mean			35.4%		77.2%			3.9x	10.7x	4.4x

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(2) LTM is defined as last twelve months.

(3) Total Enterprise Value is defined as market capitalization plus total debt less cash and cash equivalents.

(4) Net Debt is defined as total debt less cash and cash equivalents.

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

STORAGE AND TERMINALS

SELECTED TRANSACTIONS (1)

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
9/16/2019	SemGroup Corporation (NYSE:SEMGM)	Energy Transfer LP (NYSE:ET)	\$4,991.7	2.1x	13.5x
8/27/2019	Tallgrass Energy, LP (NYSE:TGE)	The Blackstone Group Inc. (NYSE:BX)	\$9,337.3	8.9x	11.2x
8/21/2019	Kinder Morgan Canada Limited (TSX:KML)	Pembina Pipeline Corporation (TSX:PPL)	\$2,294.7	4.4x	16.3x
5/10/2019	Buckeye Partners, LP (NYSE:BPL)	IFM Global Infrastructure Fund	\$10,500.3	2.7x	18.6x
11/8/2018	Western Gas Partners, LP (NYSE:WES)	Western Gas Equity Partners, LP (NYSE:WGP)	\$13,427.9	6.5x	12.0x
10/22/2018	EnLink Midstream Partners, LP (NYSE:ENLK)	EnLink Midstream, LLC (NYSE:ENLC)	\$12,923.5	1.7x	12.2x
10/18/2018	Valero Energy Partners LP	Valero Energy Corporation (NYSE:VLO)	\$4,069.8	7.6x	10.5x
9/19/2018	Dominion Energy Midstream Partners, LP (NYSE:DM)	Dominion Energy, Inc. (NYSE:D)	\$10,405.4	13.6x	19.7x
8/1/2018	Energy Transfer Partners, LP (NYSE:ETP)	Energy Transfer Equity, LP (NYSE:ETE)	\$69,412.3	2.1x	10.8x
7/30/2018	Four Corners Area Assets	Harvest Midstream Company	\$1,125.0	-	13.2x
7/10/2018	Transmontaigne Partners LP (NYSE:TLP)	TLP Acquisition Holdings LLC	\$1,254.3	6.1x	11.5x
6/29/2018	Boardwalk Pipeline Partners, LP	Boardwalk GP LP	\$6,792.1	5.3x	8.3x
5/17/2018	Enbridge Energy Partners, LP (NYSE:EEP)	Enbridge Inc. (TSX:ENB)	\$15,925.8	6.6x	10.1x
4/30/2018	Andeavor (NYSE:ANDV)	Marathon Petroleum Corporation (NYSE:MPC)	\$35,101.9	0.9x	12.7x
4/26/2018	Rice Midstream Partners LP (NYSE:RMP)	EQM Midstream Partners, LP (NYSE:EQM)	\$2,443.1	7.7x	9.9x
3/26/2018	Tallgrass Energy Partners, LP (NYSE:TEP)	Tallgrass Equity, LLC	\$4,176.5	6.4x	6.9x
8/29/2017	Arc Logistics Partners LP (NYSE:ARCX)	Zenith Energy U.S. Logistics Holdings, LLC	\$658.0	6.2x	10.4x
8/14/2017	Western Refining Logistics, LP (NYSE:WNRL)	Andeavor Logistics LP (NYSE:ANDX)	\$1,842.8	0.8x	14.4x
6/19/2017	Rice Energy Inc. (NYSE:RICE)	EQT Corporation (NYSE:EQT)	\$10,239.2	9.9x	34.1x
6/2/2017	AMTROL Inc.	Worthington Steel of Michigan, Inc.	\$283.0	1.1x	7.4x
5/18/2017	PennTex Midstream Partners, LP	Energy Transfer Partners, LP (NYSE:ETP)	\$562.6	7.3x	18.9x

(1) Total Enterprise Value is defined as market capitalization plus total debt less cash and cash equivalents.

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PIPELINES

EQUITY COMPARABLES (1)

Oil and Gas Pipelines (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Antero Midstream Corporation	\$736	\$0	0.0%	\$7.40	39.3%	\$3,751	\$6,270	8.5x	NM	NM
ATCO Ltd.	3,549	1,447	40.8	36.62	98.8	4,191	14,021	4.0x	9.7x	4.5x
Blueknight Energy Partners, LP	403	59	14.8	1.12	46.7	46	(59)	(0.1)x	(1.0)x	4.5x
Crestwood Equity Partners LP	3,111	384	12.3	36.51	91.3	2,639	5,878	1.9x	15.3x	6.1x
Enable Midstream Partners, LP	3,179	1,154	36.3	12.03	69.0	5,234	10,073	3.2x	8.7x	3.8x
Enbridge Inc.	37,224	8,736	23.5	35.13	90.8	71,088	129,763	3.5x	14.9x	5.8x
Energy Transfer LP	54,066	10,581	19.6	13.08	72.0	34,361	93,320	1.7x	8.8x	4.5x
Enterprise Products Partners LP	33,966	7,734	22.8	28.58	92.6	62,562	90,110	2.7x	11.7x	3.5x
Equitrans Midstream Corporation	1,589	1,310	82.4	14.55	62.0	3,711	14,071	8.9x	10.7x	4.5x
EQM Midstream Partners, LP	1,589	1,321	83.1	32.70	60.9	6,555	13,095	8.2x	9.9x	4.1x
Genesis Energy, LP	2,566	600	23.4	21.47	84.5	2,632	7,075	2.8x	11.8x	5.9x
Gibson Energy Inc.	5,276	326	6.2	17.18	93.1	2,498	3,503	0.7x	10.7x	2.9x
Inter Pipeline Ltd.	1,905	817	42.9	17.56	91.5	7,269	11,960	6.3x	14.6x	5.9x
Kinder Morgan Canada Limited	313	141	45.0	11.26	28.7	394	1,364	4.4x	9.7x	2.6x
Kinder Morgan, Inc.	13,638	6,393	46.9	20.61	95.9	46,657	84,811	6.2x	13.3x	5.8x
ONEOK, Inc.	10,637	2,356	22.1	73.69	95.4	30,432	41,522	3.9x	17.6x	5.2x
Plains All American Pipeline, LP	33,301	3,512	10.5	20.75	79.4	15,107	27,232	0.8x	7.8x	2.9x
Sanchez Midstream Partners LP	89	50	55.9	0.37	4.4	7	530	5.9x	10.6x	8.4x
Southcross Energy Partners, LP	545	22	4.0	0.01	1.3	1	542	1.0x	24.7x	29.4x
Summit Midstream Partners, LP	464	235	50.6	4.86	28.8	402	2,069	4.5x	8.8x	5.9x
Targa Resources Corp.	8,795	1,285	14.6	40.17	67.8	9,351	19,789	2.3x	15.4x	5.7x
TC PipeLines, LP	679	575	84.7	40.67	96.6	2,900	4,964	7.3x	8.6x	3.3x
The Williams Companies, Inc.	8,298	4,023	48.5	24.06	81.4	29,161	54,125	6.5x	13.5x	5.5x
TC Energy Corporation	10,497	6,638	63.2	51.82	97.7	48,336	89,856	8.6x	13.5x	5.5x
Western Midstream Partners, LP	2,406	1,247	51.8	24.89	69.6	11,275	18,940	7.9x	15.2x	6.3x
Median			36.3%		79.4%			4.0x	11.2x	5.3x
Mean			36.2%		69.6%			4.4x	11.9x	5.9x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PIPELINES

SELECTED TRANSACTIONS (1)

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
9/16/2019	SemGroup Corporation (NYSE:SEMG)	Energy Transfer LP (NYSE:ET)	\$4,991.7	2.1x	13.5x
8/27/2019	Tallgrass Energy, LP (NYSE:TGE)	The Blackstone Group Inc. (NYSE:BX)	\$9,337.3	8.9x	11.2x
8/21/2019	Kinder Morgan Canada Limited (TSX:KML)	Pembina Pipeline Corporation (TSX:PPL)	\$2,294.7	4.4x	16.3x
5/10/2019	Buckeye Partners, LP (NYSE:BPL)	IFM Global Infrastructure Fund	\$10,500.3	2.7x	18.6x
11/8/2018	Western Gas Partners, LP (NYSE:WES)	Western Gas Equity Partners, LP (NYSE:WGP)	\$13,427.9	6.5x	12.0x
10/18/2018	Valero Energy Partners LP	Valero Energy Corporation (NYSE:VLO)	\$4,069.8	7.6x	10.5x
10/9/2018	Antero Midstream Partners LP (NYSE:AM)	Antero Midstream GP LP (NYSE:AMGP)	\$7,359.7	7.7x	11.5x
9/28/2018	American Midstream Partners, LP (NYSE:AMID)	ArcLight Capital Partners, LLC	\$1,595.1	2.0x	14.2x
7/10/2018	Transmontaigne Partners LP (NYSE:TLP)	TLP Acquisition Holdings LLC	\$1,254.3	6.1x	11.5x
5/17/2018	Williams Partners LP	The Williams Companies, Inc. (NYSE:WMB)	\$57,090.5	7.0x	14.1x
5/17/2018	Enbridge Energy Partners, LP (NYSE:EEP)	Enbridge Inc. (TSX:ENB)	\$15,925.8	6.6x	10.1x
5/10/2018	Amberjack Pipeline Company LLC	Shell Midstream Partners, LP (NYSE:SHLX)	\$1,928.7	8.2x	9.4x
3/26/2018	Tallgrass Energy Partners, LP (NYSE:TEP)	Tallgrass Equity, LLC	\$4,176.5	6.4x	6.9x
8/15/2017	Western Refining Logistics, LP (NYSE:WNRL)	Andeavor Logistics LP (NYSE:ANDX)	\$1,843.8	0.8x	14.4x
12/20/2016	Howard Midstream Partners, LP	Alberta Investment Management Corporation	\$1,394.7	4.3x	14.4x
11/21/2016	Sunoco Logistics Partners LP	Energy Transfer Partners, LP (NYSE:ETP)	\$15,527.3	1.5x	13.7x
10/24/2016	JP Energy Partners LP	American Midstream Partners, LP (NYSE:AMID)	\$465.0	-	11.3x
5/31/2016	Rose Rock Midstream, LP	SemGroup Corporation (NYSE:SEMG)	\$1,649.9	-	10.4x
2/1/2016	Dominion Energy Questar Corporation	Dominion Energy, Inc. (NYSE:D)	\$6,092.9	-	9.7x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

TRUCKERS

EQUITY COMPARABLES (1)

Truckers (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 09/30/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Adams Resources & Energy, Inc.	\$1,823	\$14	0.8%	\$31.00	70.9%	\$131	\$21	0.0x	1.5x	(7.7)x
ArcBest Corporation	3,045	199	6.5	30.45	60.5	777	833	0.3x	4.2x	0.3x
Covenant Transportation Group, Inc.	934	117	12.6	16.44	54.5	303	598	0.6x	5.1x	2.8x
Daseke, Inc.	1,781	159	8.9	2.50	29.7	161	968	0.5x	6.1x	4.6x
Heartland Express, Inc.	577	169	29.4	21.51	96.5	1,763	1,558	2.7x	9.2x	(0.3)x
Hess Corporation	6,287	2,717	43.2	60.48	80.8	18,415	24,939	4.0x	9.2x	2.0x
J.B. Hunt Transport Services, Inc.	9,033	1,156	12.8	110.65	90.6	11,814	13,303	1.5x	11.5x	1.2x
Knight-Swift Transportation Holdings Inc.	5,042	973	19.3	36.30	92.5	6,190	7,269	1.4x	7.5x	1.1x
Landstar System, Inc.	4,277	361	8.5	112.58	91.0	4,462	4,327	1.0x	12.0x	(0.5)x
Marten Transport, Ltd.	830	161	19.4	20.78	92.9	1,135	1,054	1.3x	6.5x	(0.2)x
Old Dominion Freight Line, Inc.	4,127	1,107	26.8	169.97	96.5	13,599	13,483	3.3x	12.2x	(0.2)x
P.A.M. Transportation Services, Inc.	529	99	18.6	59.11	87.2	340	539	1.0x	5.5x	2.1x
Patriot Transportation Holding, Inc.	109	9	8.1	17.90	84.3	60	39	0.4x	4.5x	(2.4)x
Parkland Fuel Corporation	12,977	917	7.1	32.10	89.5	4,727	7,612	0.6x	8.3x	2.9x
Roadrunner Transportation Systems, Inc.	1,999	(31)	(1.6)	10.36	43.6	390	778	0.4x	NM	NM
Ryder System, Inc.	8,905	2,414	27.1	51.77	70.0	2,761	10,550	1.2x	4.4x	3.3x
Saia, Inc.	1,750	273	15.6	93.70	96.0	2,404	2,657	1.5x	9.7x	1.0x
Schneider National, Inc.	4,912	644	13.1	21.72	85.5	3,847	3,927	0.8x	6.1x	0.0x
TFI International Inc.	3,924	548	14.0	30.64	84.1	2,528	4,222	1.1x	7.7x	3.1x
Titanium Transportation Group Inc.	126	11	9.0	0.98	70.3	36	98	0.8x	8.6x	5.0x
Universal Logistics Holdings, Inc.	1,522	173	11.4	23.28	62.2	635	1,071	0.7x	6.2x	2.6x
USA Truck, Inc.	540	48	8.9	8.03	35.5	67	259	0.5x	5.4x	3.9x
Werner Enterprises, Inc.	2,488	471	18.9	35.30	96.6	2,443	2,794	1.1x	5.9x	0.7x
YRC Worldwide Inc.	4,959	193	3.9	3.02	31.1	110	1,202	0.2x	6.2x	5.9x
Median			12.7%		84.2%			0.9x	6.2x	1.2x
Mean			14.3%		74.7%			1.1x	7.1x	1.4x

- (1) Matching public companies to middle-market companies is an imperfect comparable analysis due to the variables of size, equipment, markets, etc. Nonetheless JKC's research has yielded this list as the closest available.
- (2) LTM is defined as last twelve months.
- (3) Total Enterprise Value is defined as market capitalization plus total debt less cash and cash equivalents.
- (4) Net Debt is defined as total debt less cash and cash equivalents.

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

TRUCKERS

SELECTED TRANSACTIONS (1)

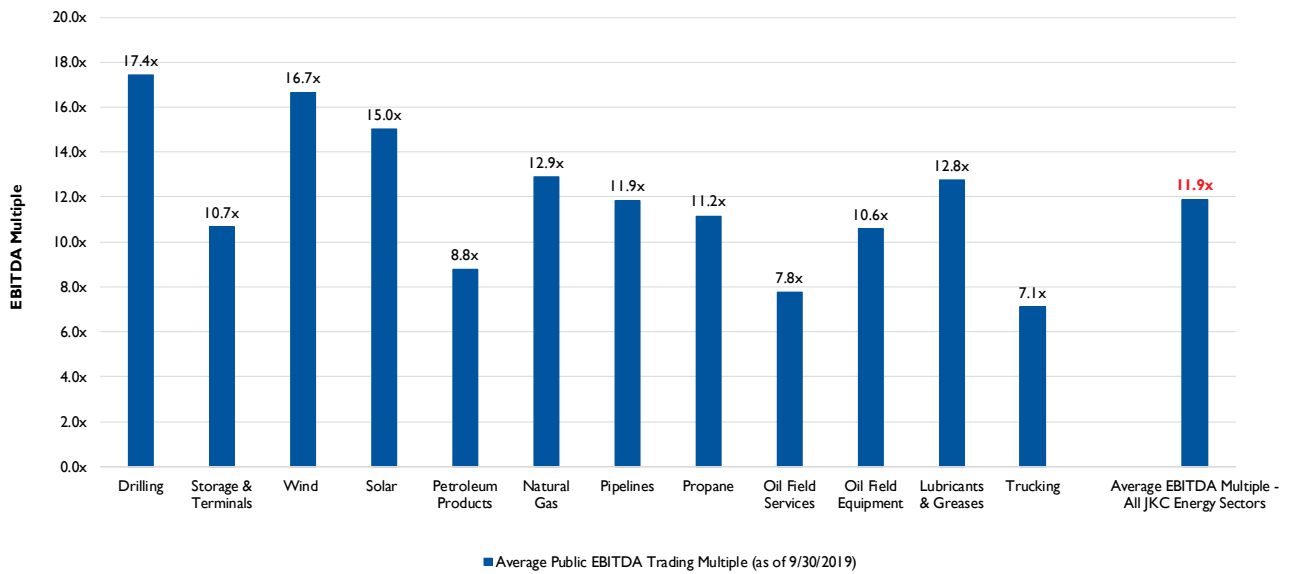
Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
11/5/2018	CaseStack, Inc.	Hub Group, Inc. (NasdaqGS:HUBG)	\$255.0	1.1x	11.6x
8/31/2018	Mode Transportation, LLC	York Capital Management	\$238.5	-	10.0x
12/7/2017	Keen Transport, Inc.	Wallenius Wilhelmsen ASA (OB:WALWIL)	\$64.0	0.8x	6.4x
7/19/2016	Span-Alaska Transportation, Inc.	Matson Logistics, Inc.	\$197.6	-	9.4x
5/2/2016	Trimac Transportation Ltd.	Trimac Corporation	\$215.9	-	5.9x
9/9/2015	Con-way Inc.	XPO Logistics, Inc. (NYSE:XPO)	\$3,057.0	-	6.2x
8/17/2015	Liberty International Inc.	Janel Corporation (OTCPK:JANL)	\$2.3	-	26.6x
7/28/2015	Stagecoach Cartage and Distribution, LLC	Roadrunner Transportation Systems, Inc. (NYSE:RRTS)	\$40.0	-	5.7x
5/25/2015	Hodges Trucking Company, LLC	Rodan Transport (U.S.A.) Ltd.	\$42.0	-	3.0x
5/6/2015	Quality Distribution Inc.	Apax Partners LLP	\$823.3	-	12.0x
5/4/2015	Bridge Terminal Transport Inc.	XPO Logistics, Inc. (NYSE:XPO)	\$100.0	-	8.1x
4/21/2015	Command Transportation, LLC	Echo Global Logistics, Inc. (NasdaqGS:ECHO)	\$391.0	-	10.6x
1/20/2015	Wheels Group Inc.	Radiant Global Logistics Ltd.	\$80.1	-	13.5x

(1) Total Enterprise Value is defined as market capitalization plus total debt less cash and cash equivalents.

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

AVERAGE PUBLIC EBITDA TRADING MULTIPLES

ALL JKC ENERGY SECTORS (AS OF 9/30/2019)



FACTOIDS: LITTLE-KNOWN FACTS AND STATS

PETROLEUM PRODUCTS (1)

- The United States now exports crude oil to more destinations than it imports from. In the first seven months of 2019, the United States exported crude oil to as many as 31 destinations per month, while the largest number of sources in any month fell to 27.
- U.S. crude oil production in the U.S. Federal Gulf of Mexico is expected to set new production records in 2019 and 2020. Crude oil production averaged 1.8 million barrels per day in 2018, setting a new annual record. Producers expect eight new projects to come online in 2019 and four more in 2020.

NATURAL GAS (2)

- Domestic gas production accounts for nearly 92% of all natural gas consumed in the United States and shale gas production now accounts for more than 50% of gas produced.
- The U.S. estimated future supply of natural gas stood at 2,817 trillion cubic feet at the end of 2016 – enough to meet America’s energy needs for more than 100 years.

PROPANE AND HEATING/FUEL OIL (3)

- For the average U.S. household, it is expected that both natural gas and electricity bills will decline by 1%, home heating oil by 4% and propane by 15%.
- Industry observers estimate that Marcellus shale alone can supply more than two billion gallons of propane per year.

(1) U.S. Energy Information Administration.

(2) American Gas Association.

(3) Propane Education & Research Council.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

LUBRICANTS AND GREASES

- Shell Lubricants announced a new engine oil, one of the first of its kind to operate in natural gas, diesel and gasoline engines. With the T4 NG Plus, Shell Rotella joins Valvoline in the multi-engine type oil space. ⁽¹⁾
- The move toward wet electric vehicle motors has sparked a need for specialized transmission fluids that can keep equipment cooler and electric current in its place. ⁽²⁾

SOLAR ⁽³⁾

- In 2018, 28% of global electricity was generated from renewable energy sources. It is projected that renewables will collectively increase to 49% of global electricity generation by 2050. Solar's share is expected to grow the fastest and hydroelectric's share to grow the slowest.
- According to 2017 data from the U.S. Energy Information Administration, annual capacity-weighted average construction costs for solar photovoltaic systems continued to decrease, while costs for onshore wind turbines and natural gas generators increased slightly.

WIND ⁽³⁾

- Wind speeds generally increase with height, so taller wind turbines can usually access better wind resources than shorter turbines at the same site.
- It is expected that U.S. wind capacity additions in both 2019 and 2020 will be near the annual record level of additions set in 2012.

(1) Transport Topics.

(2) Lubes N Grease Magazine.

(3) U.S. Energy Information Administration.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

OIL AND GAS FIELD SERVICES

- In 2018, the number of people employed in the U.S. oil and gas extraction industry was about 143,000.⁽¹⁾
- In 2014, the offshore oil industry had 245 floating rigs working globally. Now there are less than half that number. Over the last few years, roughly \$100 billion in spending has shifted from offshore work to shale work.⁽²⁾

EQUIPMENT AND PHYSICAL TECHNOLOGY ⁽³⁾

- Virtual reality is finding its way into upstream, midstream and downstream sectors of the oil and gas industry with applications in the simulation of new processes, analysis of project designs, reviewing of maintenance requirements and planning disaster responses.
- Despite not being a new technology, oil, gas and petrochemical storage terminals are increasingly turning to laser scanning as a way of digitizing their assets.

STORAGE AND TERMINALS

- From April 1 through October 31, 2019, more than 2,569 billion cubic feet (Bcf) of natural gas was placed into storage in the lower 48 states. This was the second-highest net injected volume, falling short of the record 2,727 Bcf injected during the 2014 season.⁽⁴⁾
- China is set to drive most of the liquids storage capacity growth in Asia and Oceania, accounting for 59% of the regions' total capacity growth between 2019 and 2023. Following China, Indonesia is expected to be the second highest contributor.⁽³⁾

(1) Statista.

(2) oilandgaspeople.com.

(3) Storage Terminals Magazine.

(4) U.S. Energy Information Administration.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

PIPELINES

- The United States is expected to add between 16 billion cubic feet per day (Bcf/d) and 17 Bcf/d of natural gas pipeline capacity in 2019. Many of these pipeline projects will provide additional takeaway capacity out of the Permian Basin in western Texas or enable additional Permian natural gas production to reach the interstate pipeline system.⁽¹⁾
- The Federal Energy Regulatory Commission has given its final approval for the construction of Tallgrass Energy's Cheyenne connector pipeline, which will transport natural gas from Colorado's DJ Basin to Cheyenne, Wyoming, for Midwest delivery via the company's Rockies Express Pipeline.⁽²⁾

TRUCKERS ⁽³⁾

- The U.S. trucking industry has faced a driver shortage for many years. The industry is short about 60,000 drivers nationwide and this could grow to 100,000 over the next few years.
- Currently, women make up just 6% of the nation's truck drivers.

(1) U.S. Energy Information Administration.

(2) Pipeline and Gas Journal.

(3) Indiana Motor Trucking Association.

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ABOUT JORDAN KNAUFF & COMPANY

Jordan Knauff & Company was founded in 2001 to undertake a distinct mission: to assemble and maintain a staff of top-notch investment banking personnel and offer their knowledge and experience to provide the best available investment banking services to middle-market companies, the entrepreneurs who lead them and the financial entities that transact with them. On a combined basis, over the course of their careers our employees have completed over 200 transactions as investors, owners, operators, buyers, sellers and investment bankers of middle-market businesses across a variety of industries. The majority of our firm's broad transaction experience has been with private companies owned by one shareholder, a partnership, a family or private equity investors.



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EEIA is a Washington, D.C.-based trade association representing the North American natural gas and petroleum production, transportation and processing infrastructure supply chain. That supply chain is comprised of 60 industries that provide construction, equipment, materials, services and supplies to energy infrastructure and operations. EEIA advocates for sound legislative and regulatory policies at the federal and state levels. Our members include companies, trade associations and labor organizations operating in the energy sector. We advocate for our industries both directly with policymakers, and through mobilization of business leaders and workers to act and speak for the value and benefits of full and responsible development of our energy resources in their communities and with their political leaders.



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