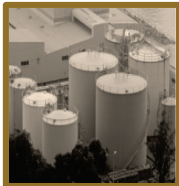


ENERGY LOGISTICS & DISTRIBUTION

Industry In-Sight™

WINTER / SPRING 2020



**ENERGY
EQUIPMENT &
INFRASTRUCTURE
ALLIANCE**

The Voice of the Energy Supply Chain



IN THIS REPORT

Introduction	5
Data Center	8
Data Center: Abbreviations & Acronyms, Definitions, Descriptions and Chart Notes	47
Hot Topics	62
Public and Transaction Comparables by Segment	67
Factoids: Little-known Facts and Stats	85

TABLE OF CONTENTS

INTRODUCTION	5
DATA CENTER	8
▪ OIL	
• Crude Oil and Gasoline Prices	8
• Diesel and Jet Fuel Prices	9
• U.S. Crude Oil and Petroleum Products Supply, Inventory and Consumption	10
• U.S. Refinery Volumes and Wholesale Prices of Petroleum Products	10
• U.S. Crude Oil Refinery Input, Distillation Capacity and Refinery Utilization	11
• U.S. Crude Oil and Petroleum Products Imports and Exports	11
▪ NATURAL GAS	
• Domestic and International Natural Gas Prices	12
• Americas and Western Europe Liquefied Natural Gas Prices	13
• Asia Liquefied Natural Gas Prices and World Liquefied Natural Gas Prices Map	14
• U.S. Import/Export Liquefied Natural Gas Prices and Natural Gas Plant Liquids Prices	15
• U.S. Natural Gas Production and Consumption and U.S. Natural Gas Supply and Inventory	16
• U.S. Natural Gas Consumption by End Use and U.S. Natural Gas Plant Liquids Production	17
• U.S. Liquefied Natural Gas Import and Export Volumes	18
• North America Liquefied Natural Gas Export Terminals – Proposed	18
• North America Liquefied Natural Gas Import/Export Terminals – Approved and Existing	19
▪ PROPANE AND HEATING/FUEL OIL	
• Heating Oil and Intermediate Fuel Oil aka “Bunker Fuel” Prices	20
• Propane Prices	21
• No. 1 Distillate Fuel Oil, Residual Fuel Oil Wholesale, Retail Sales Volume	21
• No. 2 Distillate Fuel Oil Wholesale, Retail Sales Volume	22
• Propane & Propylene and Distillate Fuel Oil Production and Consumption	22
• U.S. Ending Stocks of Propane & Propylene and Distillate Fuel Oil	23
▪ DRILLING ACTIVITY	
• U.S. Land Well Count, Rig Count and Wells per Rig	23
• U.S. Well Starts by Depth	24
• Percentage of Crude Oil and Natural Gas Production per Shale Region	24
• Drilled but Uncompleted (DUC) Wells vs. Crude Oil Price	25
• Hydraulic Fracturing Sand Consumption and Producer Price Index	25
• Crude Oil Production, Rig Count and Production per Rig	26
• Natural Gas Production, Rig Count and Production per Rig	26
• U.S. Drilling Rigs by Type	27
▪ RENEWABLES	
• Wind and Solar Prices	27
• U.S. Total Renewable Energy Consumption	28



TABLE OF CONTENTS

▪	RENEWABLES (Continued)	
•	U.S. Solar, Wind and Hydroelectric Energy Consumption	28
•	U.S. Wood, Waste, Biofuels and Geothermal Energy Consumption	29
•	Corn and Ethanol Prices and Corn Cost per Gallon of Ethanol	29
•	U.S. Solar	
–	Energy Consumption and Net Generation	30
–	Distributed Photovoltaic and Utility-Scale Electricity Generation by Sector	31
–	Capacity Installations	32
•	U.S. Wind Power	
–	Capacity Installations	32
–	Utility-Scale Capacity Installations	33
–	Under Construction or in Advanced Development	33
▪	U.S. AGGREGATED ENERGY CONSUMPTION	
•	Energy Consumption by Sector and by Source	34
•	Electricity Prices by Sector	35
▪	LOGISTICS	
•	Storage and Terminals	
–	Commercial Crude Oil, Petroleum and Other Liquids Commercial Inventory	36
–	Natural Gas Underground Storage Capacity	37
–	Crude Oil Refinery, Tank and Underground Storage Capacity and Utilization	37
•	Pipelines	
–	Crude Oil and Natural Gas Pipeline Mileage	38
–	Crude Oil and Petroleum Products Pipeline Movements Between PADDs	38
–	Natural Gas Cumulative Interstate Pipeline Systems Capacity	39
–	Crude Oil and Petroleum Products Exports to Mexico	39
•	Truckers	
–	Truck Tonnage Index and Heavy Truck Sales	40
–	Trucking Conditions Index and Freight Transportation Services Index	40
•	Shipping	
–	Crude Oil Refinery Receipts by Transportation Method	41
–	Crude Oil Movements by Tanker and Barge Between PADDs	41
•	Rail	
–	Movements of Crude Oil by Rail	42
–	Rail Carloads of Petroleum and Petroleum Products	42
▪	ECONOMIC / FINANCIAL	
•	Manufacturers' Monthly Shipments and Purchasing Managers' Index	43
•	U.S. New Housing Starts and Total U.S. Construction Spending	43
•	London Interbank Offered Rate (LIBOR) and Bank Prime Loan Interest Rates	44

TABLE OF CONTENTS

- **ECONOMIC / FINANCIAL (Continued)**
 - Commercial and Industrial Loans vs. Banking Standards and U.S. Treasury Yield Curve 45
 - Corporate Spreads to Treasuries by Quality 46

- DATA CENTER: ABBREVIATIONS & ACRONYMS, DEFINITIONS, DESCRIPTIONS AND CHART NOTES**
 - Abbreviations & Acroynms 47
 - Definitions 48
 - Descriptions 50
 - Chart Notes 51

- HOT TOPICS** 62

- PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT**
 - Petroleum Products Equity Comparables and Selected Transactions 67
 - Natural Gas Equity Comparables 68
 - Natural Gas Selected Transactions 69
 - Propane and Heating/Fuel Oil Equity Comparables and Selected Transactions 70
 - Drilling Equity Comparables and Selected Transactions 71
 - Lubricants and Greases Equity Comparables and Selected Transactions 72
 - Solar Equity Comparables and Selected Transactions 73
 - Wind Equity Comparables and Selected Transactions 74
 - Oil and Gas Field Services Equity Comparables 75
 - Equipment and Physical Technology Equity Comparables 76
 - Oil and Gas Field Services, Equipment and Physical Technology Selected Transactions 77
 - Storage and Terminals Equity Comparables 78
 - Storage and Terminals Selected Transactions 79
 - Pipelines Equity Comparables 80
 - Pipeline Selected Transactions 81
 - Truckers Equity Comparables 82
 - Truckers Selected Transactions 83
 - Average Public EBITDA Trading Multiples – All JKC Energy Sectors 84

- FACTOIDS: LITTLE-KNOWN FACTS AND STATS** 85

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.

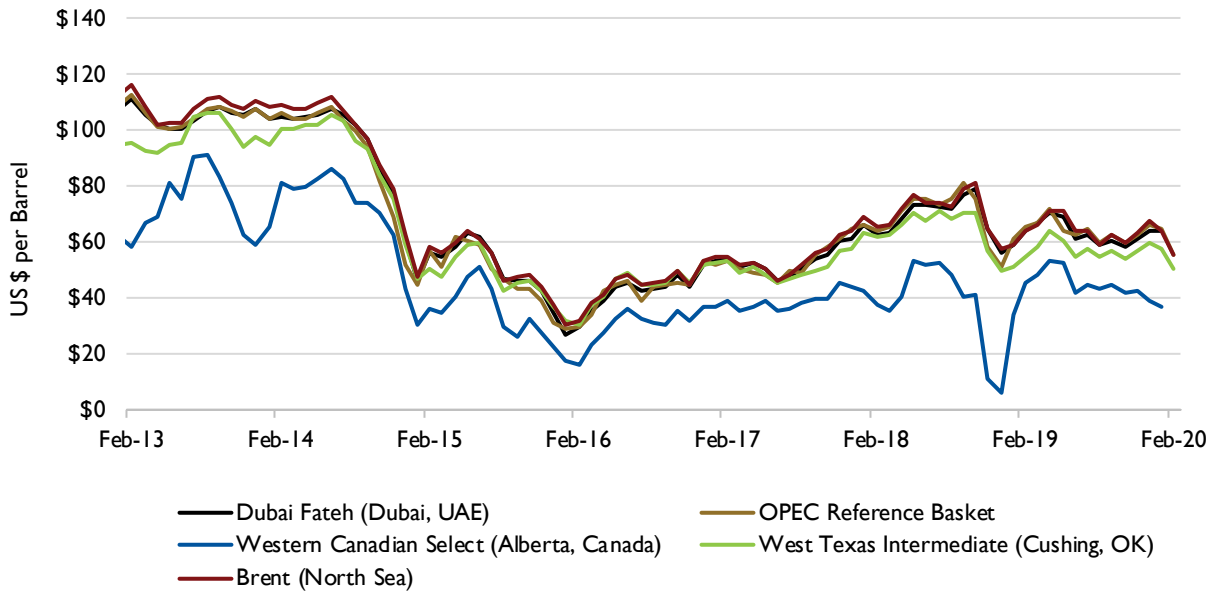
The Services We Provide

- **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.

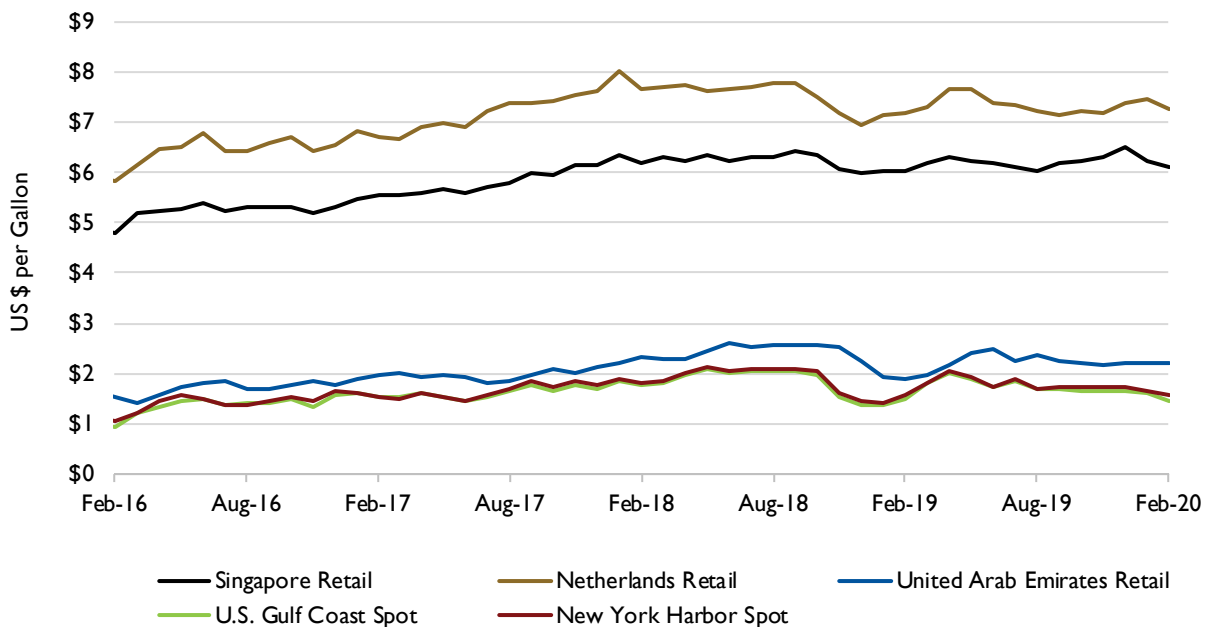
DATA CENTER

OIL

CRUDE OIL PRICES (MONTHLY AVERAGE) (1)



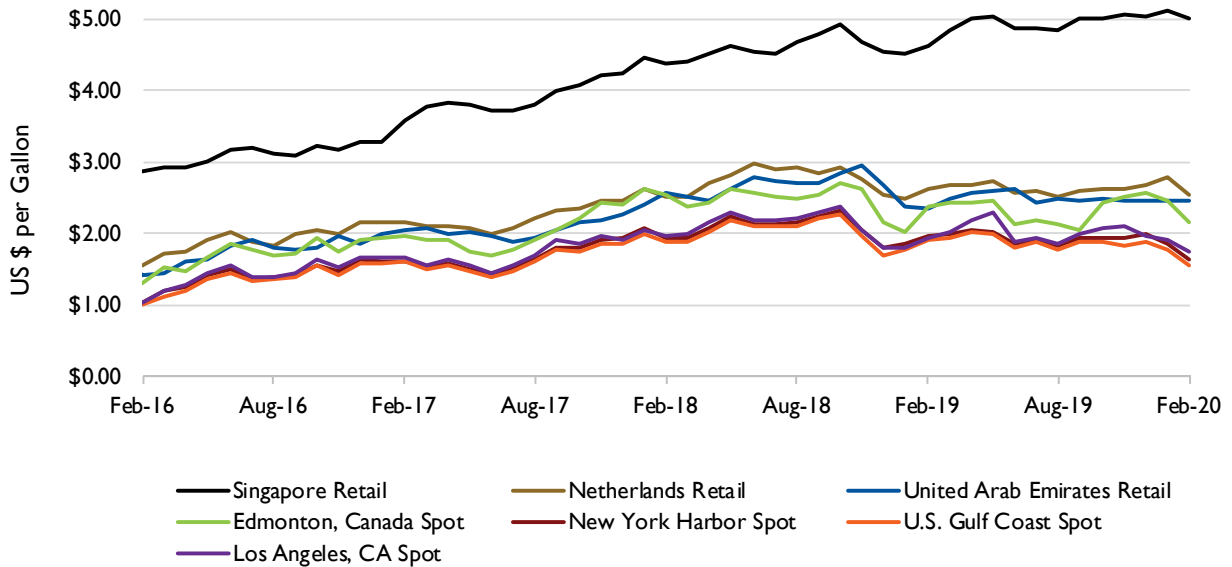
GASOLINE PRICES (MONTHLY AVERAGE) (2)



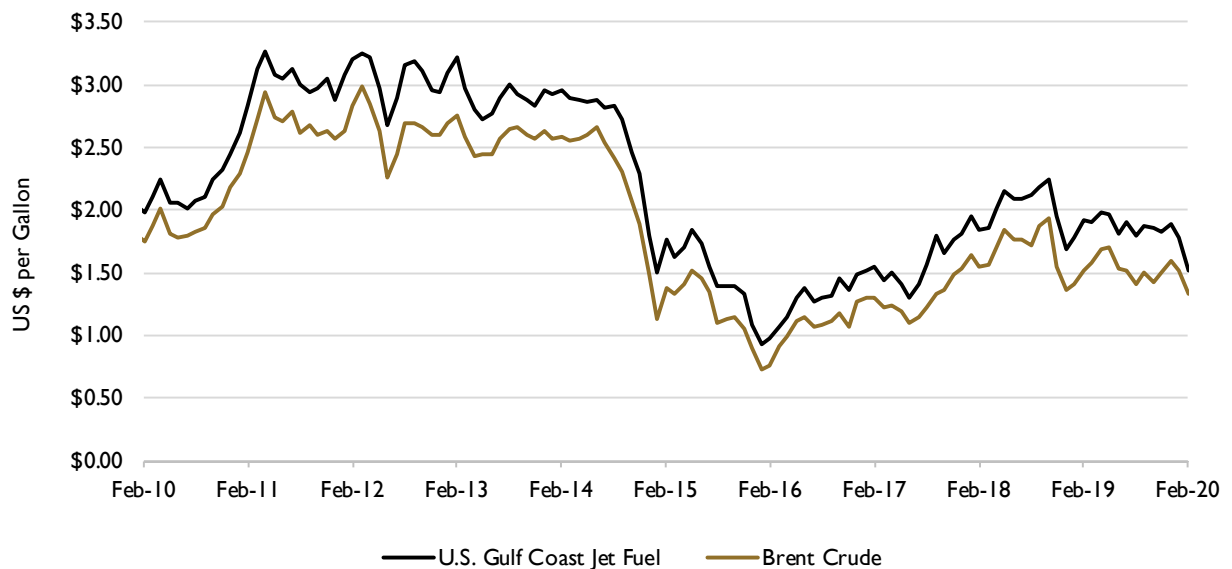
DATA CENTER

OIL

DIESEL PRICES (MONTHLY AVERAGE) (3)



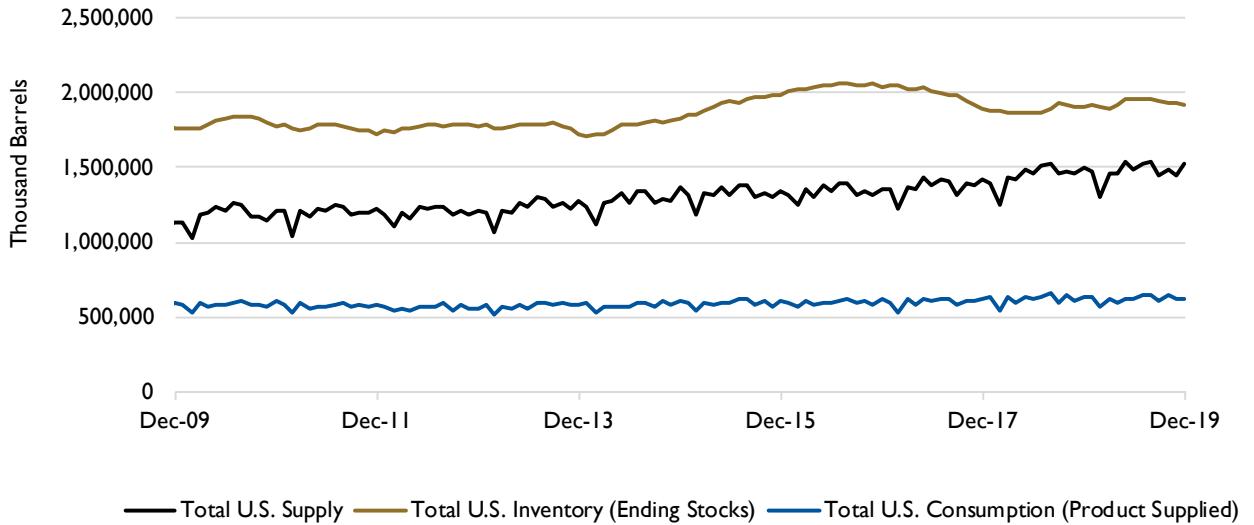
JET FUEL PRICES (MONTHLY AVERAGE) (4)



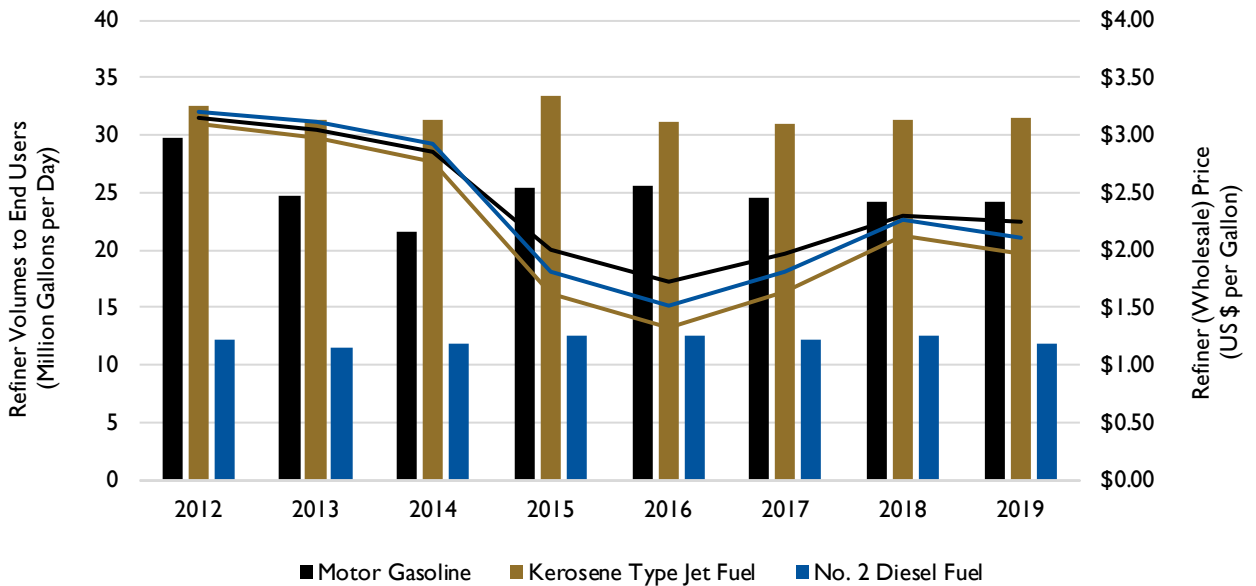
DATA CENTER

OIL

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



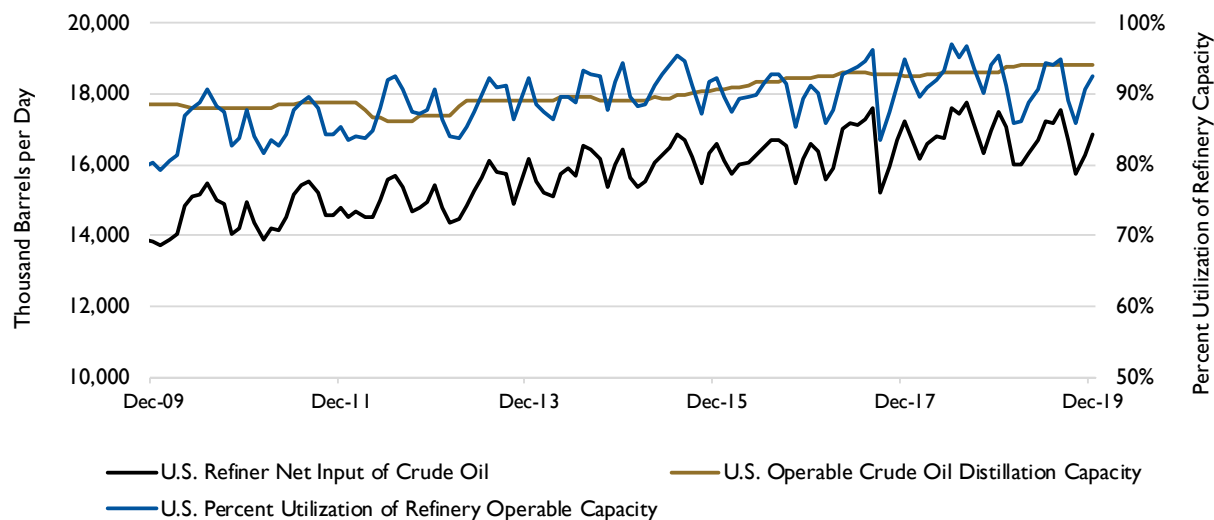
U.S. REFINERY VOLUMES AND WHOLESALE PRICES OF PETROLEUM PRODUCTS (ANNUAL AVERAGE) ⁽⁶⁾



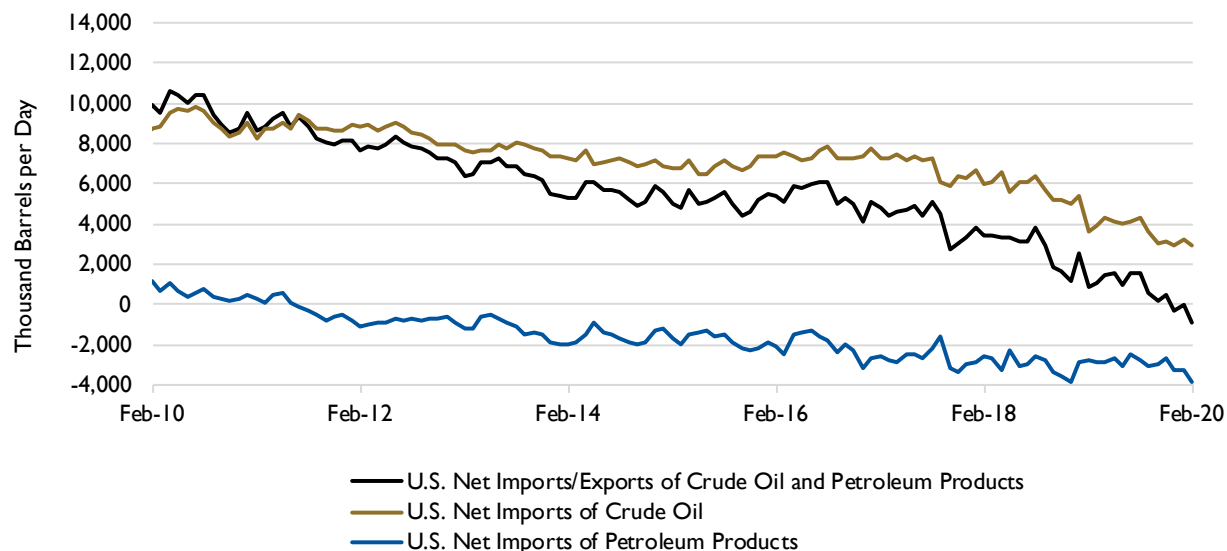
DATA CENTER

OIL

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



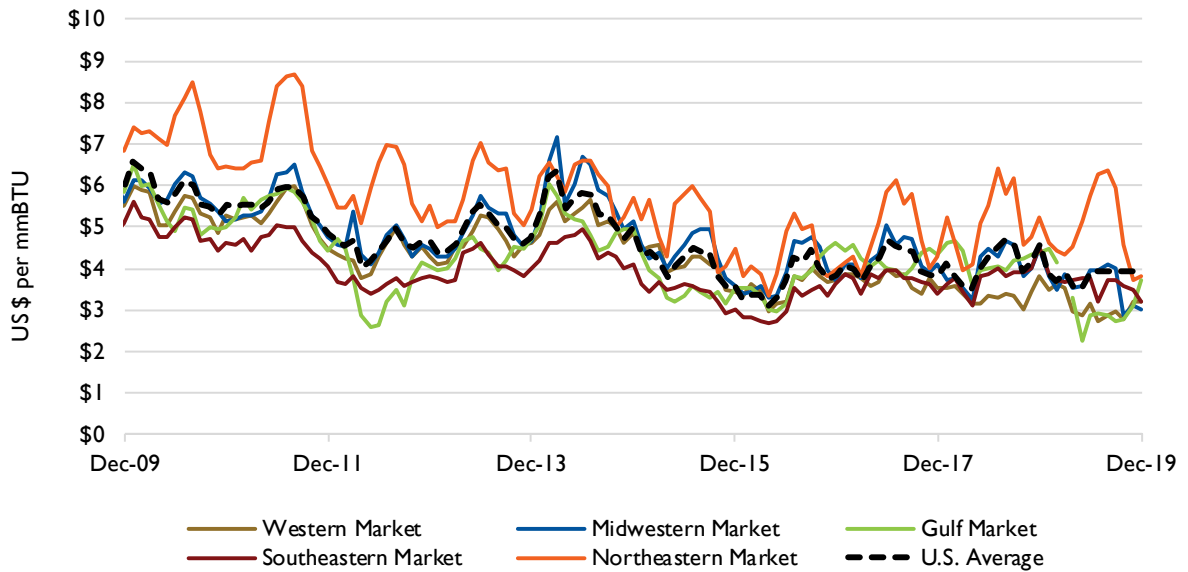
U.S. CRUDE OIL AND PETROLEUM PRODUCTS IMPORTS AND EXPORTS (MONTHLY AVERAGE) ⁽⁸⁾



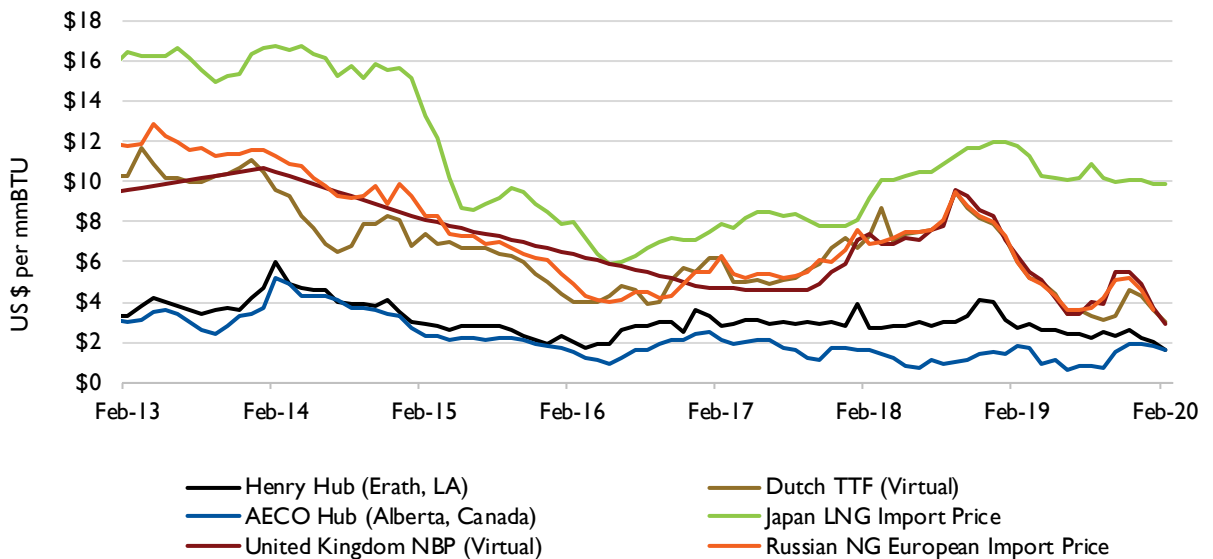
DATA CENTER

NATURAL GAS

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

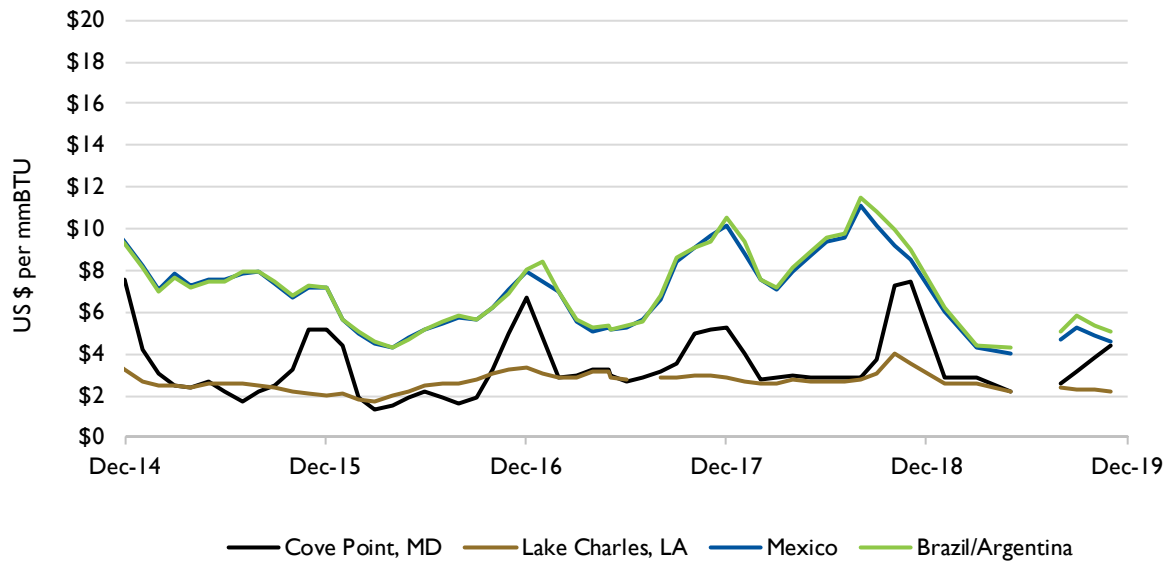


INTERNATIONAL NATURAL GAS PRICES (MONTHLY AVERAGE) (10)

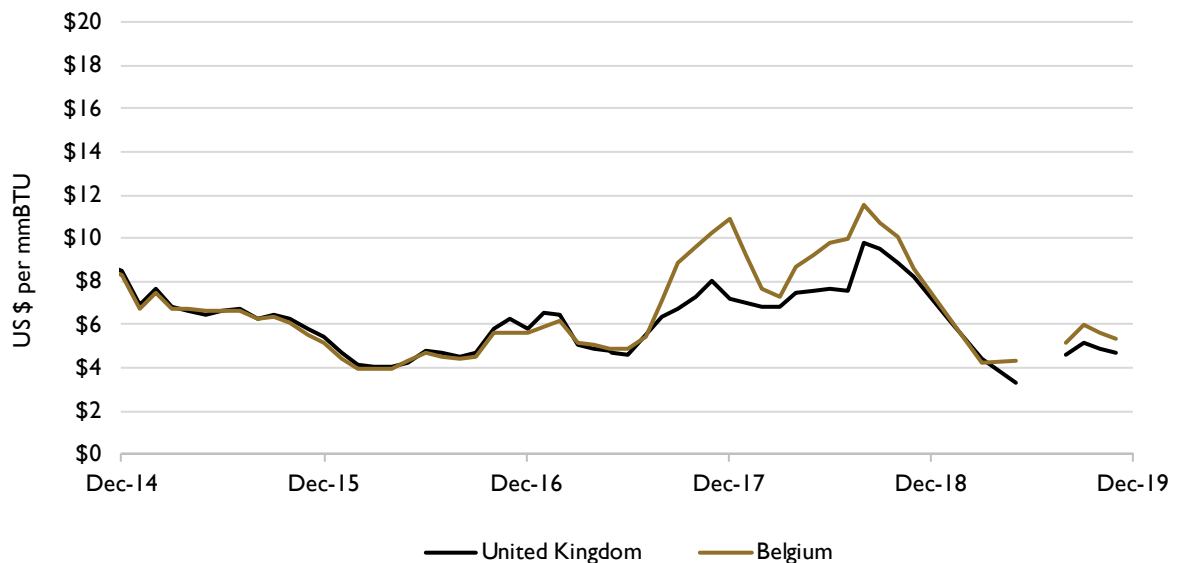


DATA CENTER NATURAL GAS

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



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



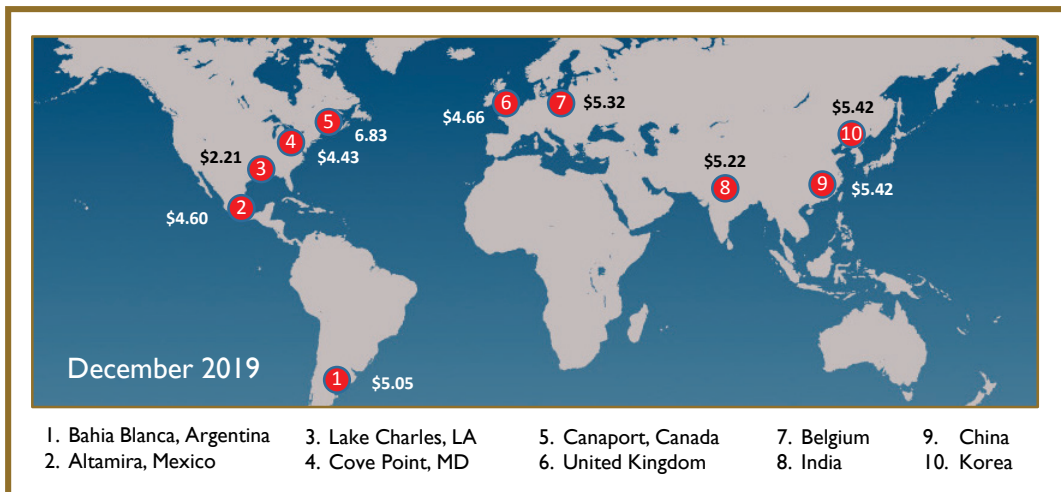
DATA CENTER

NATURAL GAS

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



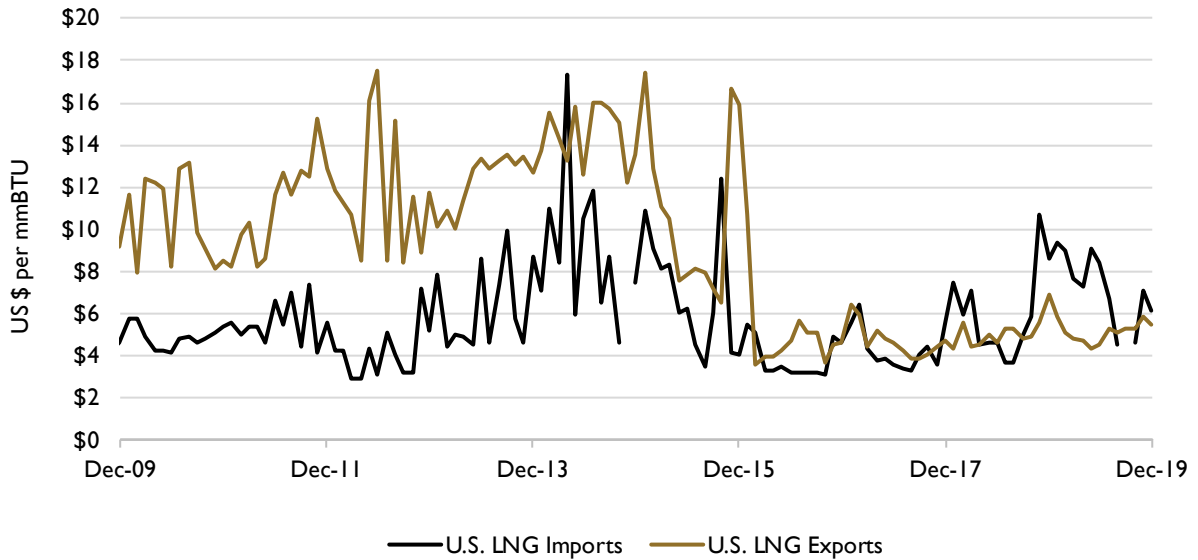
WORLD LIQUEFIED NATURAL GAS PRICES MAP (MONTHLY AVERAGE) (14)



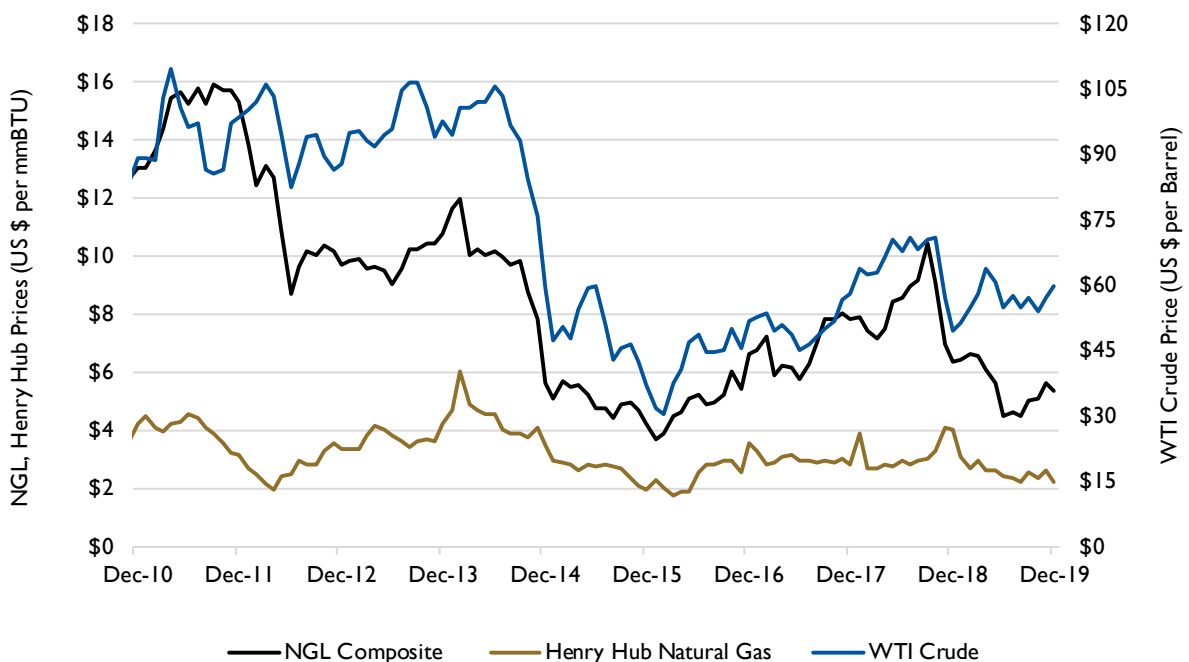
DATA CENTER

NATURAL GAS

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



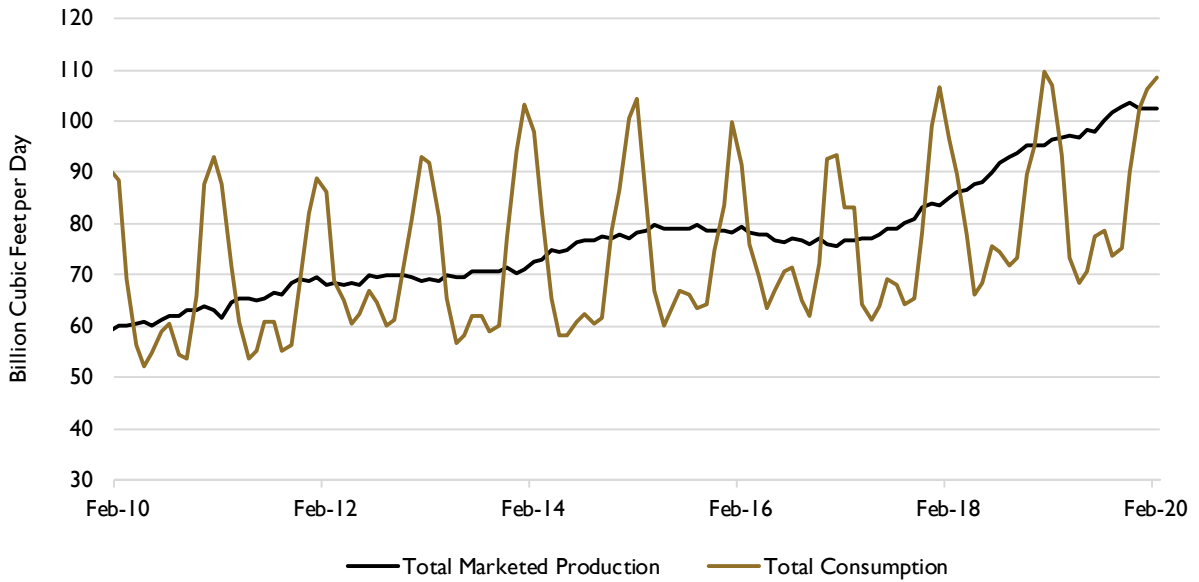
NATURAL GAS PLANT LIQUIDS PRICES (MONTHLY AVERAGE) (16)



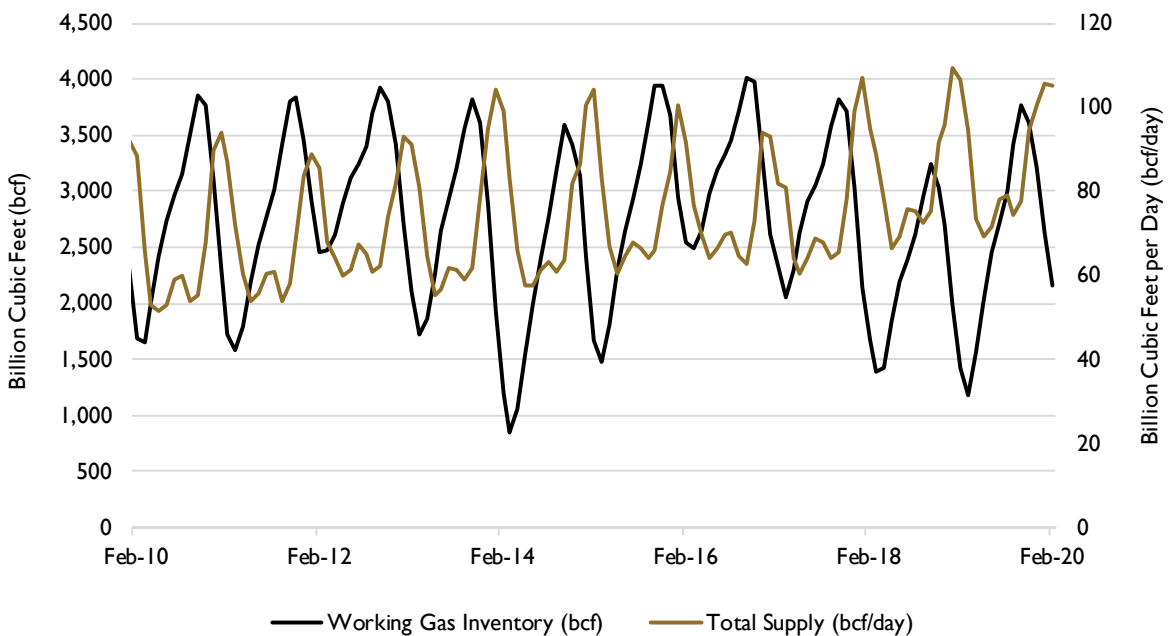
DATA CENTER

NATURAL GAS

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



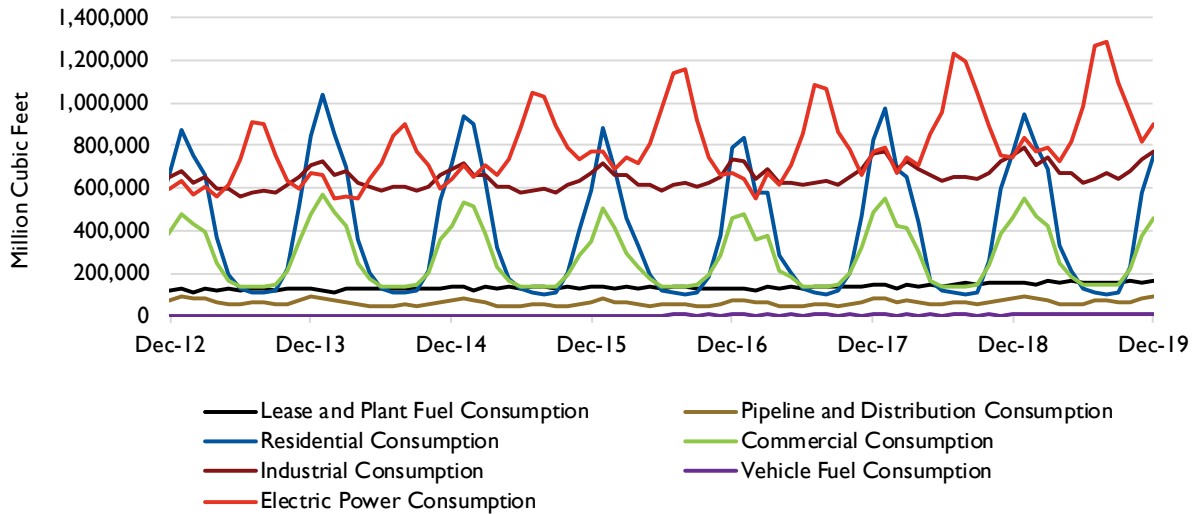
U.S. NATURAL GAS SUPPLY AND INVENTORY (MONTHLY) (18)



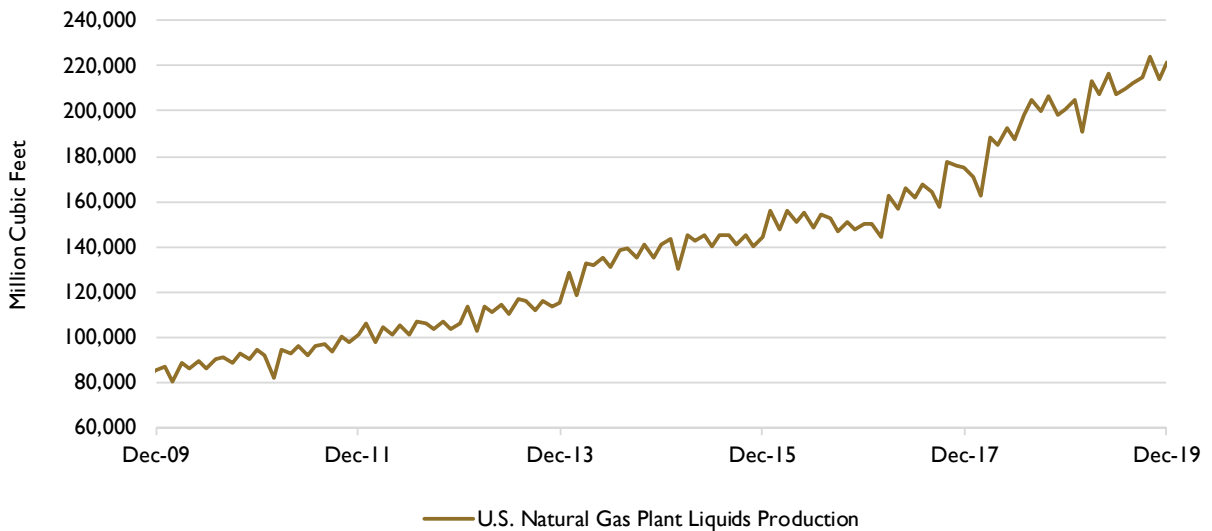
DATA CENTER

NATURAL GAS

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



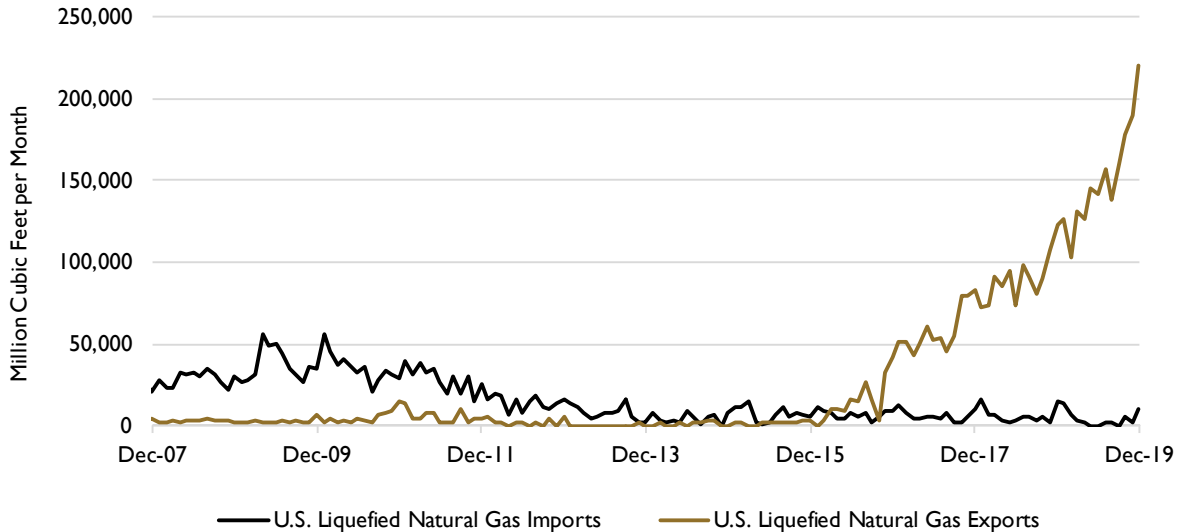
U.S. NATURAL GAS PLANT LIQUIDS PRODUCTION (MONTHLY) ⁽²⁰⁾



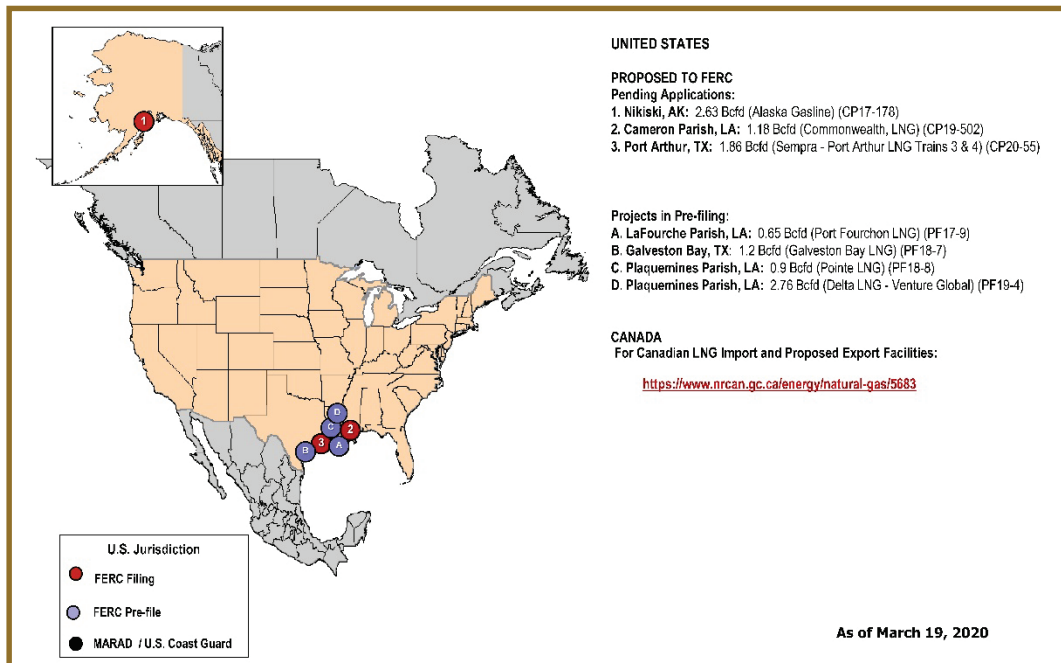
DATA CENTER

NATURAL GAS

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



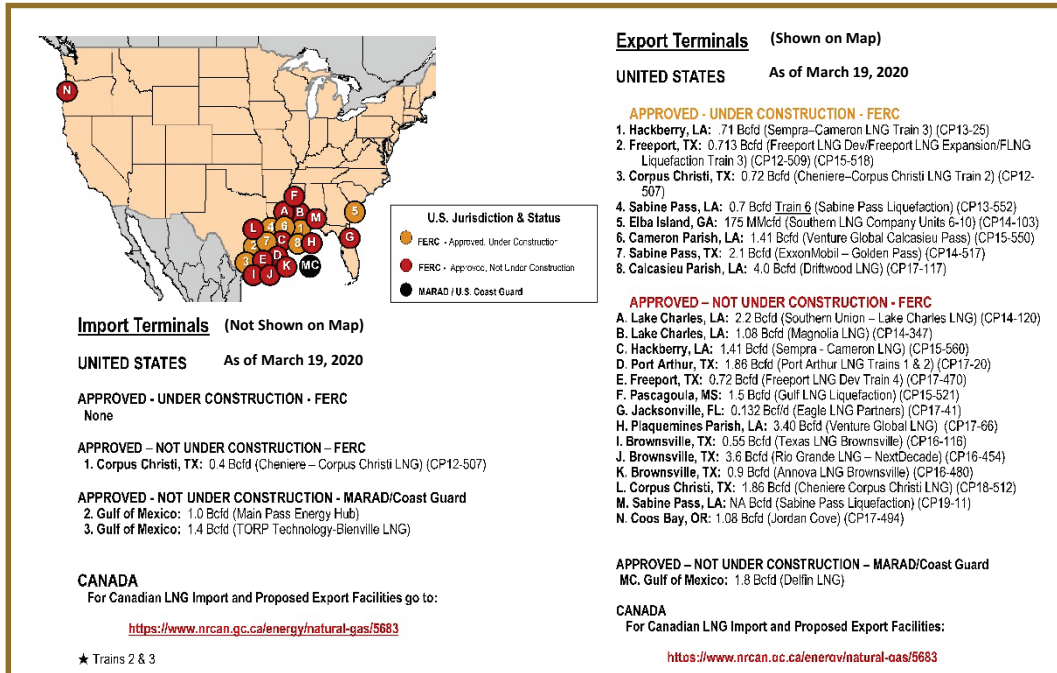
NORTH AMERICAN LNG EXPORT TERMINALS — PROPOSED ⁽²²⁾



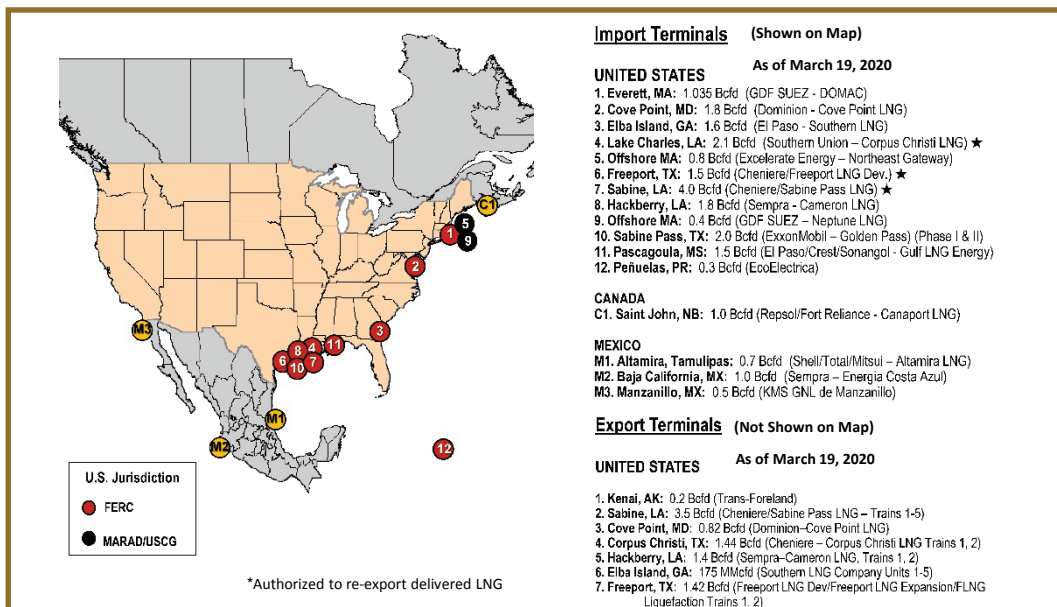
DATA CENTER

NATURAL GAS

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



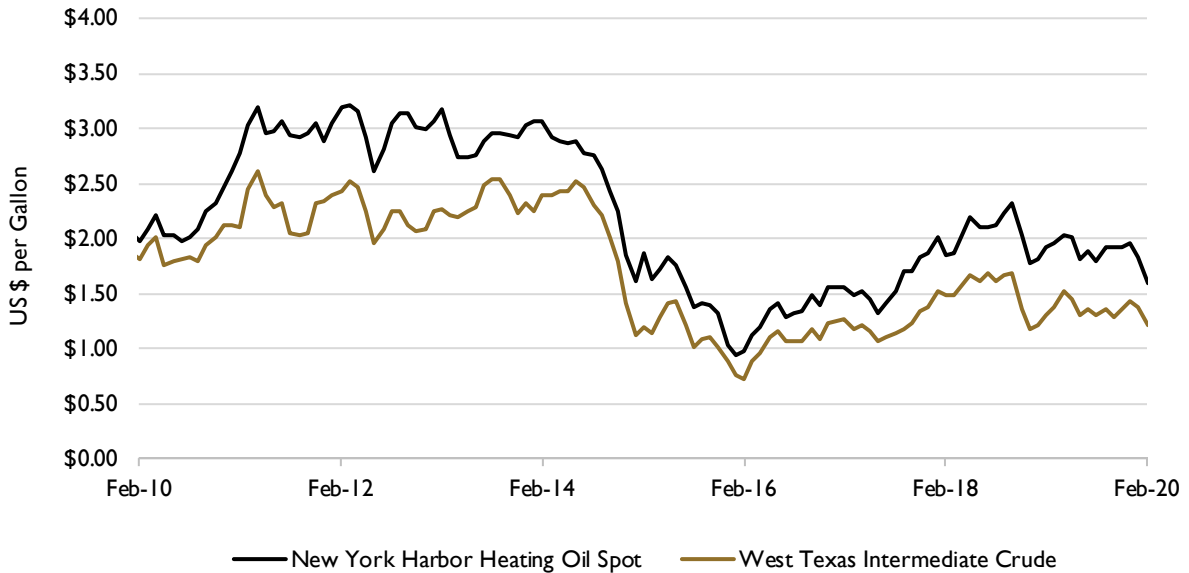
NORTH AMERICAN LNG IMPORT/EXPORT TERMINALS — *EXISTING* (24)



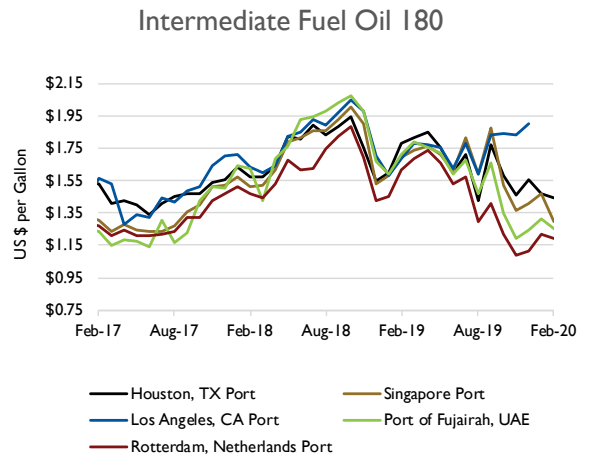
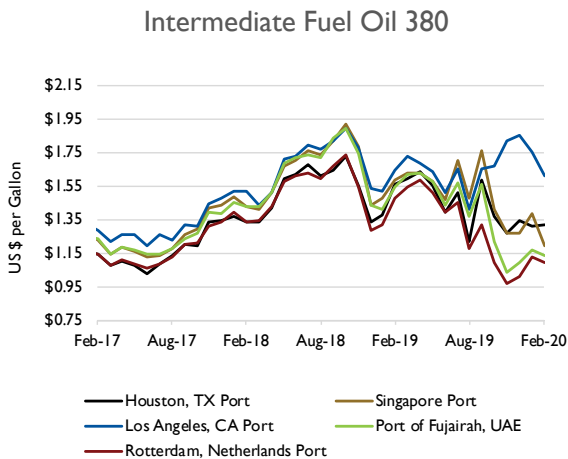
DATA CENTER

PROPANE AND HEATING/FUEL OIL

HEATING OIL PRICES (MONTHLY AVERAGE) (25)



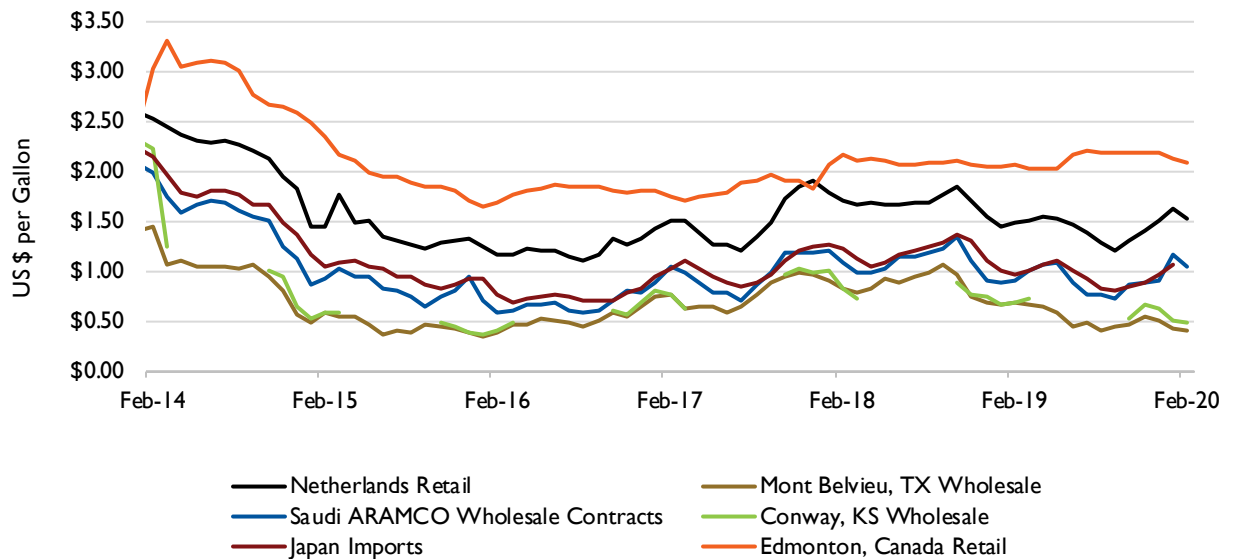
INTERMEDIATE FUEL OIL AKA “BUNKER FUEL” PRICES (MONTHLY AVERAGE) (26)



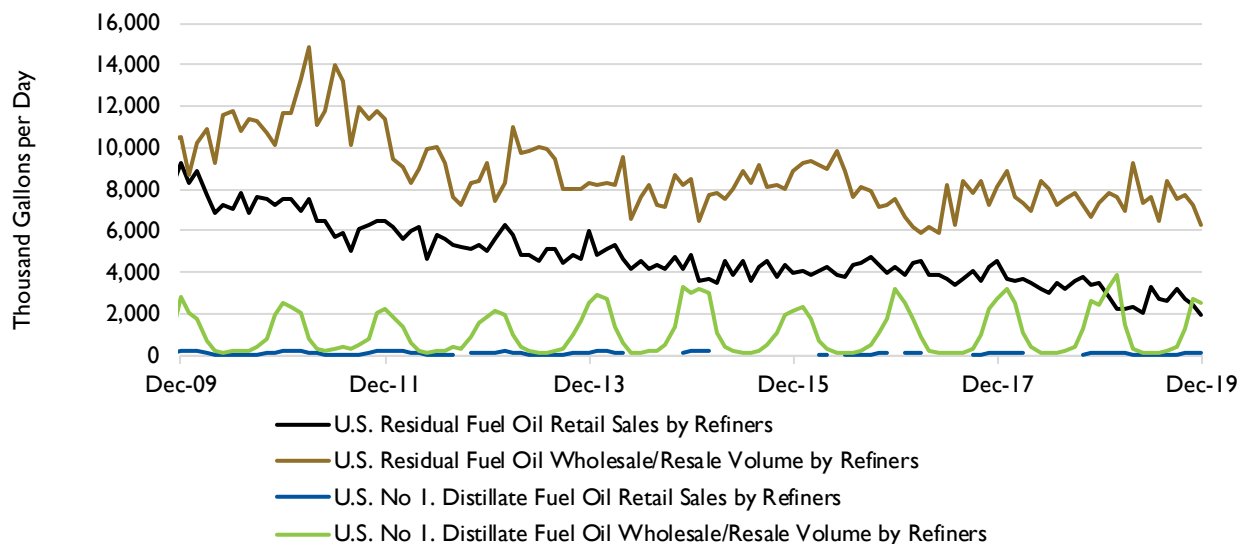
DATA CENTER

PROPANE AND HEATING/FUEL OIL

PROPANE PRICES (MONTHLY AVERAGE) (27)



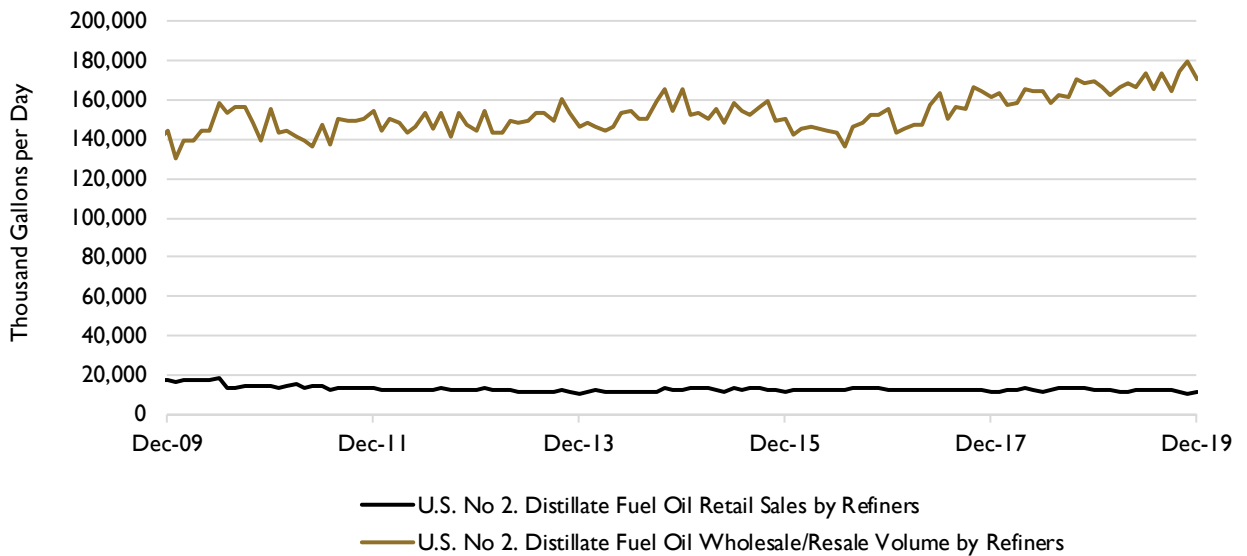
NO. 1 DISTILLATE FUEL OIL, RESIDUAL FUEL OIL WHOLESALE, RETAIL SALES VOLUME BY REFINERS (MONTHLY) (28)



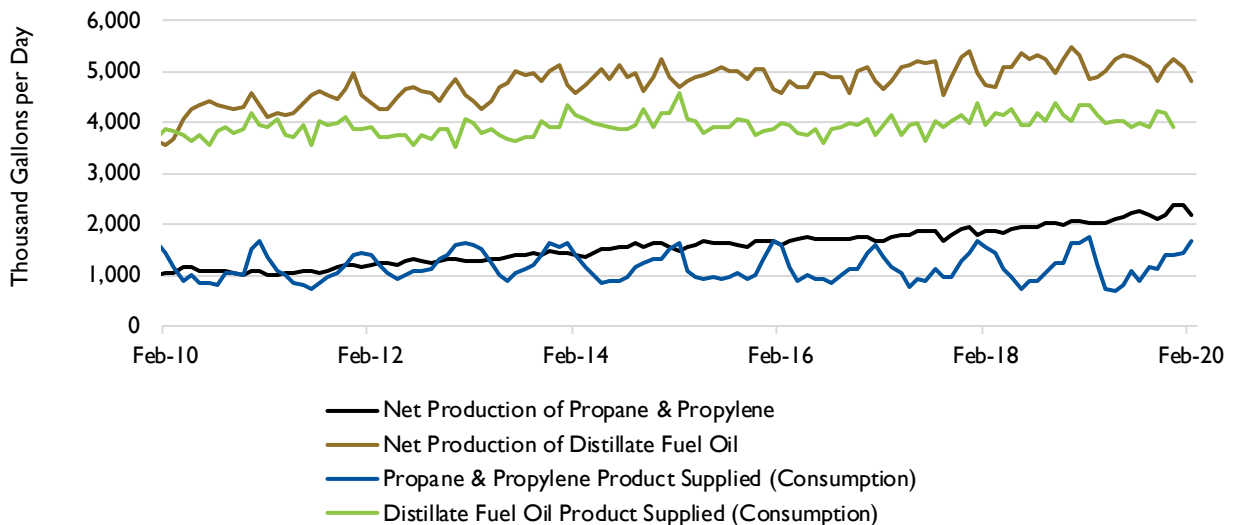
DATA CENTER

PROPANE AND HEATING/FUEL OIL

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



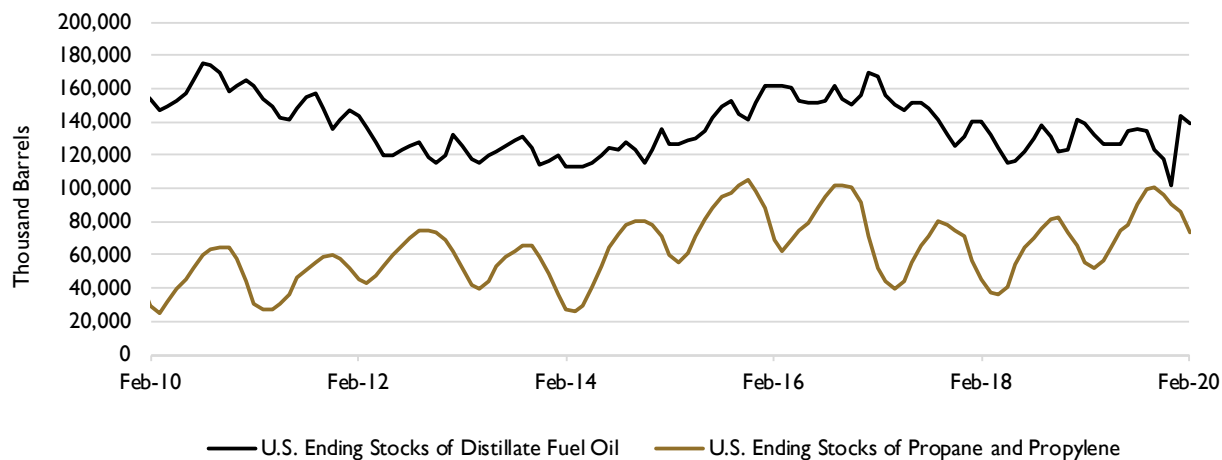
PROPANE & PROPYLENE AND DISTILLATE FUEL OIL PRODUCTION AND CONSUMPTION (MONTHLY) ⁽³⁰⁾



DATA CENTER

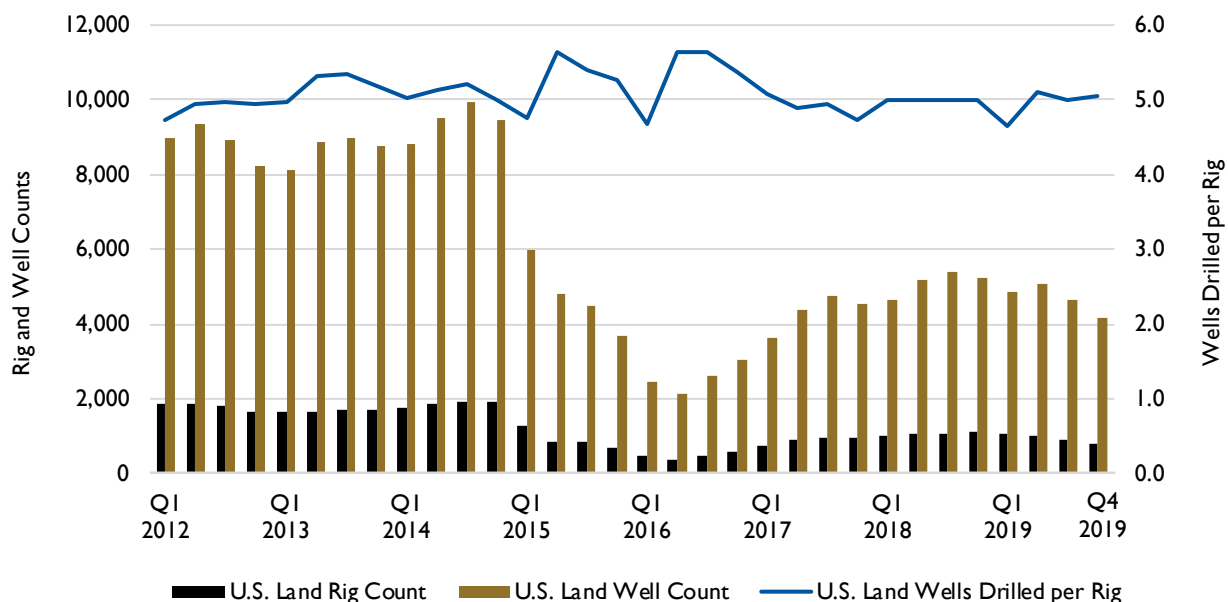
PROPANE AND HEATING/FUEL OIL

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



DRILLING ACTIVITY

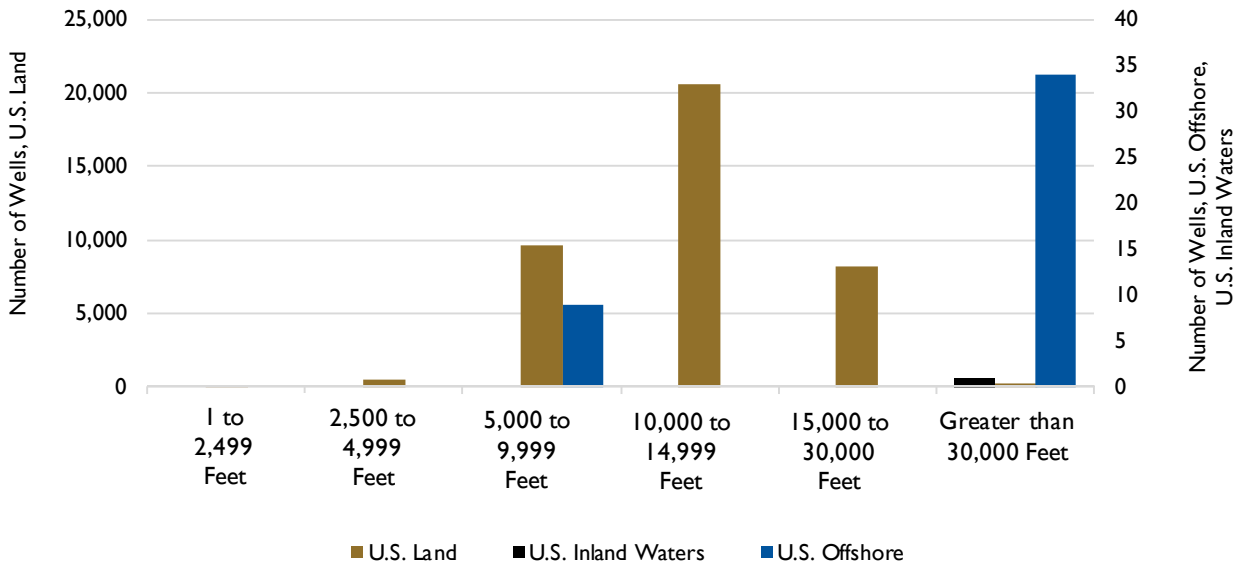
U.S. LAND WELL COUNT, RIG COUNT AND WELLS PER RIG (QUARTERLY) ⁽³²⁾



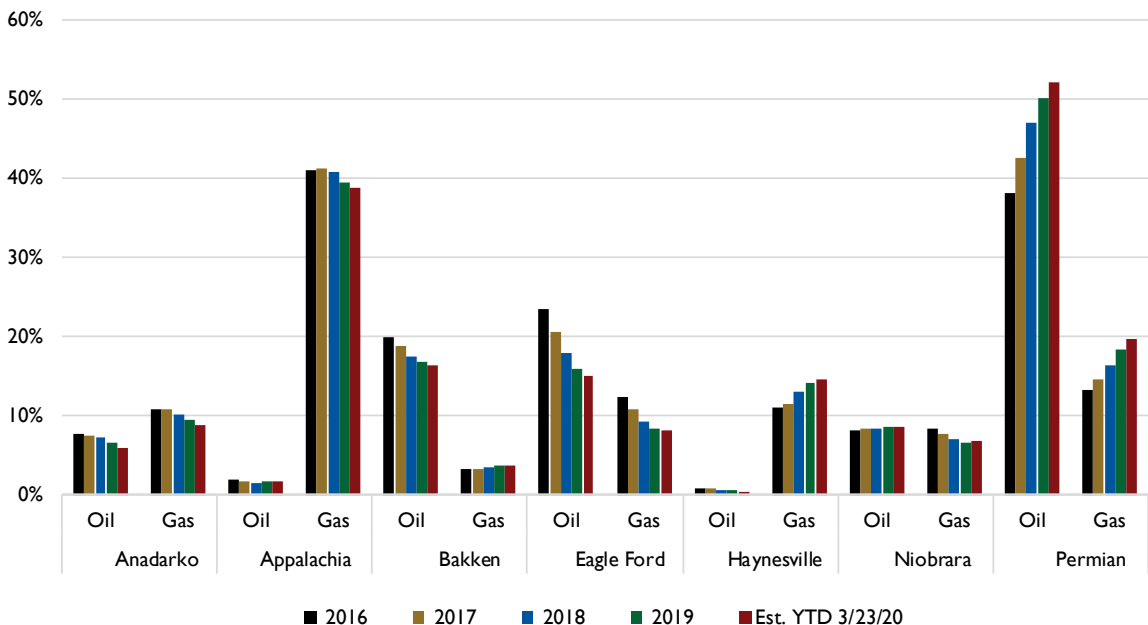
DATA CENTER

DRILLING ACTIVITY

U.S. WELL STARTS BY DEPTH (YEAR TO DATE FEBRUARY 29, 2020) ⁽³³⁾



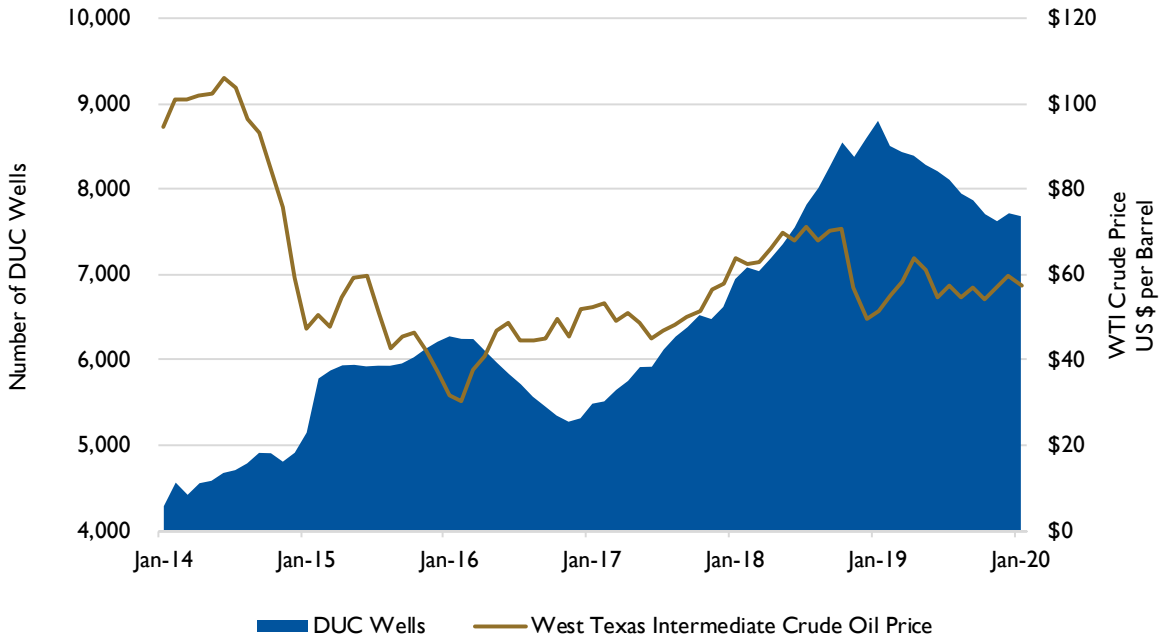
PERCENTAGE OF CRUDE OIL AND NATURAL GAS PRODUCTION PER SHALE REGION (MONTHLY) ⁽³⁴⁾



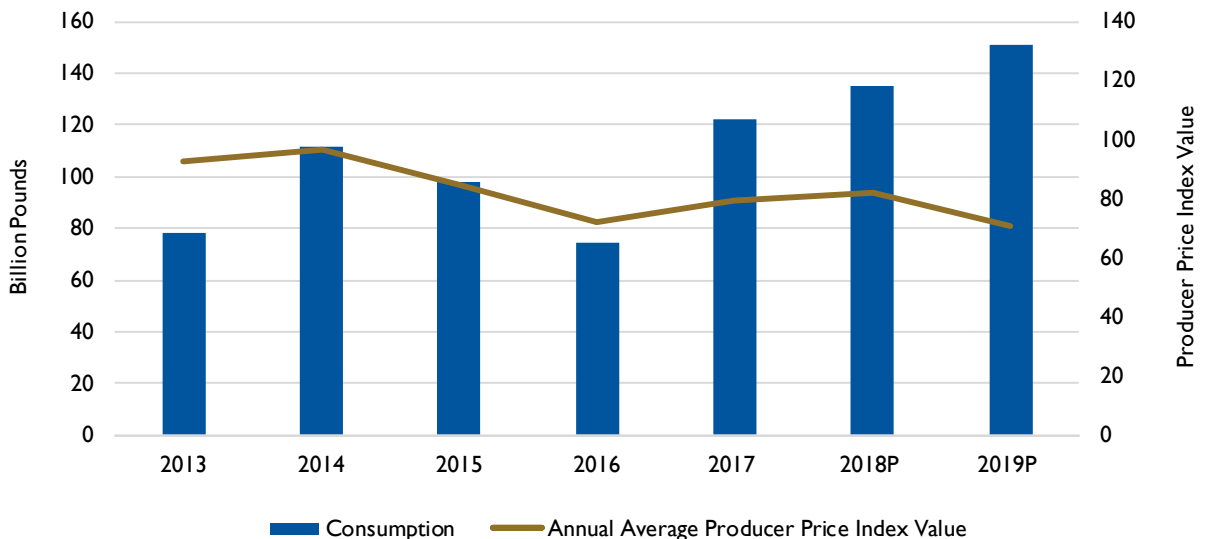
DATA CENTER

DRILLING ACTIVITY

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



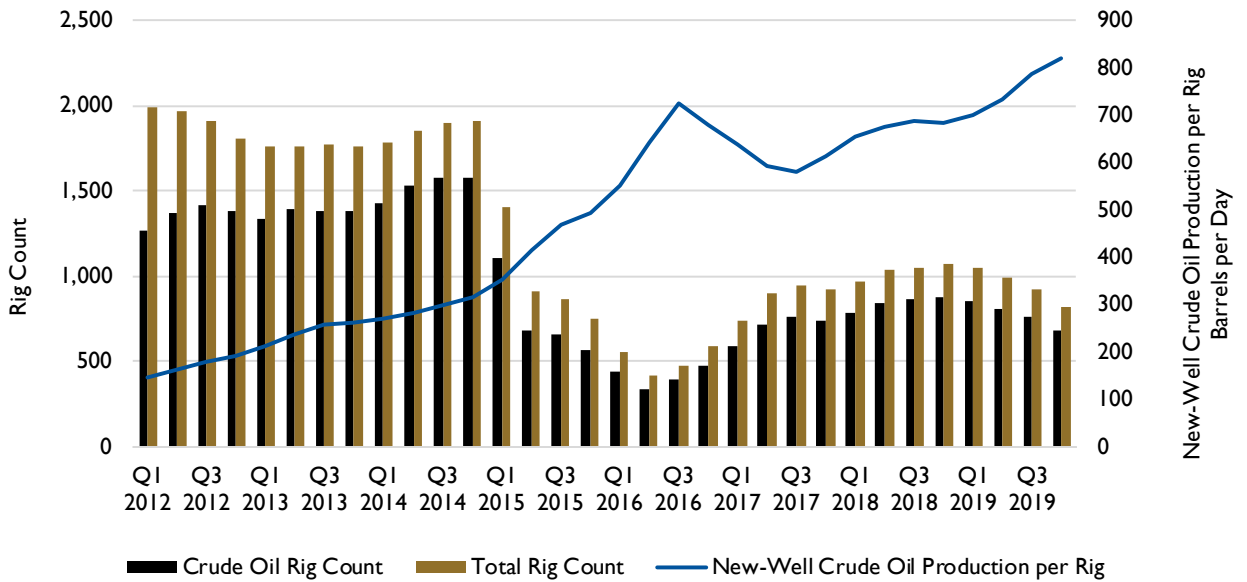
HYDRAULIC FRACTURING SAND CONSUMPTION AND PRODUCER PRICE INDEX (ANNUAL) ⁽³⁶⁾



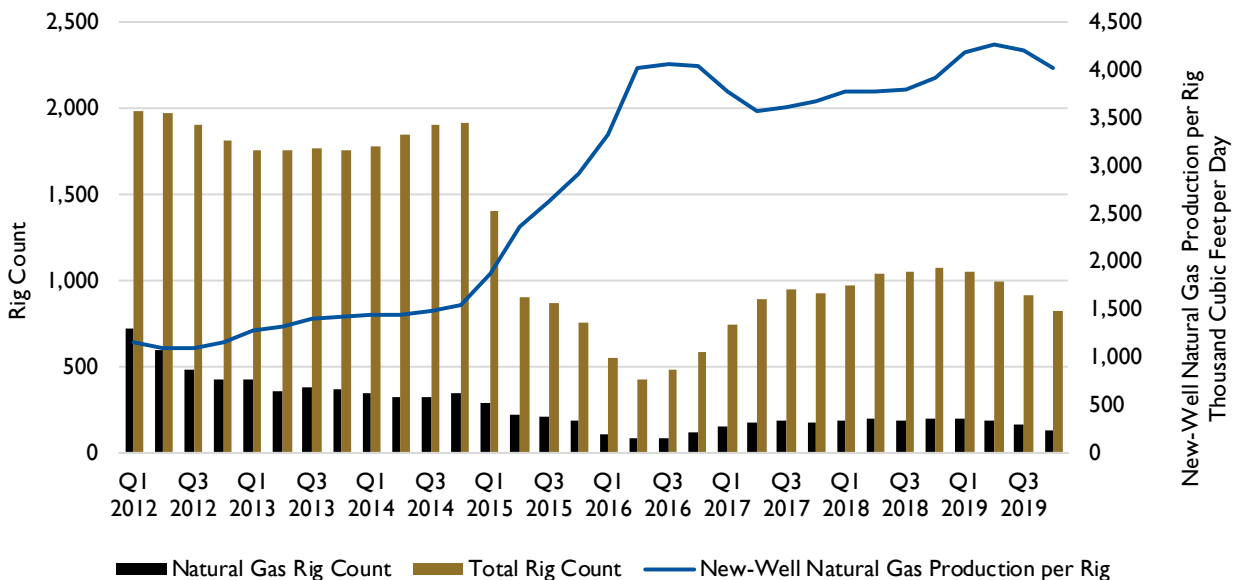
DATA CENTER

DRILLING ACTIVITY

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

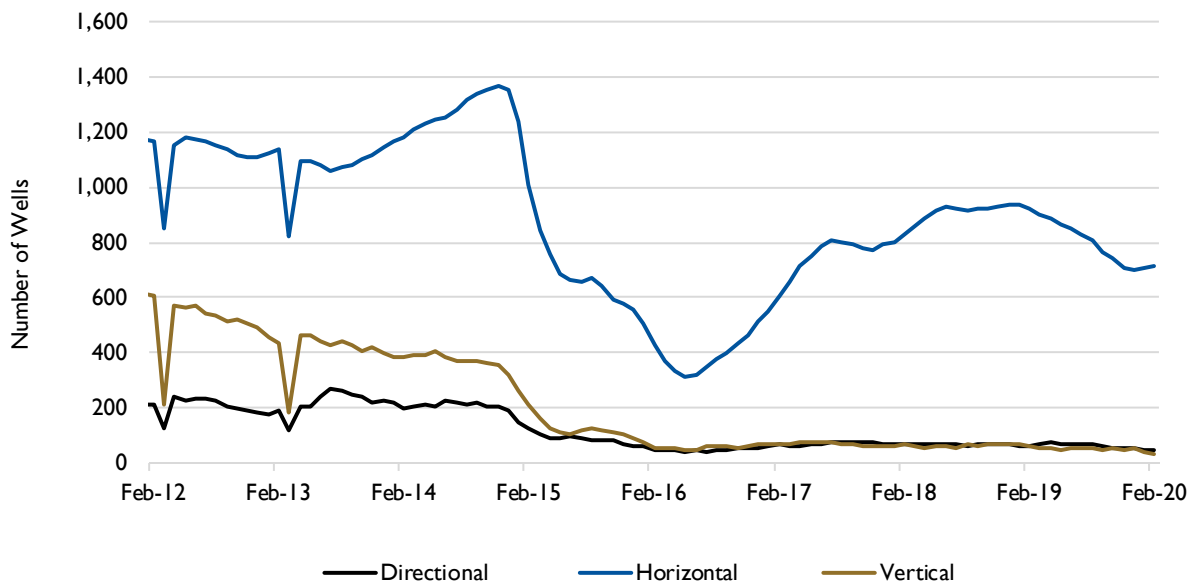


NATURAL GAS PRODUCTION, RIG COUNT AND PRODUCTION PER RIG (QUARTERLY) (38)



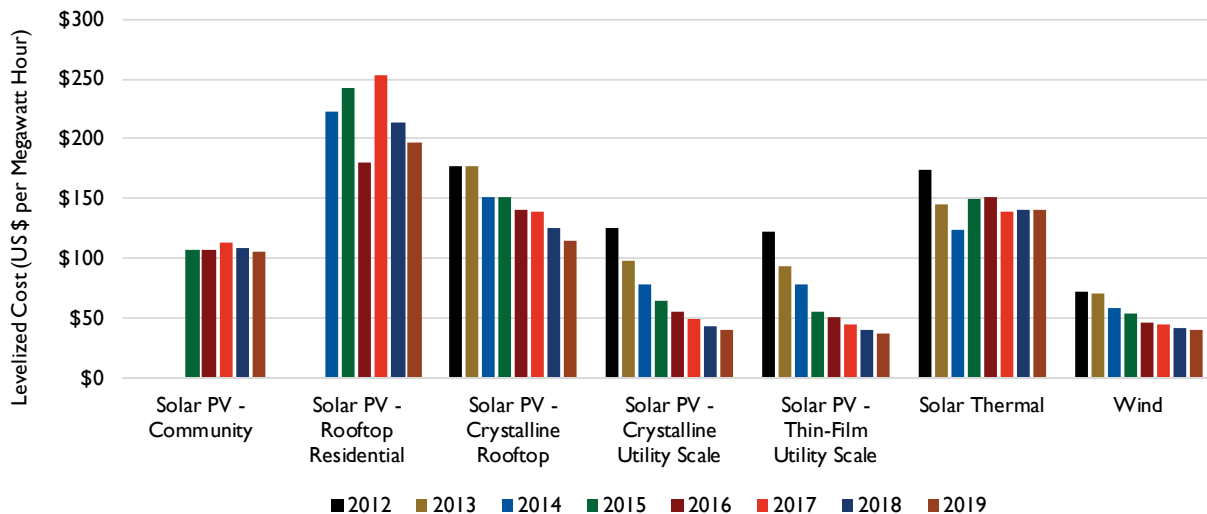
DATA CENTER DRILLING ACTIVITY

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



RENEWABLES

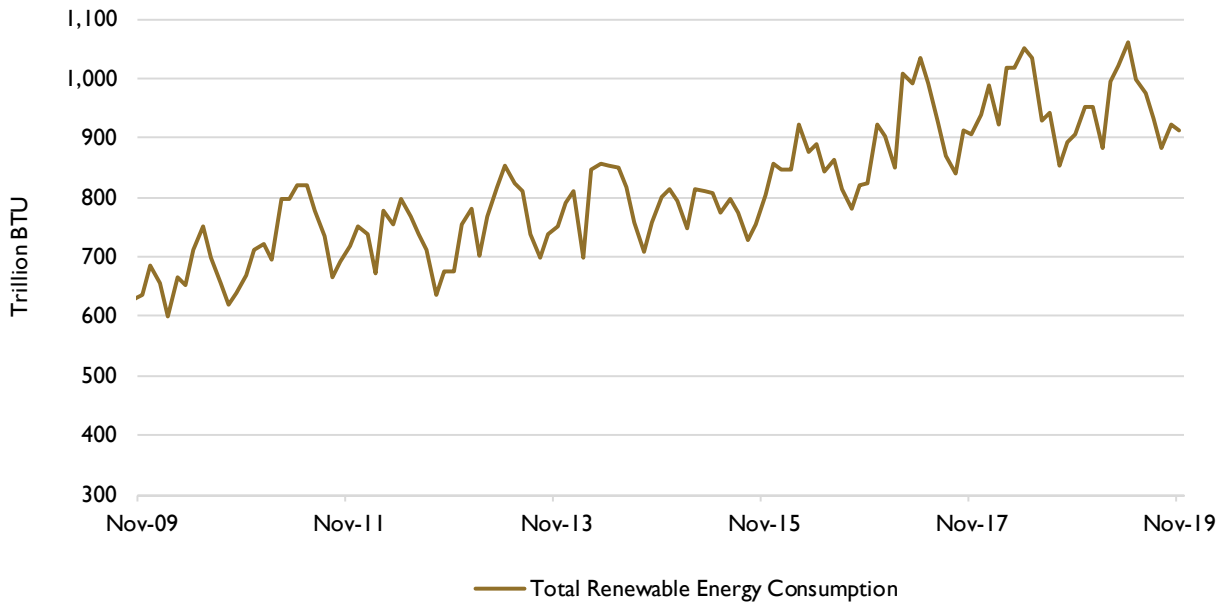
WIND AND SOLAR PRICES (ANNUAL AVERAGE) (40)



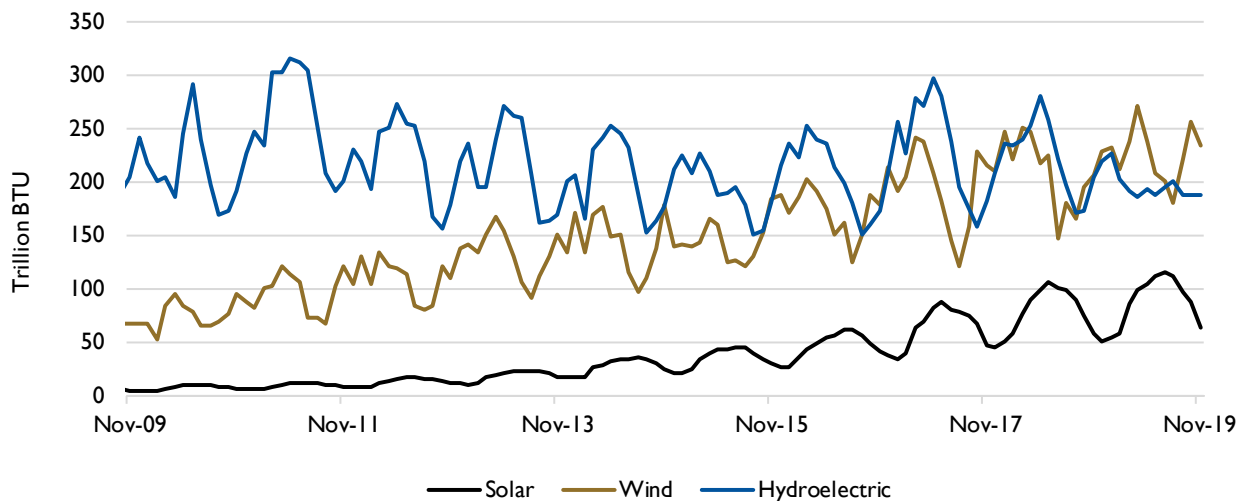
DATA CENTER

RENEWABLES

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



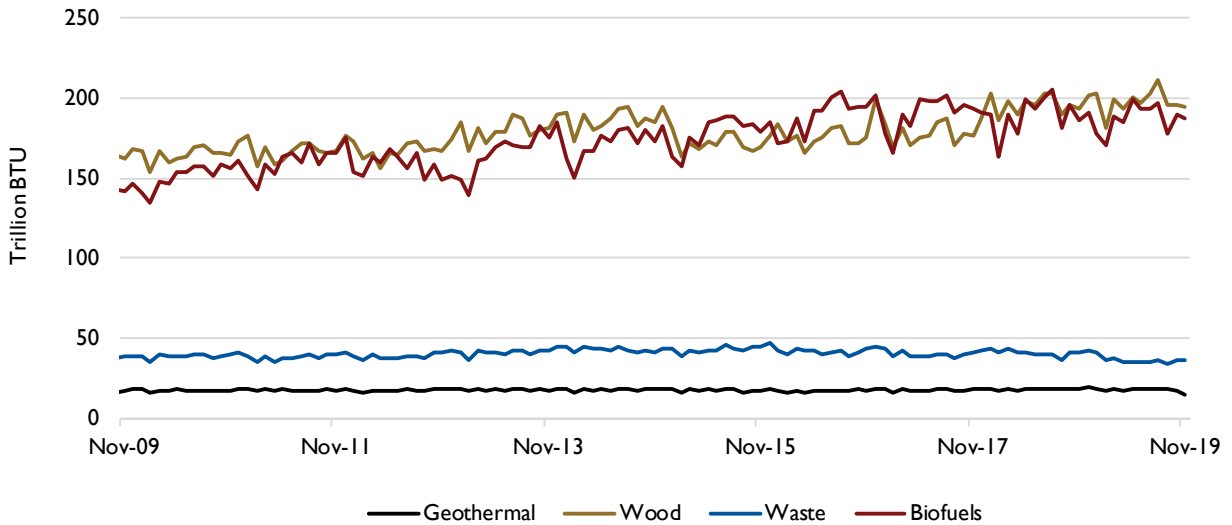
U.S. SOLAR, WIND AND HYDROELECTRIC ENERGY CONSUMPTION (MONTHLY) (42)



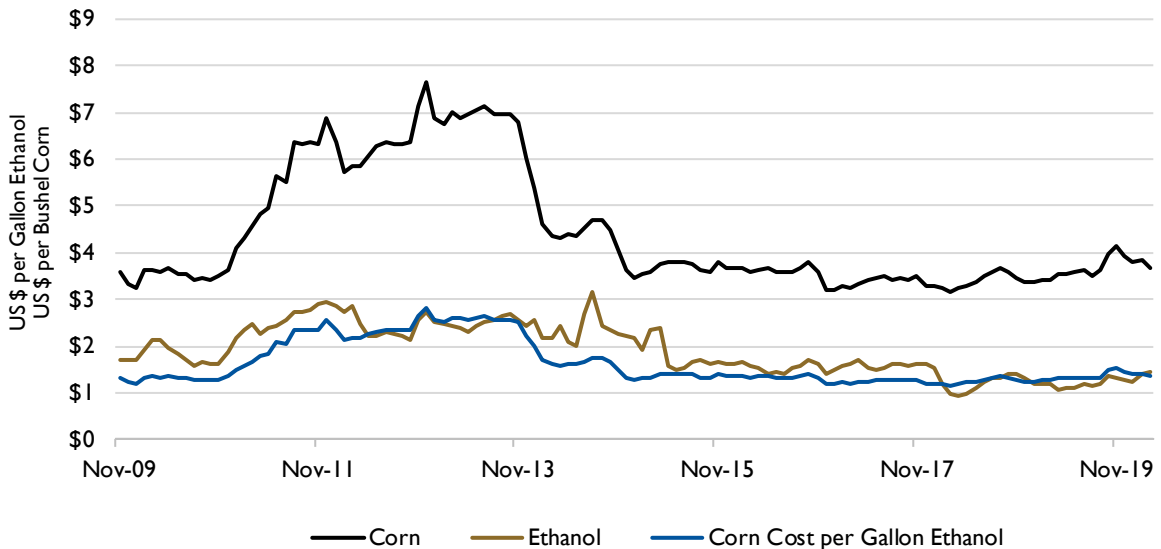
DATA CENTER

RENEWABLES

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

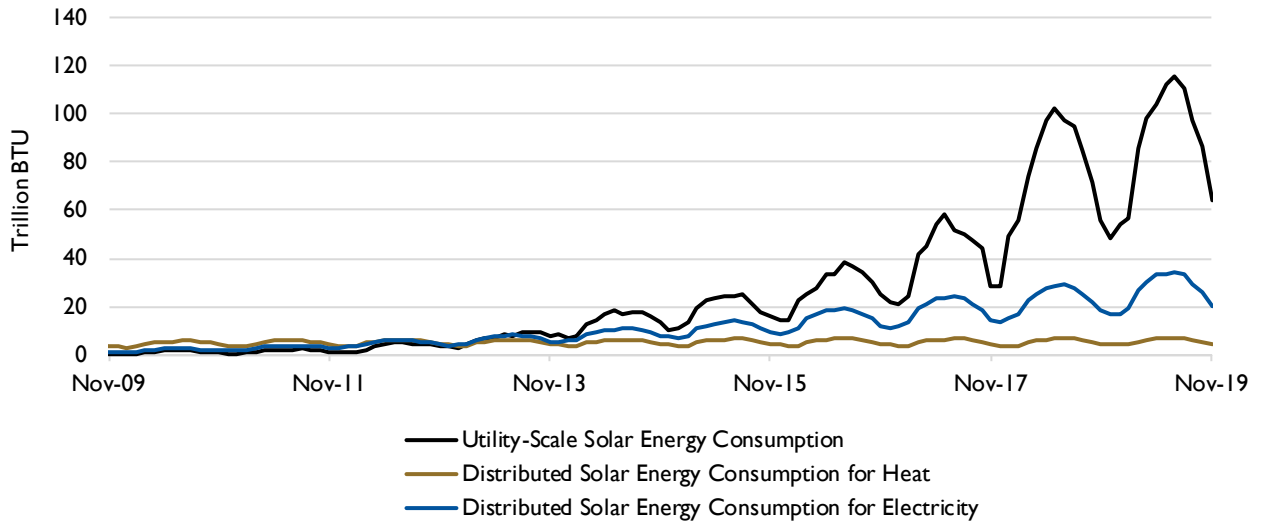


CORN AND ETHANOL PRICES AND CORN COST PER GALLON OF ETHANOL (QUARTERLY) (44)

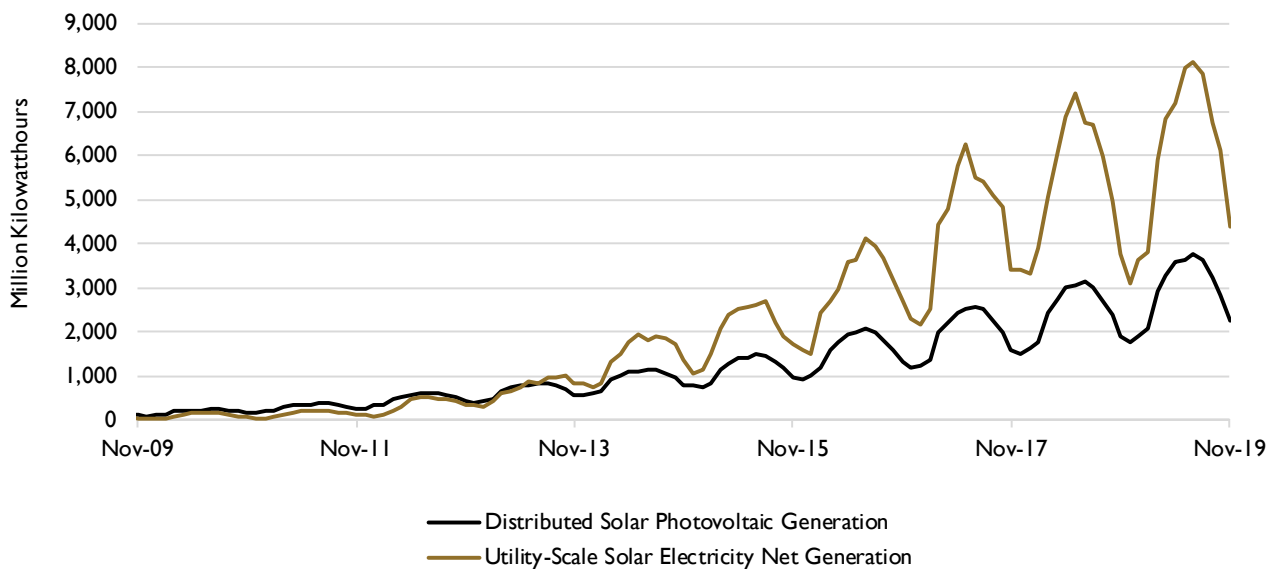


DATA CENTER RENEWABLES

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



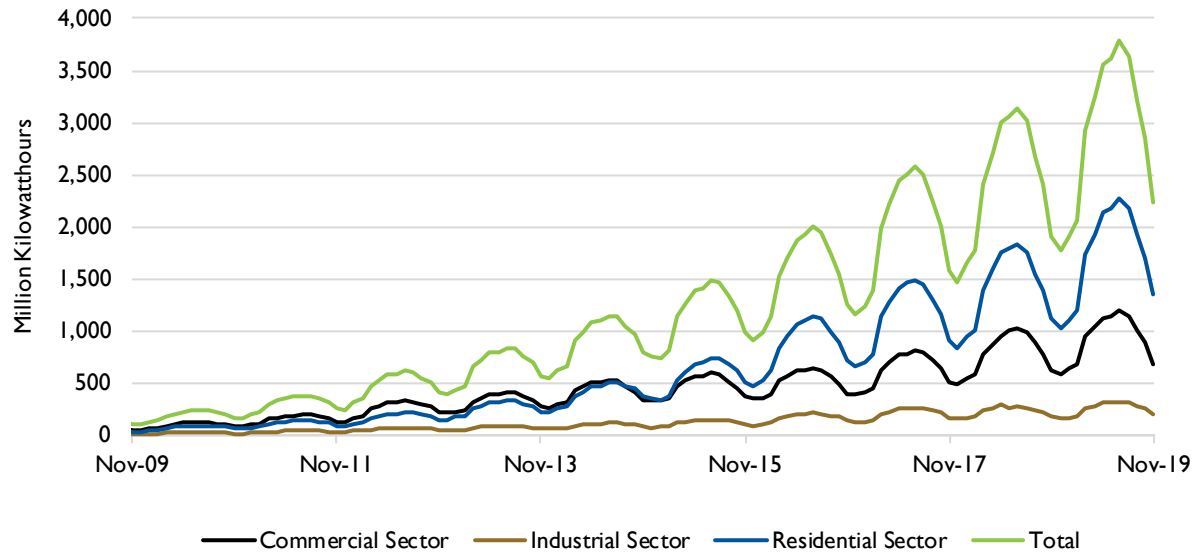
U.S. SOLAR ENERGY NET GENERATION (MONTHLY) ⁽⁴⁶⁾



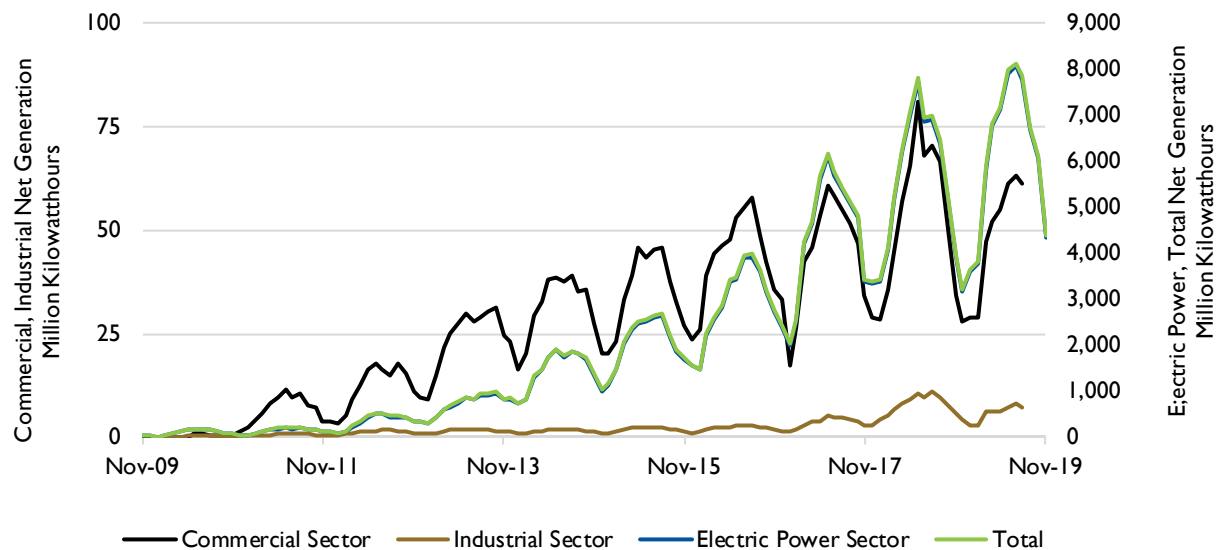
DATA CENTER

RENEWABLES

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

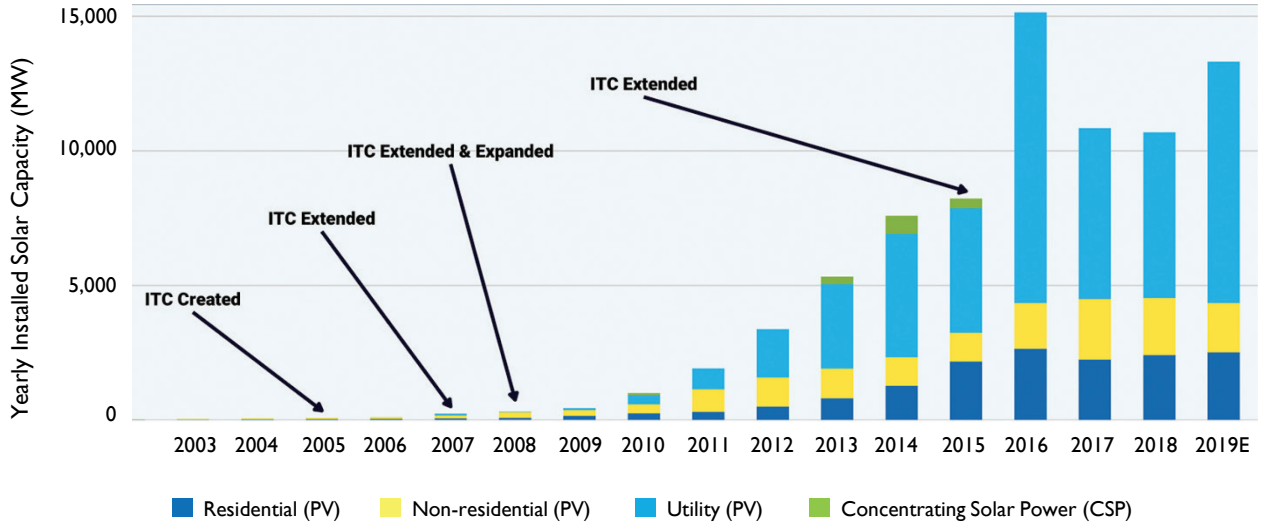


UTILITY-SCALE SOLAR ELECTRICITY NET GENERATION BY SECTOR (MONTHLY) (48)

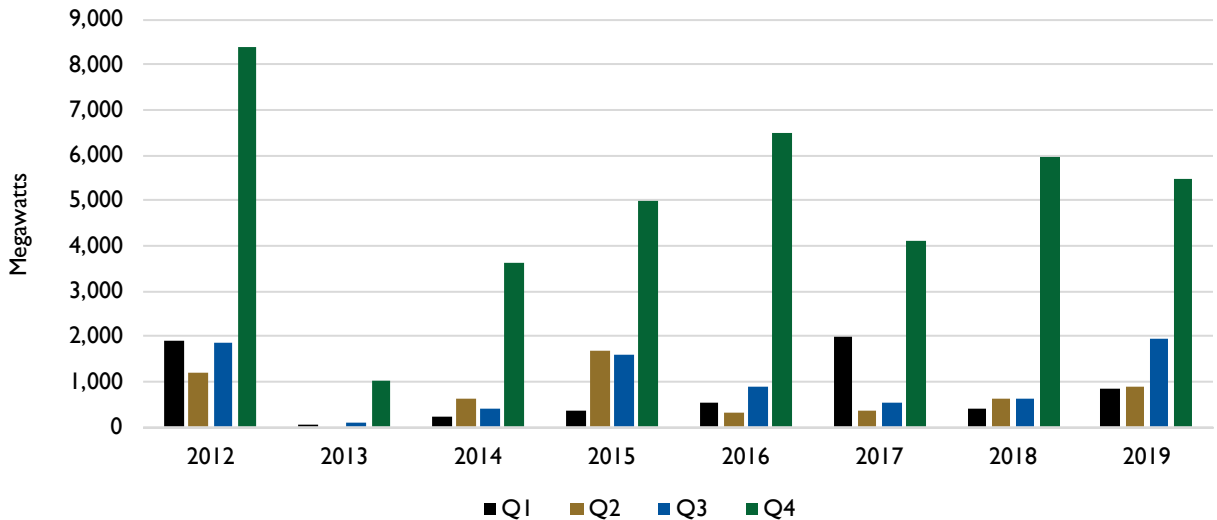


DATA CENTER RENEWABLES

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

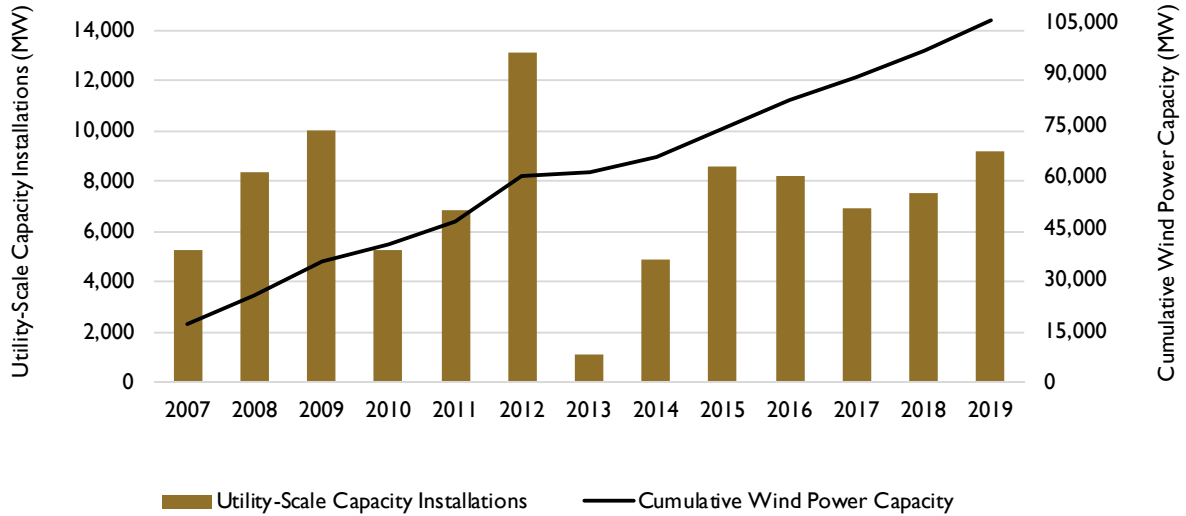


U.S. WIND POWER CAPACITY INSTALLATIONS (QUARTERLY) (50)

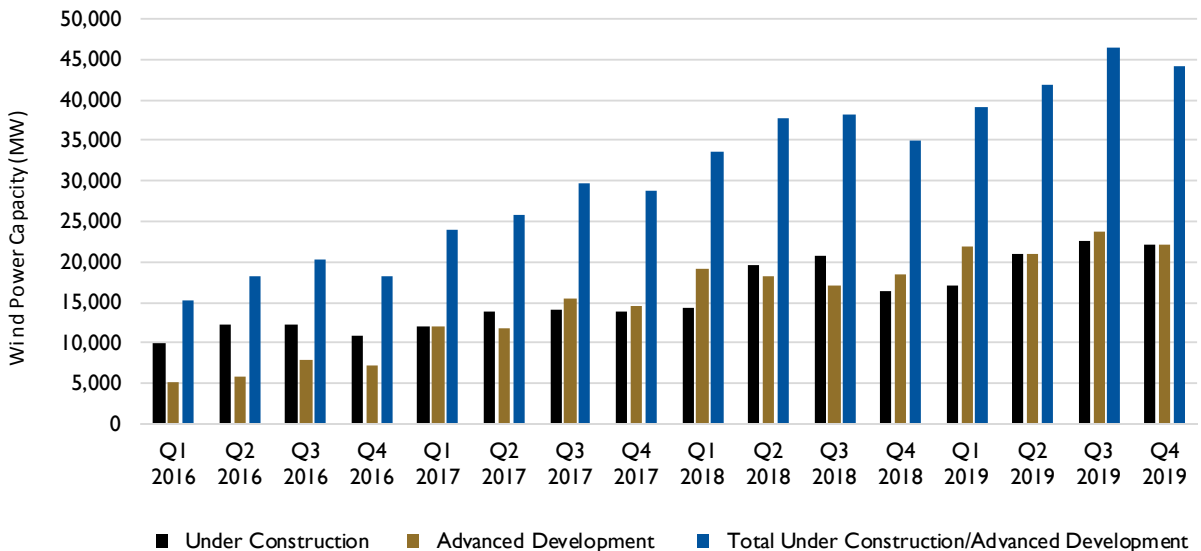


DATA CENTER RENEWABLES

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



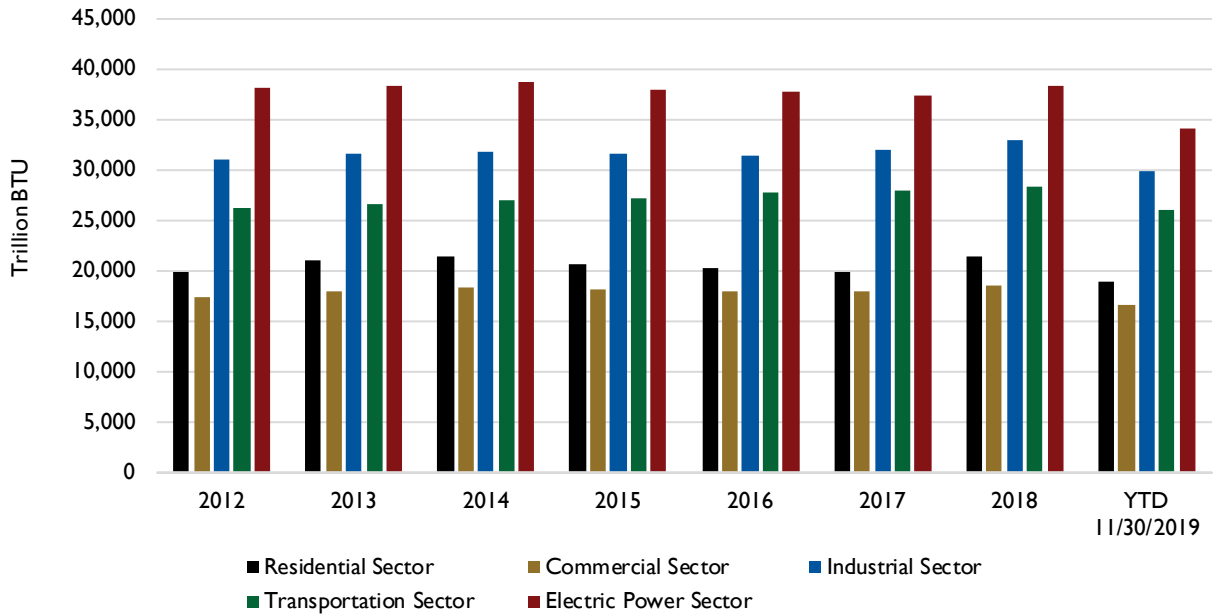
WIND POWER UNDER CONSTRUCTION OR IN ADVANCED DEVELOPMENT (QUARTERLY) (52)



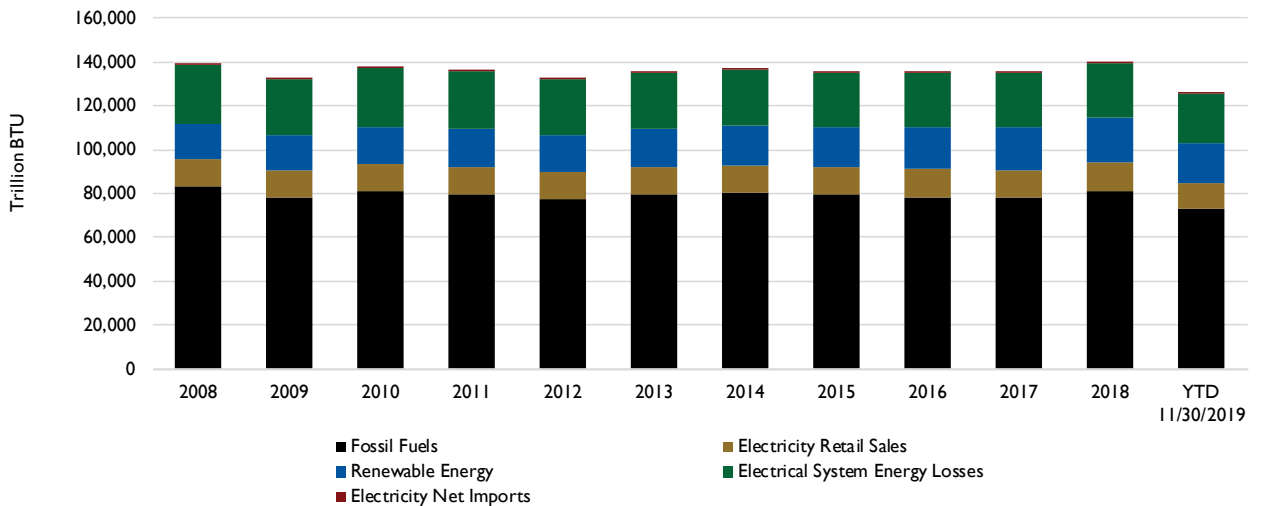
DATA CENTER

U.S. AGGREGATED ENERGY CONSUMPTION

ENERGY CONSUMPTION BY SECTOR (ANNUAL) (53)



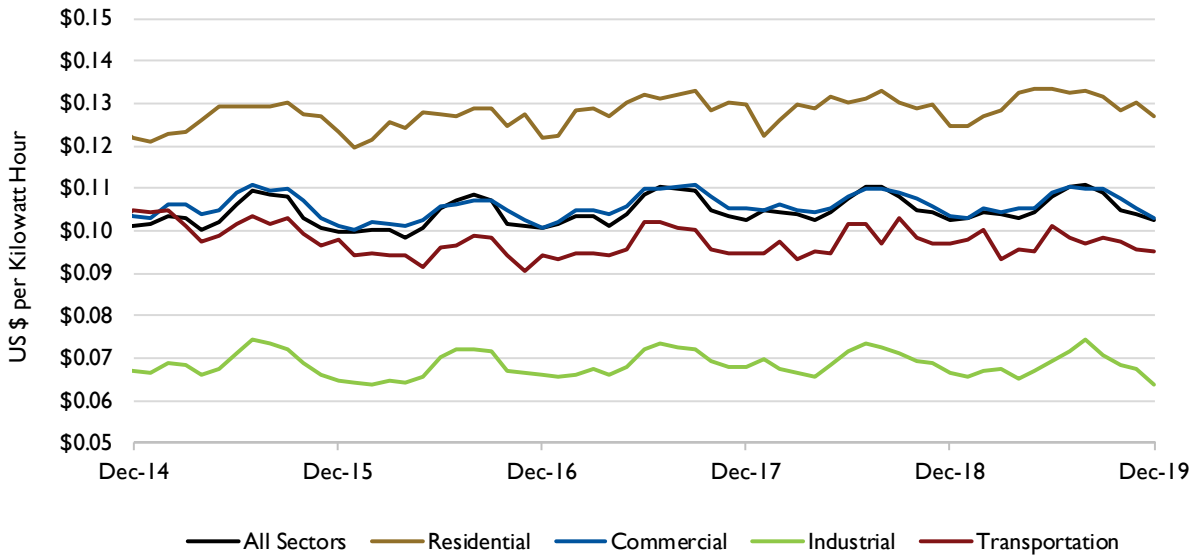
ENERGY CONSUMPTION BY SOURCE (ANNUAL) (54)



DATA CENTER

U.S. AGGREGATED ENERGY CONSUMPTION

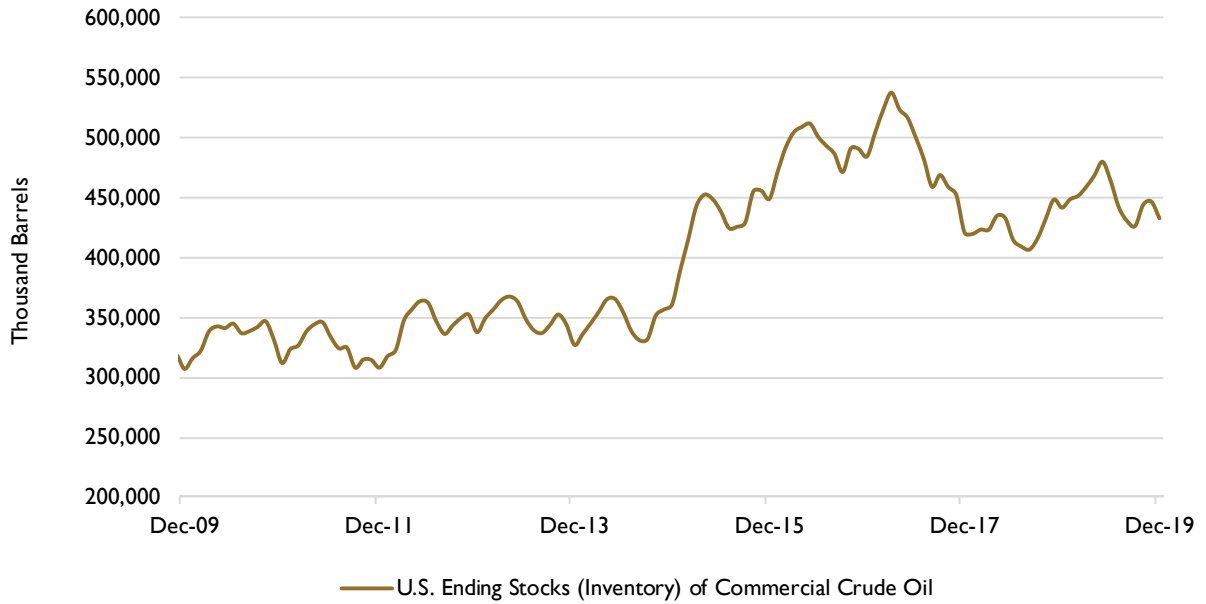
ELECTRICITY PRICES BY SECTOR (MONTHLY AVERAGE) (55)



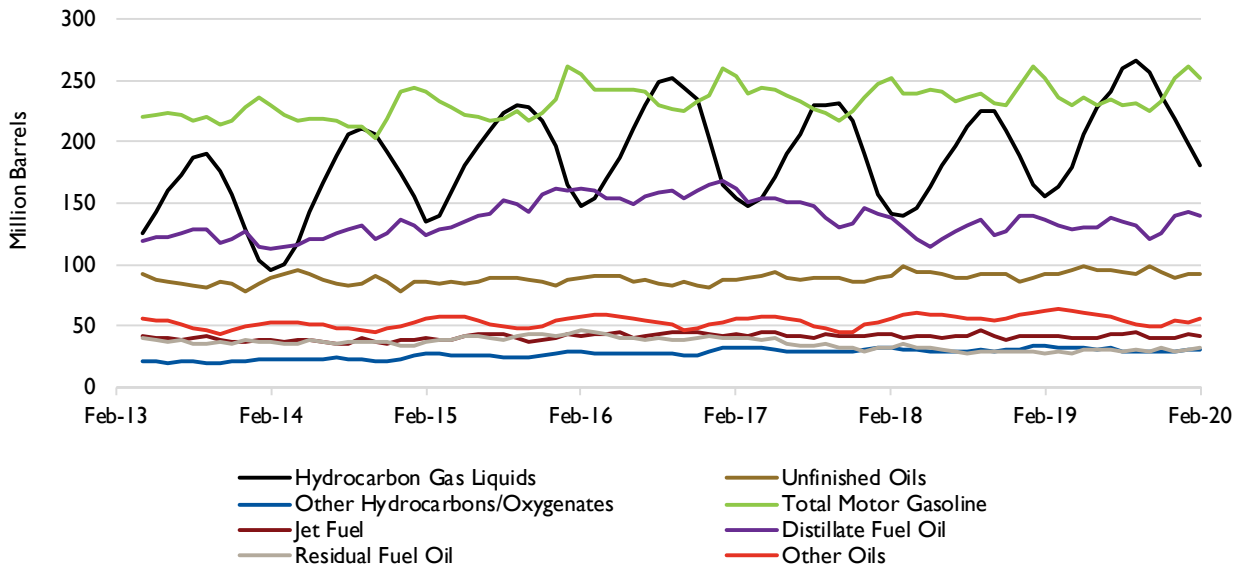
DATA CENTER

LOGISTICS - STORAGE AND TERMINALS

COMMERCIAL CRUDE OIL INVENTORY (MONTHLY) (56)



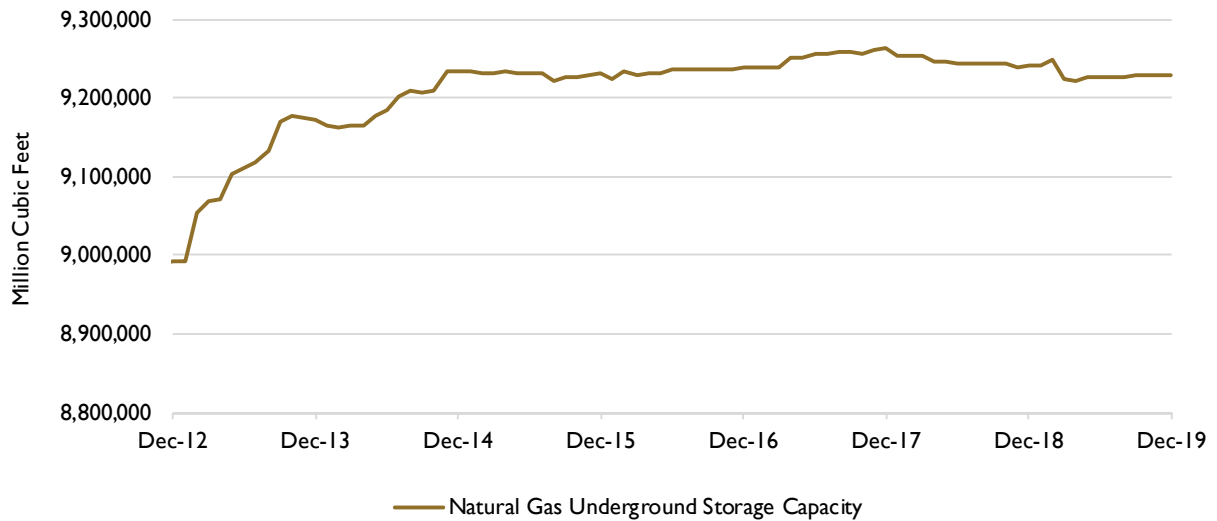
PETROLEUM AND OTHER LIQUIDS COMMERCIAL INVENTORY (MONTHLY) (57)



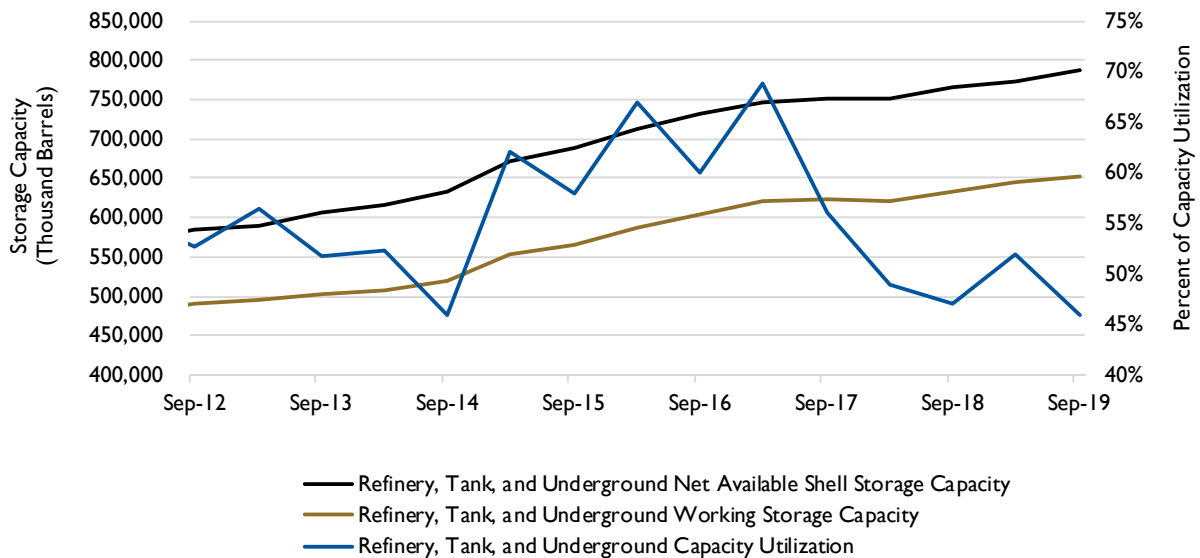
DATA CENTER

LOGISTICS - STORAGE AND TERMINALS

NATURAL GAS UNDERGROUND STORAGE CAPACITY (MONTHLY) (58)



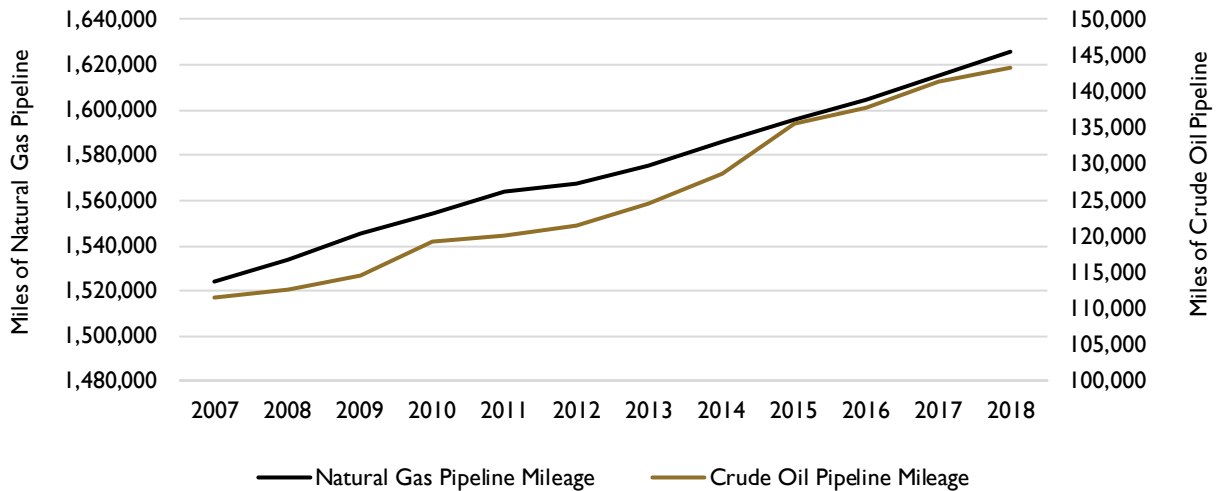
COMMERCIAL CRUDE OIL REFINERY, TANK AND UNDERGROUND STORAGE CAPACITY AND UTILIZATION (MONTHLY) (59)



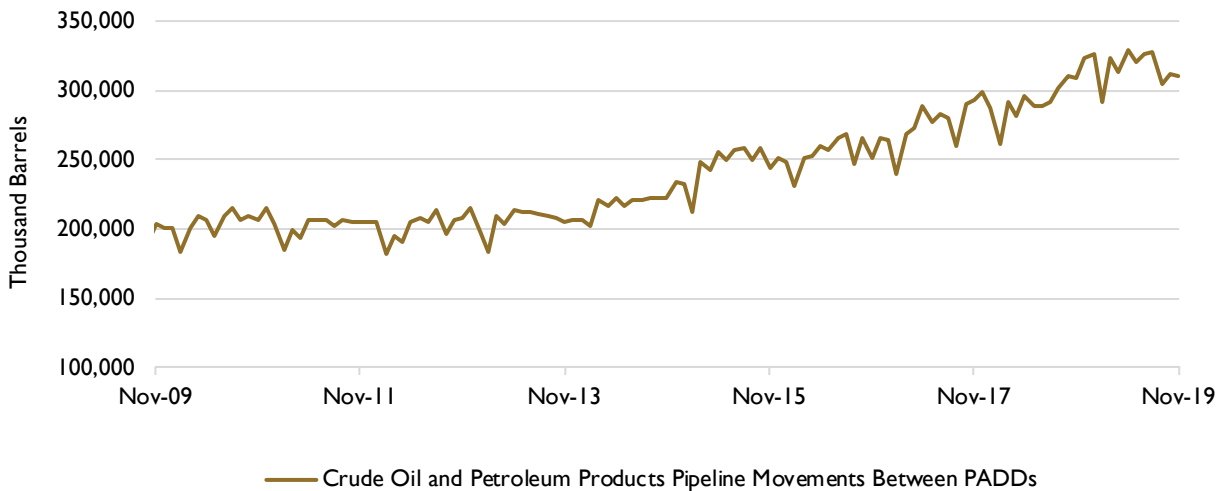
DATA CENTER

LOGISTICS - PIPELINES

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



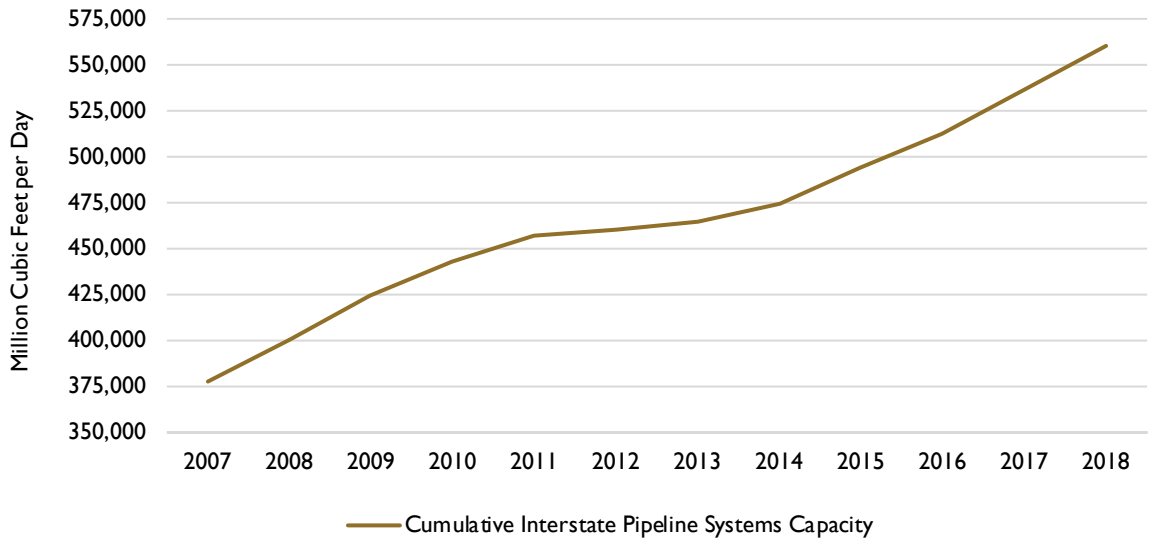
CRUDE OIL AND PETROLEUM PRODUCTS PIPELINE MOVEMENTS BETWEEN PETROLEUM ADMINISTRATION FOR DEFENSE DISTRICTS (PADDs) (MONTHLY) (61)



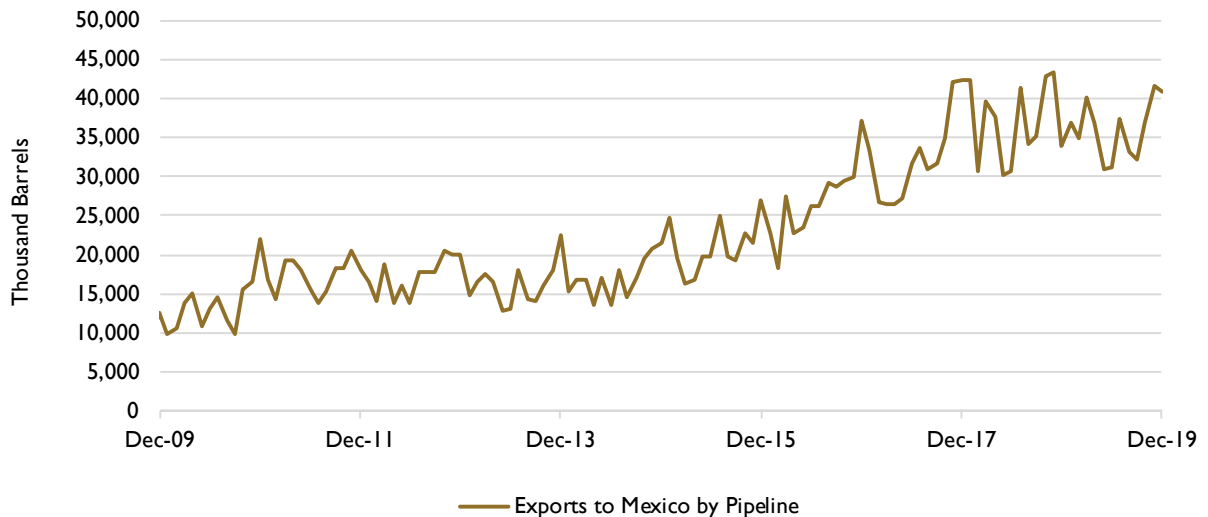
DATA CENTER

LOGISTICS - PIPELINES

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



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

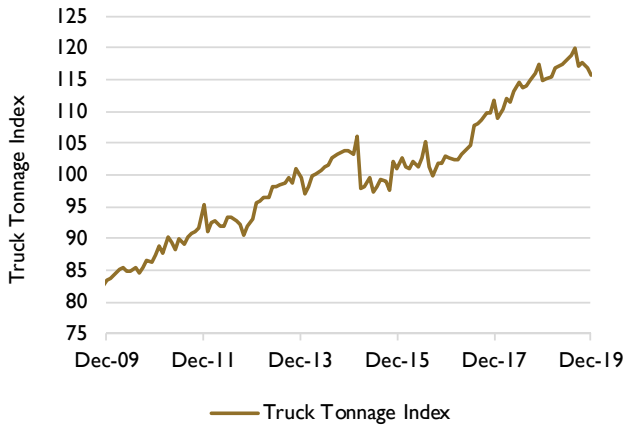


DATA CENTER

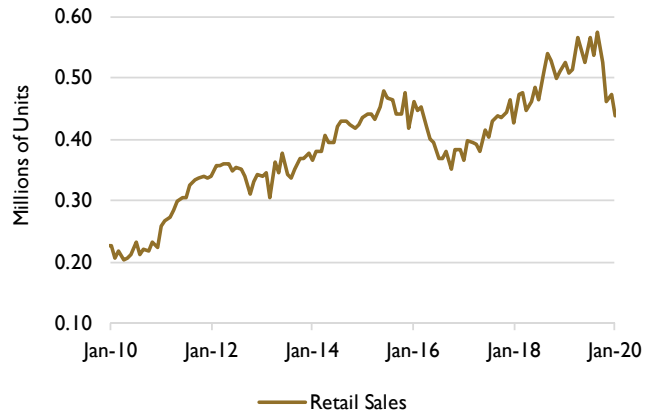
LOGISTICS - TRUCKERS

TRUCK TONNAGE INDEX (MONTHLY) (64)

MEASURES GROSS TONNAGE OF FREIGHT

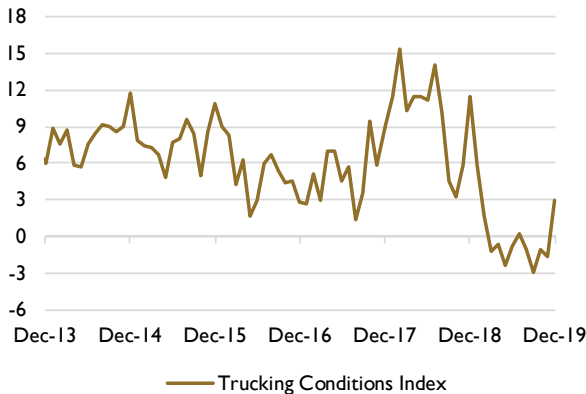


HEAVY TRUCK SALES (MONTHLY) (65)



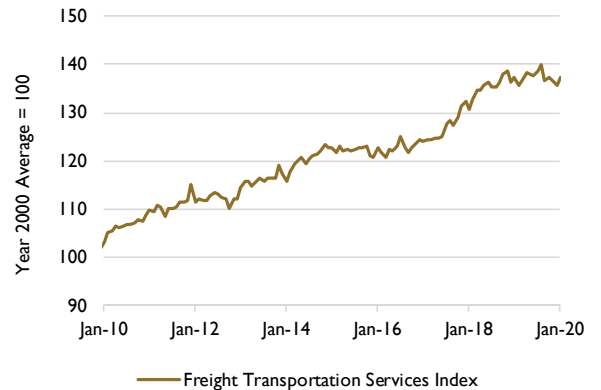
TRUCKING CONDITIONS INDEX (MONTHLY) (66)

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



FREIGHT TRANSPORTATION SERVICES INDEX (MONTHLY) (67)

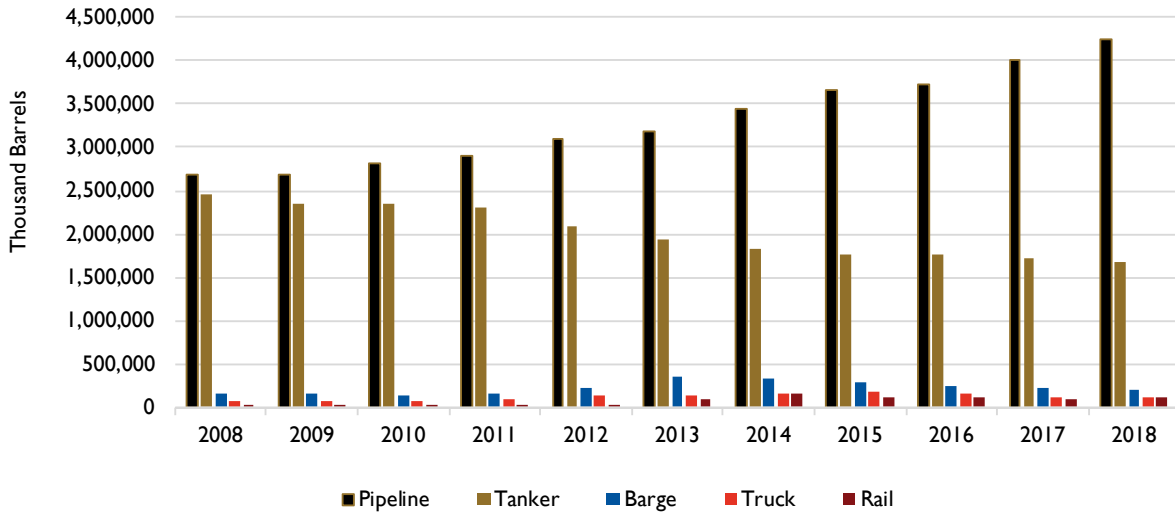
INCLUDES TRUCKING, RAIL, WATERWAYS, PIPELINES AND AIR FREIGHT



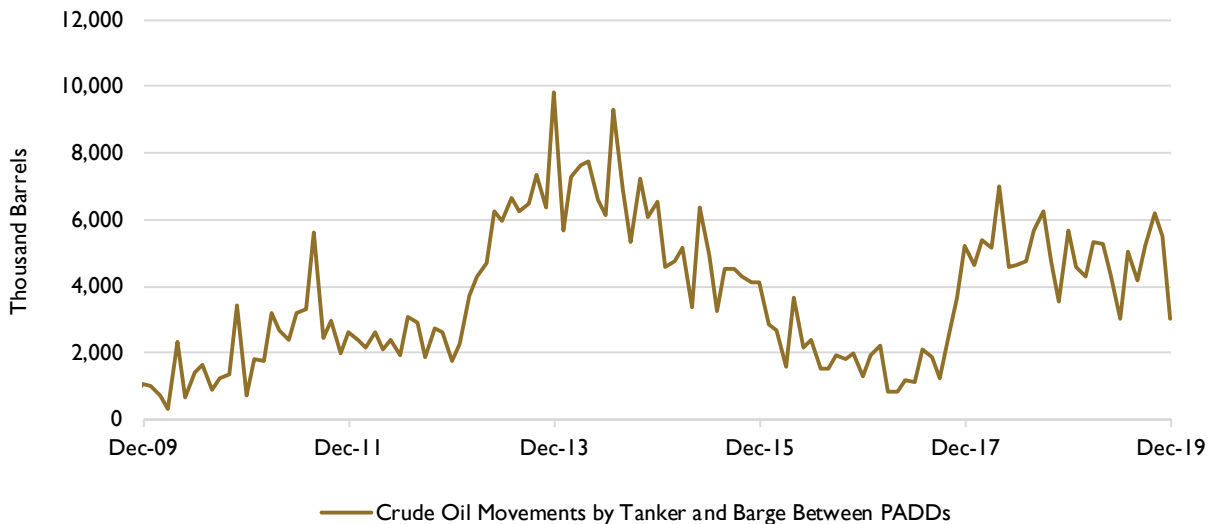
DATA CENTER

LOGISTICS - SHIPPING

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



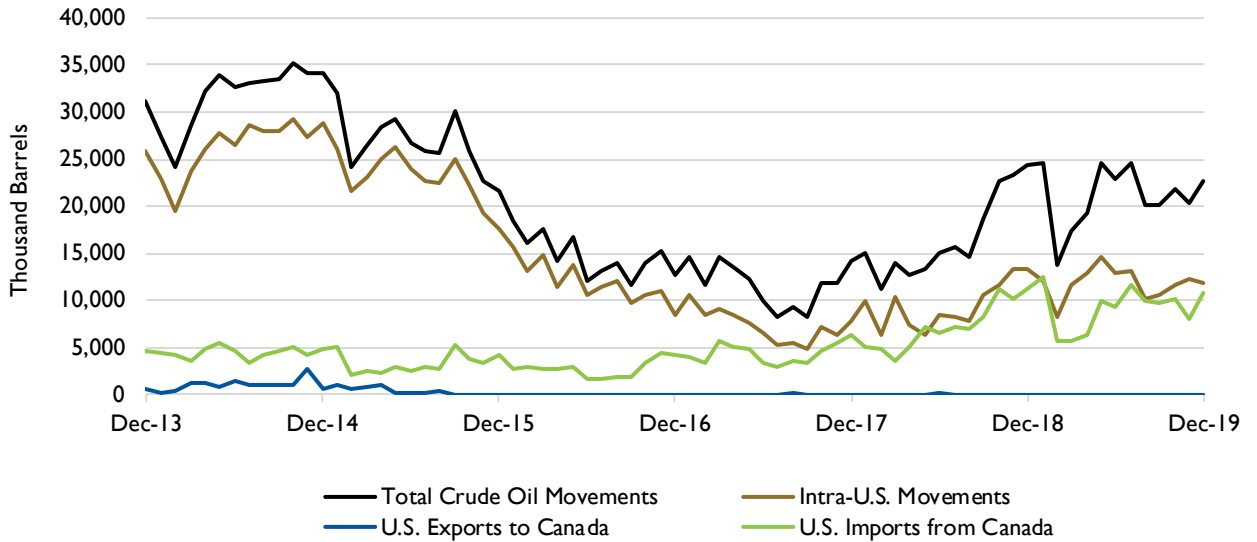
CRUDE OIL MOVEMENTS BY TANKER AND BARGE BETWEEN PETROLEUM ADMINISTRATION FOR DEFENSE DISTRICTS (PADDs) (MONTHLY) ⁽⁶⁹⁾



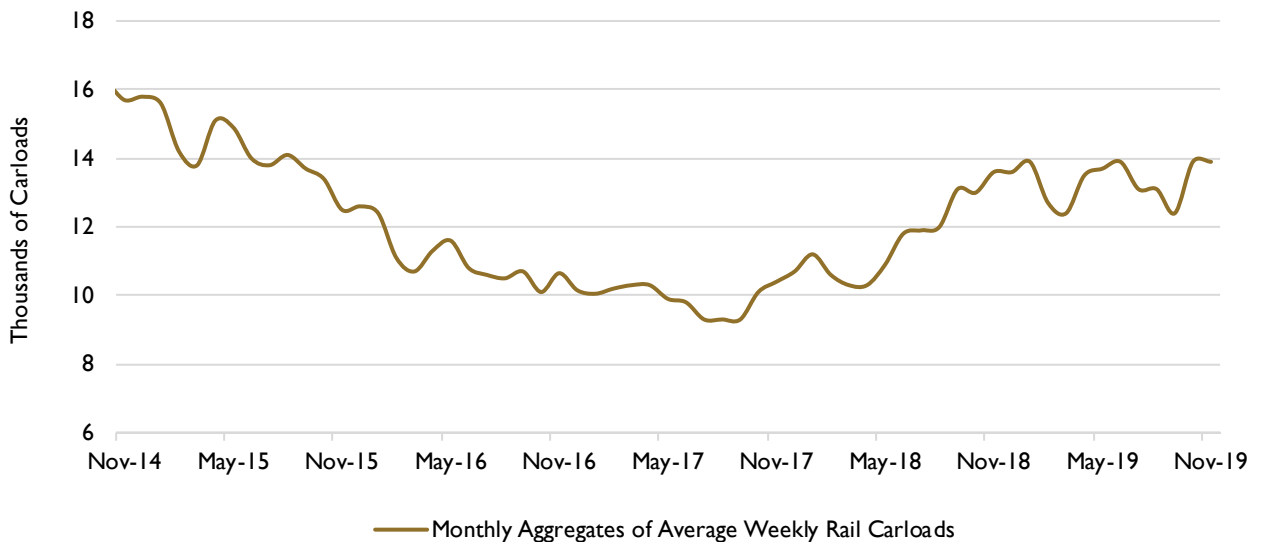
DATA CENTER

LOGISTICS - RAIL

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



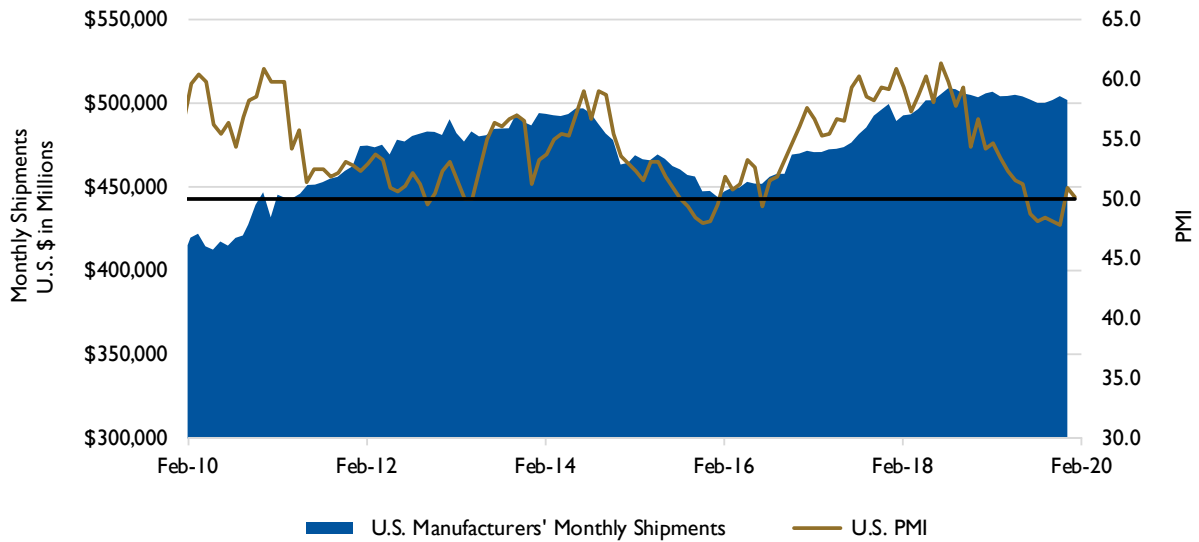
AVERAGE WEEKLY RAIL CARLOADS OF PETROLEUM AND PETROLEUM PRODUCTS (MONTHLY AGGREGATE) ⁽⁷¹⁾



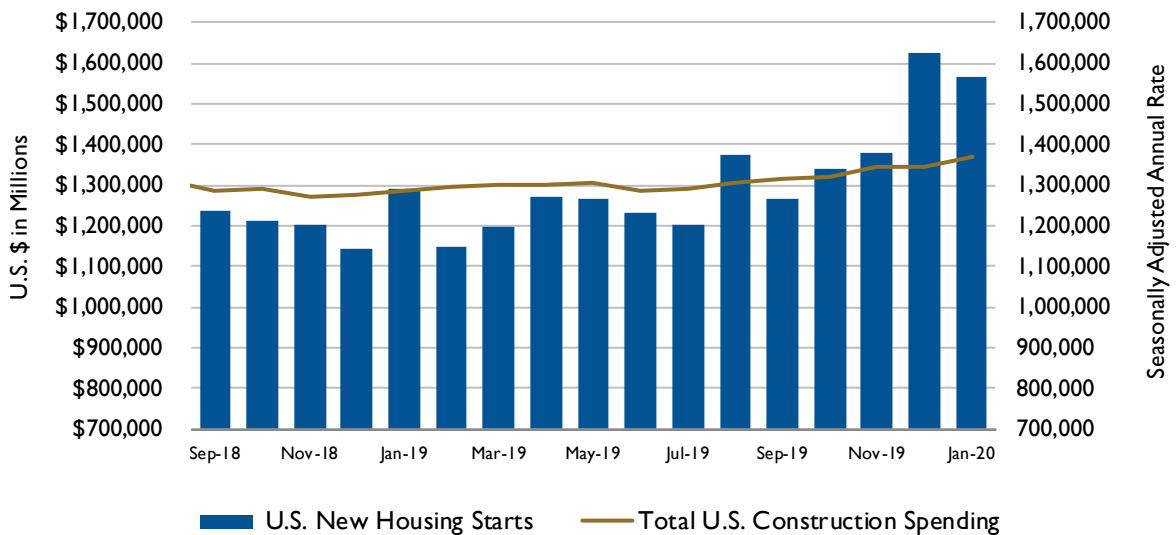
DATA CENTER

ECONOMIC / FINANCIAL

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



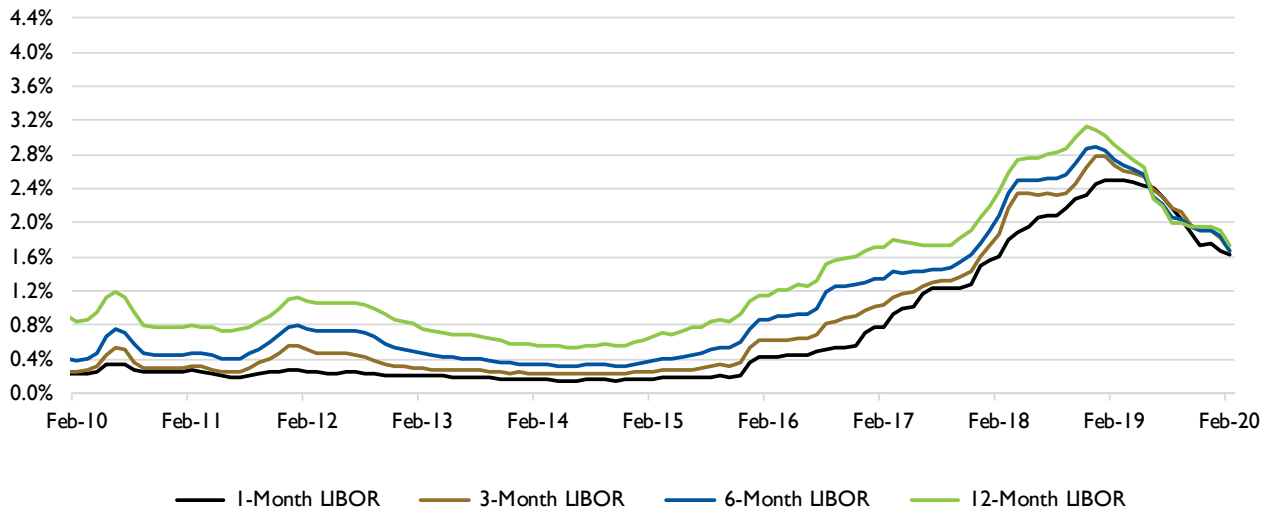
U.S. NEW HOUSING STARTS AND TOTAL U.S. CONSTRUCTION SPENDING (MONTHLY) (73)



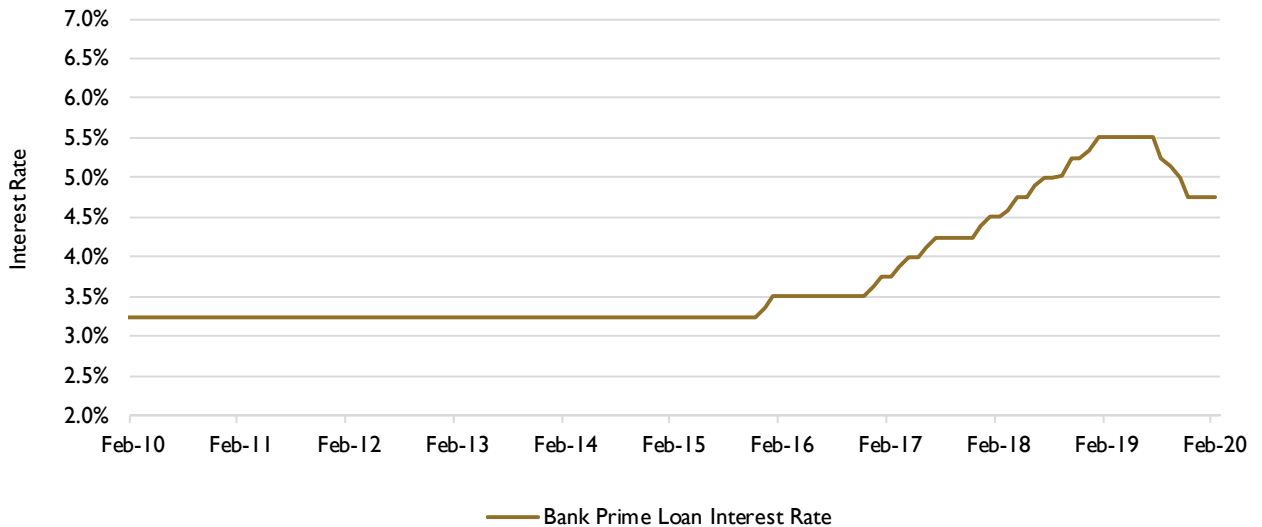
DATA CENTER

ECONOMIC / FINANCIAL

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



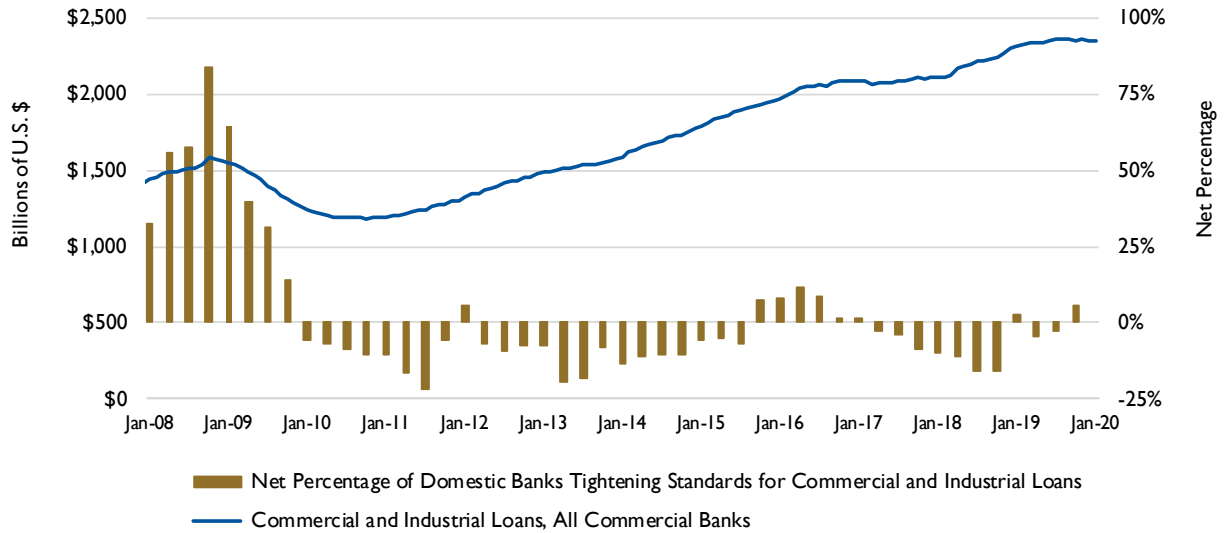
BANK PRIME LOAN INTEREST RATES (MONTHLY AVERAGE) ⁽⁷⁵⁾



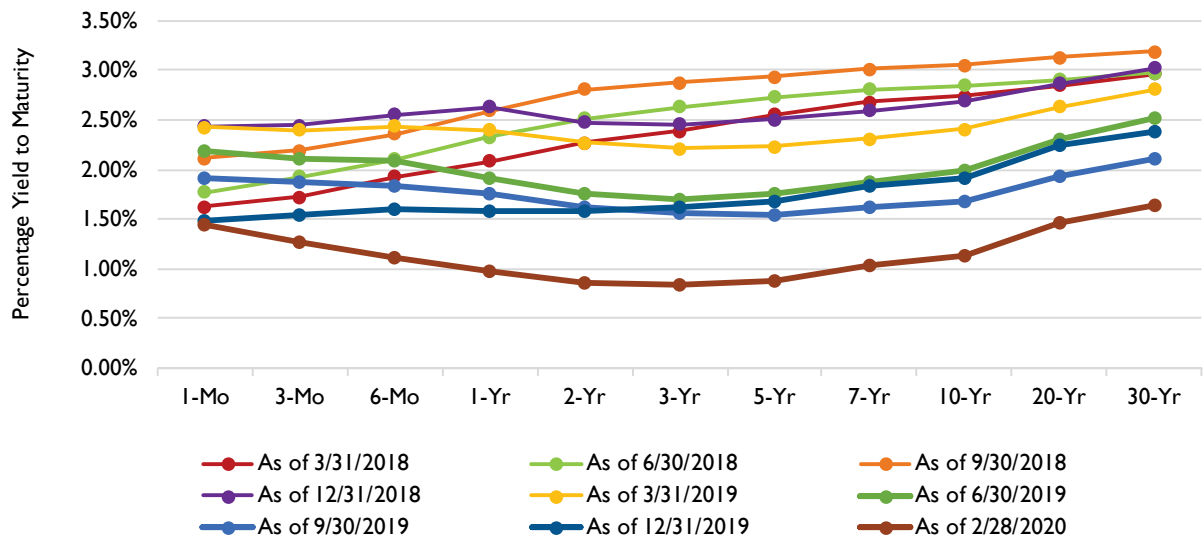
DATA CENTER

ECONOMIC / FINANCIAL

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



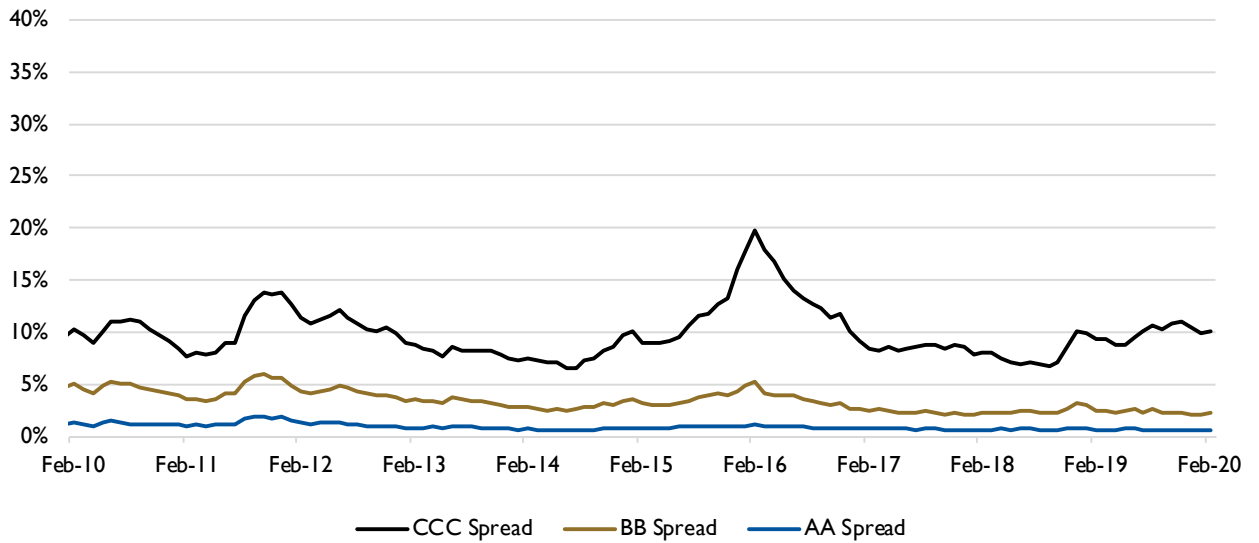
U.S. TREASURY YIELD CURVE (MONTHLY, ANNUAL) ⁽⁷⁷⁾



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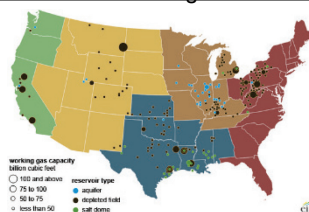
(57) Petroleum and Other Liquids Commercial Inventory (continued)

- 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

EEIA URGES U.S. SUPREME COURT TO OVERTURN RULING ALLOWING A STATE TO VETO PIPELINES

PennEast Pipeline is a planned 128-mile pipeline designed to transport one billion cubic feet per day (bcf/d) of natural gas from the Marcellus Shale fields of northeastern Pennsylvania to industrial and power generation customers along its route to south-central New Jersey. It's been on the drawing boards since 2015, going through various levels of federal and state permitting procedures. About half of the project's route is in Pennsylvania, with the pipeline crossing the Delaware River into New Jersey at a point in northern Bucks County.

The pipeline has been approved by the Federal Energy Regulatory Commission (FERC) as well as the relevant regulatory agencies in the State of Pennsylvania. Under the federal Natural Gas Act, FERC's approval empowers the pipeline developer to exercise the power of eminent domain to acquire access to the planned right-of-way from landowners with whom they are unable to reach agreement for just compensation.

In the case of PennEast, several such parcels are either owned outright by the State of New Jersey, or in which the state has a property interest such as an easement. When PennEast invoked eminent domain to gain access to those parcels, New Jersey, which is politically opposed to the pipeline, sued in federal court, claiming that the U.S. Constitution's 11th Amendment protected it from lawsuits by private entities under the "sovereign immunity" doctrine.

The case wound up in the U.S. Court of Appeals for the Third Circuit, which sits in Philadelphia and has jurisdiction in Pennsylvania, New Jersey and Delaware. Last fall the Third Circuit upheld New Jersey's claim, thus precluding the pipeline from access to the state's properties, and therefore preventing it from moving forward to construction. PennEast filed a petition in late February asking the Supreme Court to review and overturn the lower court's decision.

In late March the Energy Equipment & Infrastructure Alliance (EEIA) filed an "amicus curiae" (friend of the court) brief with the U.S. Supreme Court urging it to accept review of the case and overturn the Third Circuit's ruling. The brief pointed out that if the ruling were to stand, its precedent would in effect grant a single state the right to veto an interstate natural gas pipeline project found by the Federal Government to be in the public interest, and notwithstanding that the pipeline serves the interests of customers in any number of adjacent states that the pipeline would serve.

EEIA's brief argued that the case "presents a question of immediate and exceptional national importance that endangers the boom in natural gas production", and that "the Third Circuit's decision will have severe national economic consequences on the complex commercial web that provides the equipment, labor, and infrastructure necessary to build interstate pipelines."

HOT TOPICS

EEIA URGES U.S. SUPREME COURT TO OVERTURN RULING ALLOWING A STATE TO VETO PIPELINES (CONTINUED)

EEIA's President Toby Mack pointed out that "the Third Circuit ruling's own words alone should be enough to convince the Supreme Court to grant review, when it acknowledged that its ruling 'may disrupt how the natural gas industry has used the Natural Gas Act to construct interstate pipelines over State-owned land for the past eighty years'."

Although EEIA is optimistic, it's not known when and how the Court will rule on the petition. The Supreme Court will decide over the next few months if it will accept the case for review. If it does, arguments will be heard somewhat later and a ruling could come before the end of the year.

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HOT TOPICS

RUSSIA AND SAUDI ARABIA START OIL PRICE WAR

Oil prices recorded their biggest one-day crash since the Gulf War of 1991 on March 9th. Saudi Arabia, the world's top oil exporter, aggressively cut most of its official selling prices by the most in at least 20 years and threatened to increase production to record levels, while Russia's largest oil producer said it will ramp up production in April. On March 9th, Brent crude fell 24% to \$34.36 per barrel. The price has continued to fall since then reaching \$30.67 on March 19th. The fall puts oil prices at their lowest level in four years and about 55% below a peak on January 6th.

Oil prices had been falling for much of the year before the crash on March 9th due to a demand shock from the coronavirus' effect on global travel, industrial activity and overall economic growth, in combination with the warmest winter on record in the Northern Hemisphere. Global oil demand is expected to be down 2.5 million barrels a day in the first quarter of 2020, with China accounting for 1.8 million barrels of that drop according to the International Energy Association (IEA). The IEA is forecasting that global oil demand will fall this year for the first time since 2009, contracting by 90,000 barrels per day. JPMorgan Chase expects Brent crude oil prices to average \$27 a barrel and U.S. West Texas Intermediate oil to trade at \$24 per barrel in the second quarter of this year.

In 2017, Saudi Arabia and OPEC joined with Russia to limit oil supply and prop up prices. The alliance held up until now. In meetings on March 5th and 6th in Vienna, Saudi Arabia recommended additional oil production cuts of 1.5 million barrels per day starting in April due to falling demand from China, extending until the end of the year. But Russia rejected the additional cuts. As a result, the OPEC+ (the extended 24-member alliance that includes Russia) agreement forged in 2017 will end in April.

Saudi Arabia announced plans to increase its daily production to 12.3 million barrels per day in April compared to about 9.7 million barrels per day in February. Saudi Arabia's aggressive price cuts targeted some of Russia's core markets in China and Northern Europe. Russia said it can increase its production by 200,000 to 300,000 barrels per day in the short term and 500,000 barrels per day in the long term. Thus, oil prices are falling as both Saudi Arabia and Russia are poised to flood the market with cheap crude oil in all-out price war just as the coronavirus is spurring contraction in demand.

The conflict stems in part from Russian and Saudi Arabian concerns over the U.S. shale industry, which in recent years has upended global energy markets and made America self-sufficient in oil. U.S. shale production has continued to increase steadily in recent years. Domestic output rose to a record 13.1 million barrels per day during the week ended February 29th according to the U.S. Energy Information Administration.

By lowering prices, Saudi Arabia hopes to undermine U.S. shale producers, as well as to destabilize their archrival Iran. In addition, this could be a move by Crown Prince Mohammed to assert his influence over the Kingdom's oil policies and raise his international standing.

HOT TOPICS

RUSSIA AND SAUDI ARABIA START OIL PRICE WAR (CONTINUED)

Low oil prices mean Saudi Arabia has to borrow to balance its budget and makes it difficult for Crown Prince Mohammad to carry out his expensive economic transformation plans in Saudi Arabia, including a new \$500 billion high tech city in the desert. According to Saudi Arabian officials, the country needs oil prices over \$60 per barrel to balance its budget.

The initial public offering in December of Saudi Arabia's national oil company, Aramco, brought in cash to help fund the Prince's plans, but low oil prices make its shares less attractive. Aramco shares are now valued less than they were at the offering. Foreign investors could be very hesitant to invest in the company if its operations (including production and prices) are dictated by the Saudi Royal Palace. The company's initial public offering was the world's largest raising \$25.6 billion and valuing the company at about \$1.7 trillion.

Moscow is fighting an oil market war on two fronts, with Saudi Arabia and U.S. shale. Moscow may be hoping to force American shale producers out of the market by lowering prices, or may be trying to take a bigger slice of the Asian market from Saudi Arabia.

As it became less reliant on global oil imports, the U.S. became increasingly bold in its use of sanctions against other nations. Moscow grew concerned when the U.S. started to focus its energy sanctions on Russia. In December, the U.S. announced restrictions on the \$10.5 billion pipeline which is set to deliver more Russian gas to Germany. Part of Russia's decision may also be a response to fresh U.S. sanctions on Venezuela, where Russia's Rosneft oil corporation is helping finance state oil producer PDVSA.

Russia is better prepared to withstand low oil prices as oil now accounts for less than a third of its budget revenue and the country has accumulated massive reserves. Russia believes it could withstand 10 years of oil prices at \$25 to \$30 per barrel.

Oil prices have suffered massive drops each time Saudi Arabia has launched a price war to drive competitors out of the market. West Texas Intermediate crude oil fell 66% from late 1985 to March 1986 when Saudi Arabia pumped at will amid a resurgence of U.S. oil output.

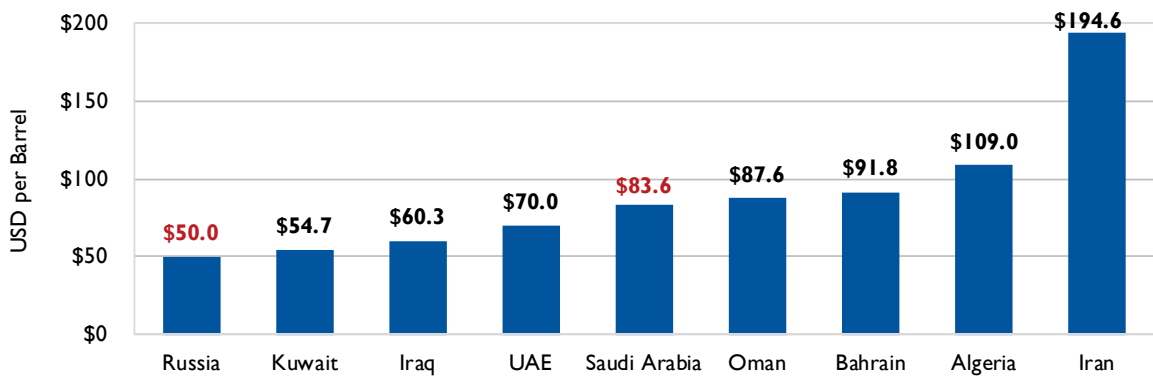
However, this strategy has backfired before. In 2014, OPEC began to pump oil at will to compete with U.S. shale producers. The cartel believed that their ability to produce at extremely low prices would force U.S. producers out of the market. But after the price of crude fell below \$28 a barrel in 2016, OPEC and Russia agreed to cut production in the first OPEC+ deal. Within months, oil prices more than doubled.

Lower oil prices will be a problem for the world's main oil exporting countries, but some will be more affected than others. The next page shows oil prices required by each country in order to balance their national budgets.

HOT TOPICS

RUSSIA AND SAUDI ARABIA START OIL PRICE WAR (CONTINUED)

Oil Exporters' Breakeven Oil Prices, 2020 Projections (USD per Barrel)



Source: The Eurasia Group.

Russia and Saudi Arabia held talks in February that focused on possibly forging a broader long term alliance in which Saudi Arabia would speed up its investments inside of Russia where sanctions have hit the country and back its military efforts in Syria. They will meet again in June at the next scheduled OPEC+ meeting or they could possibly meet sooner by calling a special meeting in order to address the price war.

The recent oil market manipulations by foreign states reinforces the importance of the role of the U.S. as a reliable energy source to itself, its partners and allies around the world.

Sources:

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PETROLEUM PRODUCTS EQUITY COMPARABLES (1)

Petroleum Products (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 12/31/19	% 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	\$3,453	\$198	5.7%	\$3.65	73.0%	\$283	\$1,790	0.5x	9.0x	7.2x
Chevron Corporation	139,865	29,024	20.8	120.51	94.6	227,869	254,081	1.8x	8.8x	0.9x
CVR Energy, Inc.	6,364	866	13.6	40.43	72.8	4,064	4,867	0.8x	5.6x	0.7x
EnLink Midstream, LLC	6,039	1,062	17.6	6.13	46.8	2,989	9,370	1.6x	8.8x	4.5x
Gibson Energy Inc.	5,656	310	5.5	20.50	96.1	2,983	3,960	0.7x	12.8x	3.3x
Exxon Mobil Corporation	255,583	30,529	11.9	69.78	83.6	295,247	349,977	1.4x	11.5x	1.6x
HollyFrontier Corporation	17,487	1,825	10.4	50.71	86.1	8,124	10,587	0.6x	5.8x	1.1x
Keyera Corp.	2,789	647	23.2	26.23	94.9	5,647	7,894	2.8x	12.2x	3.6x
Marathon Petroleum Corporation	124,112	9,707	7.8	60.25	86.5	39,122	78,870	0.6x	8.1x	3.1x
Parkland Fuel Corporation	14,227	911	6.4	36.78	98.6	5,437	8,505	0.6x	9.3x	3.1x
Phillips 66	107,293	4,610	4.3	111.41	92.9	49,506	62,686	0.6x	13.6x	2.5x
NuStar Energy LP	1,498	677	45.2	25.85	86.0	2,786	7,582	5.1x	11.2x	5.1x
Valero Energy Corporation	102,729	6,140	6.0	93.65	91.8	38,458	47,677	0.5x	7.8x	1.4x
Median			10.4%		86.5%			0.7x	9.0x	3.1x
Mean			13.7%		84.9%			1.3x	9.6x	2.9x

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 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Alliant Energy Corporation	\$3,648	\$1,313	36.0%	\$54.72	98.8%	\$13,152	\$19,716	5.4x	15.0x	5.0x
AltaGas Ltd.	4,237	785	18.5	15.25	94.8	4,250	11,446	2.7x	14.6x	7.3x
Atmos Energy Corporation	2,900	1,168	40.3	111.86	97.1	13,676	17,648	6.1x	15.1x	3.7x
Avista Corporation	1,346	427	31.7	48.09	97.2	3,208	5,448	4.0x	12.8x	5.4x
Baytex Energy Corp.	1,145	694	60.6	1.44	59.7	805	2,295	2.0x	3.3x	2.0x
Calumet Specialty Products Partners, LP	3,453	198	5.7	3.65	73.0	283	1,790	0.5x	9.0x	7.2x
Cenovus Energy Inc.	15,559	2,941	18.9	10.18	92.2	12,505	19,044	1.2x	6.5x	2.2x
Chesapeake Utilities Corporation	480	158	32.9	95.83	97.2	1,572	2,256	4.7x	14.3x	4.7x
Corning Natural Gas Holding Corporation	34	9	27.7	20.00	85.1	62	120	3.5x	12.7x	5.9x
Crestwood Equity Partners LP	3,182	386	12.1	30.82	77.1	2,228	5,604	1.8x	14.5x	6.1x
Dominion Energy, Inc.	16,572	7,393	44.6	82.82	98.7	68,169	112,237	6.8x	15.2x	5.3x
EnLink Midstream, LLC	6,039	1,062	17.6	6.13	46.8	2,989	9,370	1.6x	8.8x	4.5x
Enbridge Inc.	38,603	9,387	24.3	39.81	99.0	80,564	141,281	3.7x	15.1x	5.4x
Enterprise Products Partners LP	32,789	7,516	22.9	28.16	91.2	61,647	89,748	2.7x	11.9x	3.7x
Epsilon Energy Ltd.	28	17	61.6	4.21	88.3	89	70	2.5x	4.0x	(1.1)x
Eversource Energy	8,526	2,747	32.2	85.07	98.3	27,542	43,328	5.1x	15.8x	5.7x
Genesis Energy, LP	2,481	591	23.8	20.48	85.2	2,510	6,926	2.8x	11.7x	6.0x
National Fuel Gas Company	1,647	763	46.3	46.54	75.4	4,018	6,186	3.8x	8.1x	2.9x
New Jersey Resources Corporation	2,395	265	11.0	44.57	87.1	4,294	5,876	2.5x	22.2x	7.6x
Northwest Natural Holding Company	746	236	31.6	73.73	99.5	2,244	3,204	4.3x	13.6x	4.3x
MDU Resources Group, Inc.	5,337	735	13.8	29.71	99.6	5,953	8,392	1.6x	11.4x	3.1x
OGE Energy Corp.	2,232	850	38.1	44.47	97.2	8,902	12,299	5.5x	14.5x	3.9x
ONE Gas, Inc.	1,653	470	28.4	93.57	96.8	4,935	6,639	4.0x	14.1x	3.9x
ONEOK, Inc.	10,164	2,381	23.4	75.67	98.0	31,258	43,392	4.3x	18.2x	5.4x
RGC Resources, Inc.	67	21	31.8	28.58	92.2	231	334	5.0x	15.8x	5.4x
South Jersey Industries, Inc.	1,629	340	20.9	32.98	95.6	3,040	6,226	3.8x	18.3x	10.0x
Southwest Gas Holdings, Inc.	3,120	660	21.2	75.97	81.7	4,150	6,813	2.2x	10.3x	4.1x
Summit Midstream Partners, LP	445	235	52.7	3.31	22.9	309	2,005	4.5x	8.5x	6.3x
Targa Resources Corp.	8,671	1,484	17.1	40.83	83.7	9,505	20,544	2.4x	13.8x	5.1x
TC Energy Corporation	10,219	6,361	62.2	53.32	97.9	49,823	91,318	8.9x	14.4x	5.9x
Median			28.1%		93.5%			3.7x	14.0x	5.2x
Mean			30.3%		86.9%			3.7x	12.8x	4.9x

(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

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	% of	Market Cap	Total	TEV / LTM		Net Debt ⁽⁴⁾
	Revenues	EBITDA	Margin	Price 12/31/19	52-Week High		Enterprise Value ⁽³⁾	Revenues	EBITDA	EBITDA
Ferrellgas Partners, LP	\$1,560	\$220	14.1%	\$0.34	18.0%	\$33	\$2,295	1.5x	10.4x	10.6x
NGL Energy Partners LP	23,354	510	2.2	11.34	72.2	1,452	5,104	0.2x	10.0x	6.3x
Spire Inc.	1,917	495	25.8	83.31	94.7	4,247	7,349	3.8x	14.8x	6.3x
Star Group, LP	1,728	104	6.0	9.46	92.3	447	593	0.3x	5.7x	3.2x
Suburban Propane Partners, LP	1,224	282	23.1	21.85	87.8	1,356	2,581	2.1x	9.1x	4.9x
UGI Corporation	7,127	1,339	18.8	45.16	78.8	9,439	15,602	2.2x	11.7x	5.1x
Median			16.5%		83.3%			1.8x	10.2x	5.7x
Mean			15.0%		74.0%			1.7x	10.3x	6.1x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
2/6/2020	All American Propane, Inc.	ThompsonGas LLC	-	-	-
1/9/2020	Evelyn Jeanne, Inc., d/b/a Western Propane Service	Superior Plus Corp. (TSX:SPB)	-	-	-
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	-	-

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

DRILLING

EQUITY COMPARABLES (1)

Drilling (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
AKITA Drilling Ltd.	\$136	\$13	9.3%	\$0.92	26.9%	\$37	\$103	0.8x	8.2x	5.4x
Baker Hughes Company	23,838	3,038	12.7	25.63	89.5	16,656	34,230	1.4x	11.3x	1.4x
CES Energy Solutions Corp.	989	112	11.3	1.80	63.5	476	799	0.8x	7.1x	2.8x
Diamond Offshore Drilling, Inc.	935	74	8.0	7.19	56.9	990	2,906	3.1x	39.1x	26.5x
Ensign Energy Services Inc.	1,228	302	24.6	2.20	44.2	352	1,604	1.3x	5.3x	4.0x
Halliburton Company	22,408	3,106	13.9	24.47	74.8	21,480	31,369	1.4x	10.1x	3.0x
Helmerich & Payne, Inc.	2,673	735	27.5	45.43	70.1	4,927	5,005	1.9x	6.8x	0.2x
Independence Contract Drilling, Inc.	204	43	20.9	19.94	27.0	76	198	1.0x	4.6x	3.2x
National Oilwell Varco, Inc.	8,479	75	0.9	25.05	76.8	9,665	11,694	1.4x	155.9x	21.4x
Precision Drilling Corporation	1,188	282	23.7	1.40	44.7	403	1,553	1.3x	5.5x	3.9x
Secure Energy Services Inc.	2,369	106	4.5	3.90	53.6	612	1,014	0.4x	9.5x	3.6x
Unit Corporation	725	311	42.9	0.70	3.8	39	1,040	1.4x	3.3x	2.6x
Valaris plc	2,053	60	2.9	6.56	33.5	1,298	7,413	3.6x	124.6x	101.2x
Median			12.7%		53.6%			1.4x	8.2x	3.6x
Mean			15.6%		51.2%			1.5x	30.1x	13.8x

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 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ / EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Albemarle Corporation	\$3,589	\$975	27.2%	\$73.04	78.4%	\$7,745	\$9,662	2.7x	9.9x	2.6x
Ashland Global Holdings Inc.	2,450	477	19.5	76.53	94.2	4,609	6,044	2.5x	12.7x	3.5x
Clean Harbors, Inc.	3,412	525	15.4	85.75	97.4	4,786	6,216	1.8x	11.8x	2.6x
CSW Industrials, Inc.	379	75	19.8	77.00	98.3	1,159	1,162	3.1x	15.5x	(0.2)x
FMC Corporation	4,610	1,221	26.5	99.82	97.9	12,938	16,333	3.5x	13.4x	2.6x
Ingevity Corporation	1,293	392	30.3	87.38	72.6	3,655	4,957	3.8x	12.6x	3.2x
Kraton Corporation	1,804	237	13.1	25.32	62.1	803	2,304	1.3x	9.7x	6.0x
NewMarket Corporation	2,190	448	20.4	486.52	96.3	5,444	6,075	2.8x	13.6x	1.3x
Ocean Bio-Chem, Inc.	41	5	11.9	3.31	83.0	31	34	0.8x	7.0x	0.6x
Quaker Chemical Corporation	1,134	153	13.5	164.52	73.3	2,917	3,687	3.3x	24.1x	5.4x
Stepan Company	1,859	204	11.0	102.44	99.5	2,305	2,290	1.2x	11.2x	(0.3)x
Synalloy Corporation	305	9	3.0	12.91	65.7	117	235	0.8x	25.5x	11.9x
Trecora Resources	259	30	11.4	7.15	67.8	177	272	1.0x	9.2x	3.1x
Valvoline Inc.	2,440	427	17.5	21.41	89.6	4,035	5,273	2.2x	12.3x	3.4x
Median			16.4%		86.3%			2.3x	12.5x	2.8x
Mean			17.2%		84.0%			2.2x	13.5x	3.3x

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 QnC 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 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Boralex Inc.	\$443	\$288	65.2%	\$18.86	96.5%	\$1,817	\$4,405	10.0x	15.3x	8.4x
Capital Power Corporation	1,321	862	65.3	26.51	98.0	2,789	6,158	4.7x	7.1x	3.0x
NextEra Energy Partners, LP	855	564	66.0	52.65	97.7	3,202	12,171	14.2x	21.6x	7.9x
NRG Energy, Inc.	9,821	1,825	18.6	39.75	91.0	10,001	16,450	1.7x	9.0x	3.3x
TerraForm Power, Inc.	948	600	63.4	15.39	83.3	3,494	10,437	11.0x	17.4x	10.5x
Vivint Solar, Inc.	341	(110)	(32.4)	7.26	73.9	886	2,347	6.9x	NM	NM
Median			64.3%		93.7%			8.4x	15.3x	7.9x
Mean			41.0%		90.1%			8.1x	14.1x	6.6x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
1/13/2020	TerraForm Power, Inc. (NasdaqGS:TERP)	Brookfield Renewable Partners LP. (TSX:BEP.UN)	\$10,880.5	9.5x	13.0x
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 12/31/19	% 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.	\$1,625	\$635	39.1%	\$14.16	95.0%	\$7,424	\$12,872	7.9x	20.3x	6.2x
Avangrid, Inc.	6,338	1,874	29.6	51.16	96.8	15,809	23,783	3.8x	12.7x	4.3x
Boralex Inc.	443	288	65.2	18.86	96.5	1,817	4,405	10.0x	15.3x	8.4x
Brookfield Renewable Partners LP	2,980	1,874	62.9	46.49	93.5	14,470	34,476	11.6x	18.4x	5.8x
Innergex Renewable Energy Inc.	429	390	90.7	13.00	97.0	1,812	5,620	13.1x	14.4x	9.2x
NextEra Energy Partners, LP	855	564	66.0	52.65	97.7	3,202	12,171	14.2x	21.6x	7.9x
Northland Power Inc.	1,279	953	74.5	20.97	96.7	3,784	10,082	7.9x	10.6x	6.1x
Pattern Energy Group Inc.	534	299	56.0	26.76	93.9	2,628	6,292	11.8x	21.0x	11.4x
TerraForm Power, Inc.	948	600	63.4	15.39	83.3	3,494	10,437	11.0x	17.4x	10.5x
TransAlta Renewables Inc.	338	207	61.2	11.97	98.3	3,174	3,886	11.5x	18.8x	3.3x
Median			63.1%		96.6%			11.3x	17.9x	7.1x
Mean			60.8%		94.9%			10.3x	17.0x	7.3x

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
1/13/2020	TerraForm Power, Inc. (NasdaqGS:TERP)	Brookfield Renewable Partners LP. (TSX:BEP.UN)	\$10,880.5	9.5x	13.0x
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)	Innergex 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 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Archrock, Inc.	\$965	\$392	40.6%	\$10.04	87.8%	\$1,525	\$3,370	3.5x	8.6x	4.8x
Baker Hughes Company	23,838	3,038	12.7	25.63	89.5	16,656	34,230	1.4x	11.3x	1.4x
Blueknight Energy Partners, LP	403	59	14.8	1.13	47.1	46	(64)	(0.2)x	(1.1)x	4.5x
CARBO Ceramics Inc.	184	(33)	(17.9)	0.24	4.6	7	87	0.5x	NM	NM
Cathedral Energy Services Ltd.	109	(3)	(2.4)	0.23	34.9	11	28	0.3x	NM	NM
CES Energy Solutions Corp.	989	112	11.3	1.80	63.5	476	799	0.8x	7.1x	2.8x
Cypress Energy Partners, LP	402	29	7.3	9.20	90.7	111	205	0.5x	7.0x	2.1x
Dawson Geophysical Company	146	6	3.8	2.40	56.1	56	44	0.3x	8.0x	(3.1)x
Eco-Stim Energy Solutions, Inc.	41	(23)	(55.3)	0.01	1.0	0	4	0.1x	NM	NM
ENGGlobal Corporation	52	(3)	(5.1)	0.98	66.2	27	23	0.4x	NM	NM
Enservco Corporation	53	4	8.3	0.19	25.9	10	47	0.9x	10.8x	8.4x
Ensign Energy Services Inc.	1,228	302	24.6	2.20	44.2	352	1,604	1.3x	5.3x	4.0x
Enterprise Group, Inc.	15	1	6.9	0.15	64.5	8	16	1.0x	15.0x	7.0x
Essential Energy Services Ltd.	109	7	6.8	0.29	77.6	42	62	0.6x	8.5x	2.3x
High Arctic Energy Services Inc.	144	15	10.4	1.78	57.0	88	88	0.6x	5.8x	(0.1)x
Hyduke Energy Services Inc.	6	(5)	(83.7)	0.01	27.3	1	0	0.1x	NM	NM
Innospec Inc.	1,513	208	13.8	103.44	96.6	2,534	2,591	1.7x	12.4x	0.1x
Matrix Service Company	1,414	65	4.6	22.88	93.9	621	518	0.4x	8.0x	(1.0)x
McDermott International, Inc.	8,431	9	0.1	0.68	6.2	123	4,451	0.5x	NM	NM
Mullen Group Ltd.	986	146	14.8	7.15	71.3	749	1,170	1.2x	8.0x	2.8x
Newpark Resources, Inc.	820	76	9.2	6.27	64.8	563	702	0.9x	9.3x	1.9x
North American Construction Group Ltd.	554	124	22.4	12.12	89.0	310	659	1.2x	5.3x	2.6x
Parkland Fuel Corporation	14,227	911	6.4	36.78	98.6	5,437	8,505	0.6x	9.3x	3.1x
Pioneer Energy Services Corp.	576	53	9.3	0.03	1.4	3	451	0.8x	8.5x	8.5x
Precision Drilling Corporation	1,188	282	23.7	1.40	44.7	403	1,553	1.3x	5.5x	3.9x
Profire Energy, Inc.	39	5	12.3	1.45	68.3	69	56	1.4x	11.6x	(2.3)x
ProPetro Holding Corp.	2,043	450	22.0	11.25	44.3	1,130	1,155	0.6x	2.6x	0.1x
Secure Energy Services Inc.	2,369	106	4.5	3.90	53.6	612	1,014	0.4x	9.5x	3.6x
Select Energy Services, Inc.	1,292	160	12.4	9.28	72.8	797	1,047	0.8x	6.5x	0.1x
Shawcor Ltd.	1,148	74	6.4	9.66	55.8	678	1,028	0.9x	13.9x	4.5x
Smart Sand, Inc.	233	83	35.7	2.52	53.8	104	162	0.7x	1.9x	0.7x
STEP Energy Services Ltd.	515	55	10.7	1.21	53.0	81	276	0.5x	5.0x	3.5x
USA Compression Partners, LP	698	408	58.4	18.14	95.5	1,753	4,090	5.9x	10.0x	4.6x
Median			9.3%		57.0%			0.7x	8.0x	2.8x
Mean			7.6%		57.6%			1.0x	7.9x	2.6x

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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 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
AKITA Drilling Ltd.	\$136	\$13	9.3%	\$0.92	26.9%	\$37	\$103	0.8x	8.2x	5.4x
CSI Compressco LP	477	114	23.9	2.71	68.2	128	782	1.6x	6.9x	5.7x
Enerflex Ltd.	1,577	252	16.0	9.43	60.0	845	1,037	0.7x	4.1x	1.2x
Exterran Corporation	1,317	199	15.1	7.83	38.9	262	773	0.6x	3.9x	2.3x
Forum Energy Technologies, Inc.	957	56	5.9	1.68	24.0	185	622	0.7x	11.0x	7.2x
Geospace Technologies Corporation	104	19	18.8	16.77	95.0	229	210	2.0x	10.8x	(0.5)x
Gulf Island Fabrication, Inc.	303	(23)	(7.6)	5.07	48.6	77	11	0.0x	NM	NM
Halliburton Company	22,408	3,106	13.9	24.47	74.8	21,480	31,369	1.4x	10.1x	3.0x
Hanwei Energy Services Corp.	8	(0)	(5.6)	0.01	33.3	1	4	0.5x	NM	NM
Helix Energy Solutions Group, Inc.	752	168	22.4	9.63	96.3	1,433	1,781	2.4x	10.6x	2.4x
ION Geophysical Corporation	175	34	19.2	8.68	49.7	131	272	1.6x	8.1x	3.9x
Key Energy Services, Inc.	414	(10)	(2.5)	5.11	1.6	2	228	0.6x	NM	NM
McCoy Global Inc.	41	3	7.0	0.46	47.2	13	12	0.3x	4.1x	0.8x
Mitcham Industries, Inc.	42	(7)	(17.3)	2.87	64.9	35	53	1.3x	NM	NM
Nabors Industries Ltd.	3,043	805	26.4	2.88	70.6	1,047	4,692	1.5x	5.8x	3.6x
National Oilwell Varco, Inc.	8,479	75	0.9	25.05	76.8	9,665	11,694	1.4x	155.9x	21.4x
Natural Gas Services Group, Inc.	75	25	33.1	12.26	63.8	165	147	2.0x	5.9x	(0.8)x
Parker Drilling Company	630	129	20.4	22.50	93.4	339	431	0.7x	3.3x	0.8x
PHX Energy Services Corp.	279	32	11.3	2.18	80.9	120	165	0.6x	5.2x	1.4x
RigNet, Inc.	243	24	9.8	6.60	40.9	132	238	1.0x	9.9x	4.3x
RPC, Inc.	1,222	126	10.3	5.24	40.0	1,111	1,103	0.9x	8.8x	(0.1)x
Schlumberger Limited	32,917	6,558	19.9	40.20	82.2	55,652	70,447	2.1x	10.7x	2.2x
SEACOR Holdings Inc.	800	111	13.9	43.15	83.9	871	1,260	1.6x	11.4x	3.4x
Solaris Oilfield Infrastructure, Inc.	242	135	56.0	14.00	72.5	443	536	2.2x	4.0x	(0.4)x
Strad Inc.	100	23	23.0	1.38	96.8	76	92	0.9x	4.0x	0.7x
Superior Drilling Products, Inc.	19	3	13.3	0.82	37.3	21	27	1.4x	10.5x	2.7x
TechnipFMC plc	13,409	1,604	12.0	21.44	75.0	9,585	10,040	0.7x	6.3x	0.1x
TerraVest Industries Inc.	243	38	15.6	10.02	96.3	177	262	1.1x	6.9x	2.9x
TETRA Technologies, Inc.	1,038	170	16.4	1.96	73.1	246	1,258	1.2x	7.4x	5.2x
Weatherford International plc	5,398	438	8.1	27.95	96.4	1,956	3,368	0.6x	7.7x	3.1x
Median			13.9%		69.4%			1.0x	7.5x	2.5x
Mean			13.6%		63.6%			1.1x	13.1x	3.2x

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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
2/23/2020	Strad Inc. (TSX:SDY)	Management	\$116.6	1.1x	3.5x
11/20/2019	W&W Energy Services, Inc.	Petrofac Limited (LSE:PFC)	\$24.8	-	-
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:WG.)	\$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 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Alliant Energy Corporation	\$3,648	\$1,313	36.0%	\$54.72	98.8%	\$13,152	\$19,716	5.4x	15.0x	5.0x
AltaGas Ltd.	4,237	785	18.5	15.25	94.8	4,250	11,446	2.7x	14.6x	7.3x
Blueknight Energy Partners, LP	403	59	14.8	1.13	47.1	46	(64)	(0.2)x	(1.1)x	4.5x
Chart Industries, Inc.	1,299	185	14.2	67.49	70.6	2,416	3,184	2.5x	17.2x	3.7x
EnLink Midstream, LLC	6,039	1,062	17.6	6.13	46.8	2,989	9,370	1.6x	8.8x	4.5x
EQM Midstream Partners, LP	1,630	1,354	83.1	29.91	62.8	5,996	13,020	8.0x	9.6x	4.3x
Gibson Energy Inc.	5,656	310	5.5	20.50	96.1	2,983	3,960	0.7x	12.8x	3.3x
Green Plains Partners LP	82	53	64.1	13.82	83.9	320	497	6.0x	9.4x	3.2x
Magellan Midstream Partners, LP	2,728	1,256	46.0	62.87	92.8	14,360	19,089	7.0x	15.2x	3.8x
MPLX LP	8,745	4,546	52.0	25.46	71.0	26,946	48,525	5.5x	10.7x	4.5x
NuStar Energy LP	1,498	677	45.2	25.85	86.0	2,786	7,582	5.1x	11.2x	5.1x
Median			36.0%		83.9%			5.1x	11.2x	4.5x
Mean			36.1%		77.3%			4.0x	11.2x	4.5x

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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

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PIPELINES

EQUITY COMPARABLES (1)

Oil and Gas Pipelines (United States & Canada)

Company	LTM ⁽²⁾			Stock Price 12/31/19	% of 52-Week High	Market Cap	Total Enterprise Value ⁽³⁾	TEV / LTM		Net Debt ⁽⁴⁾ EBITDA
	Revenues	EBITDA	Margin					Revenues	EBITDA	
Antero Midstream Corporation	\$850	\$530	62.4%	\$7.59	52.1%	\$3,674	\$6,332	7.5x	11.9x	5.5x
ATCO Ltd.	3,628	1,474	40.6	38.37	97.0	4,388	13,927	3.8x	9.4x	4.4x
Blueknight Energy Partners, LP	403	59	14.8	1.13	47.1	46	(64)	(0.2)x	(1.1)x	4.5x
Crestwood Equity Partners LP	3,182	386	12.1	30.82	77.1	2,228	5,604	1.8x	14.5x	6.1x
Enable Midstream Partners, LP	2,960	1,088	36.8	10.03	60.8	4,365	9,198	3.1x	8.5x	4.1x
Enbridge Inc.	38,603	9,387	24.3	39.81	99.0	80,564	141,281	3.7x	15.1x	5.4x
Energy Transfer LP	54,213	10,498	19.4	12.83	80.3	34,443	93,573	1.7x	8.9x	4.9x
Enterprise Products Partners LP	32,789	7,516	22.9	28.16	91.2	61,647	89,748	2.7x	11.9x	3.7x
Equitrans Midstream Corporation	1,630	1,352	82.9	13.36	59.9	3,403	14,097	8.6x	10.4x	4.7x
EQM Midstream Partners, LP	1,630	1,354	83.1	29.91	62.8	5,996	13,020	8.0x	9.6x	4.3x
Genesis Energy, LP	2,481	591	23.8	20.48	85.2	2,510	6,926	2.8x	11.7x	6.0x
Gibson Energy Inc.	5,656	310	5.5	20.50	96.1	2,983	3,960	0.7x	12.8x	3.3x
Inter Pipeline Ltd.	1,955	797	40.8	17.38	88.7	7,264	12,203	6.2x	15.3x	6.6x
Kinder Morgan Canada Limited	313	141	45.0	11.50	30.3	402	1,371	4.4x	9.7x	2.6x
Kinder Morgan, Inc.	13,209	6,267	47.4	21.17	98.5	47,949	86,532	6.6x	13.8x	5.4x
ONEOK, Inc.	10,164	2,381	23.4	75.67	98.0	31,258	43,392	4.3x	18.2x	5.4x
Plains All American Pipeline, LP	33,669	2,628	7.8	18.39	72.8	13,388	25,912	0.8x	9.9x	3.9x
Sanchez Midstream Partners LP	89	50	55.9	0.30	8.4	6	424	4.7x	8.5x	8.4x
Summit Midstream Partners, LP	445	235	52.7	3.31	22.9	309	2,005	4.5x	8.5x	6.3x
Targa Resources Corp.	8,671	1,484	17.1	40.83	83.7	9,505	20,544	2.4x	13.8x	5.1x
TC PipeLines, LP	563	458	81.3	42.30	96.3	3,016	5,036	8.9x	11.0x	4.2x
The Williams Companies, Inc.	8,201	2,492	30.4	23.72	80.3	28,750	54,246	6.6x	21.8x	8.9x
TC Energy Corporation	10,219	6,361	62.2	53.32	97.9	49,823	91,318	8.9x	14.4x	5.9x
Western Midstream Partners, LP	2,746	1,498	54.6	19.69	55.1	8,920	16,871	6.1x	11.3x	5.2x
Median			38.7%		80.3%			4.3x	11.5x	5.2x
Mean			39.5%		72.6%			4.5x	11.7x	5.2x

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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
2/27/2020	EQM Midstream Partners, LP (NYSE:EQM)	Equitrans Midstream Corporation (NYSE:ETRN)	\$12,076.0	7.3x	8.8x
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 12/31/19	% 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.	\$1,811	\$24	1.3%	\$38.07	90.3%	\$161	\$54	0.0x	2.2x	(4.0)x
ArcBest Corporation	2,988	188	6.3	27.60	65.9	704	766	0.3x	4.1x	0.4x
Covenant Transportation Group, Inc.	895	97	10.8	12.93	51.7	239	567	0.6x	5.9x	3.2x
Daseke, Inc.	1,737	156	9.0	3.16	55.9	204	997	0.6x	6.4x	4.5x
Heartland Express, Inc.	597	164	27.5	21.05	92.7	1,727	1,668	2.8x	10.1x	(0.5)x
Hess Corporation	6,311	2,715	43.0	66.81	90.1	20,357	27,177	4.3x	10.0x	2.4x
J.B. Hunt Transport Services, Inc.	9,165	1,256	13.7	116.78	95.5	12,446	13,786	1.5x	11.0x	1.1x
Knight-Swift Transportation Holdings Inc.	4,844	897	18.5	35.84	91.0	6,116	7,179	1.5x	8.0x	1.0x
Landstar System, Inc.	4,090	342	8.4	113.87	94.7	4,494	4,326	1.1x	12.6x	(0.5)x
Marten Transport, Ltd.	843	163	19.3	21.49	94.3	1,175	1,136	1.3x	7.0x	(0.2)x
Old Dominion Freight Line, Inc.	4,109	1,072	26.1	189.78	96.2	15,149	14,940	3.6x	13.9x	(0.3)x
P.A.M. Transportation Services, Inc.	529	99	18.6	57.71	80.6	332	544	1.0x	5.5x	2.1x
Patriot Transportation Holding, Inc.	105	8	7.6	19.48	96.4	65	44	0.4x	5.5x	(1.9)x
Parkland Fuel Corporation	14,227	911	6.4	36.78	98.6	5,437	8,505	0.6x	9.3x	3.1x
Roadrunner Transportation Systems, Inc.	1,999	(31)	(1.6)	9.21	62.4	347	773	0.4x	NM	NM
Ryder System, Inc.	8,926	2,171	24.3	54.31	80.3	2,894	10,783	1.2x	5.0x	3.7x
Saia, Inc.	1,787	271	15.2	93.12	87.0	2,393	2,663	1.5x	9.8x	0.9x
Schneider National, Inc.	4,747	639	13.5	21.82	89.5	3,865	3,867	0.8x	6.1x	(0.2)x
TFI International Inc.	3,993	568	14.2	33.75	94.5	2,749	4,480	1.1x	7.9x	3.0x
Titanium Transportation Group Inc.	129	11	8.3	1.16	90.9	42	99	0.8x	9.3x	5.2x
Universal Logistics Holdings, Inc.	1,512	136	9.0	18.96	69.0	517	970	0.6x	7.1x	3.2x
USA Truck, Inc.	523	40	7.7	7.45	35.6	62	251	0.5x	6.2x	4.7x
Werner Enterprises, Inc.	2,464	453	18.4	36.39	92.8	2,518	2,864	1.2x	6.3x	0.6x
YRC Worldwide Inc.	4,871	160	3.3	2.55	29.4	92	1,223	0.3x	7.6x	7.0x
Median			12.1%		90.2%			0.9x	7.1x	1.1x
Mean			13.7%		80.2%			1.2x	7.7x	1.7x

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

TRUCKERS

SELECTED TRANSACTIONS (1)

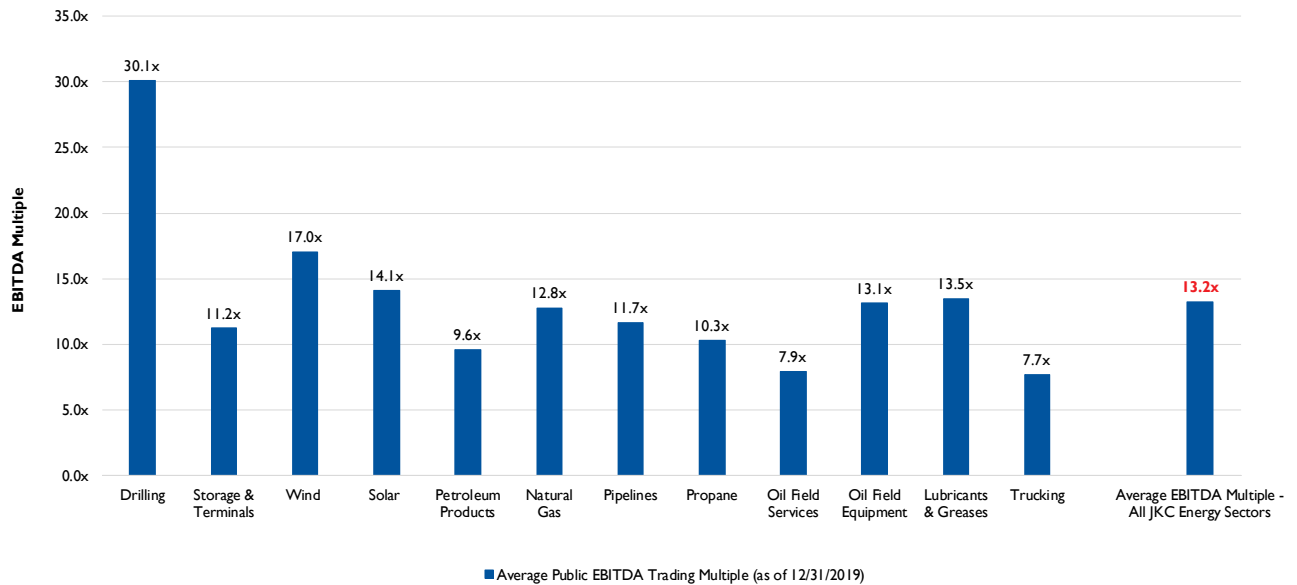
Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
2/19/2020	Performance Team LLC	A.P. Møller - Mærsk A/S (CPSE:MAERSK B)	\$545.0	1.0x	6.1x
11/5/2018	CaseStack, Inc.	Hub Group, Inc. (NasdaqGS:HUBG)	\$255.0	1.1x	11.6x
8/31/2018	Mode Transportation, LLC	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 12/31/2019)



FACTOIDS: LITTLE-KNOWN FACTS AND STATS

PETROLEUM PRODUCTS (1)

- Since the 2007–09 recession, U.S. petroleum consumption growth has shifted toward liquid fuels that are used primarily outside the transportation sector and are supplied mostly from non-refinery sources. Hydrocarbon gas liquids (HGL) have been the main driver of U.S. petroleum and other liquids demand growth since 2007.
- U.S. production and consumption of HGLs -- a group of products that include ethane, propane, normal butane and isobutane, natural gasoline, and refinery olefins -- have risen with increased natural gas production and demand from an expanding petrochemical sector.

NATURAL GAS (2)

- In 2018, 13% of the total electric generating capacity within the U.S. was made up of generators capable of switching between natural gas and petroleum liquid fuels. For most fuel-switching generators in the U.S., the primary energy source is natural gas and the secondary fuel is distillate fuel oil or residual fuel oil.
- Most fuel-switching generating capacity in the United States is located along the East Coast, with Florida having the most fuel-switching capacity, accounting for 47% of the state's total capacity.

PROPANE AND HEATING/FUEL OIL (3)

- The heating oil used today is cleaner and greener than before, thanks to Bioheat®, a blend of traditional home heating oil with biodiesel fuel, made from soybean oil and other renewable, natural sources. It promotes better air quality by producing lower toxic emissions, and it's virtually sulfur-free, making it an environmentally friendly option.
- Heating oil is non-explosive, offering an important advantage over other common home heating fuels in terms of safety. Not only is it non-explosive, but it won't ignite unless it's preheated to 140 degrees.

(1) U.S. Energy Information Administration.

(2) U.S. Energy Information Administration.

(3) Pennsylvania Petroleum Association.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

LUBRICANTS AND GREASES (1)

- Food grade lubricants are special products used in applications where contact with food or beverage related items could potentially take place. These products must perform all the duties of a regular lubricant while also meeting certain guidelines for food safety. For example, H3 Soluble Oils are applied to equipment that will directly contact food, usually for the purpose of cleaning and preventing rust.
- Food grade lubricants are blended with white oil base stocks and one of a limited number of approved thickeners.

SOLAR (2)

- It is expected that 13.5 GW of solar capacity will come online in 2020, surpassing the previous annual record addition of 8 GW in 2016. More than half of the utility-scale electric power sector solar photovoltaic (PV) capacity additions will be in four states: Texas (22%), California (15%), Florida (11%), and South Carolina (10%).
- The residential and commercial solar sectors will also experience record growth as a result of new distributed PV or rooftop systems. It is expected that an additional 5.1 GW of small-scale solar PV capacity will enter service by the end of 2020.

WIND (2)

- Annual wind generation totaled 300 million MWh in 2019, exceeding hydroelectric generation by 26 million MWh. Wind is now the top renewable source of electricity generation in the country, a position previously held by hydroelectricity.
- Wind capacity additions totaled 10 gigawatts in 2019 (3.8 GW installed in the fourth quarter), making 2019 the second-largest year for wind capacity additions, second only to 2012.

(1) The Lubricant Store.

(2) U.S. Energy Information Administration.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

OIL AND GAS FIELD SERVICES (1)

- In North Dakota, wells are drilled to 9,000–10,000 vertical feet, then reach horizontally for distances up to two miles, threading the 30 foot wide Bakken shale to allow the best opportunities for producing the crude oil the Bakken contains.
- In western Colorado “flex rigs” drill as many as 22 directional wells from a single pad, finding natural gas accumulations contained in the complex weave of river.

EQUIPMENT AND PHYSICAL TECHNOLOGY (1)

- Advancements in computerization, sophisticated sensing and measuring tools provide real-time information from the wellbore back up to the operators during drilling operations. These “bottom hole assemblies” are attached at the end of the drill pipe and linked directly to the motors that power the drill bit. Based on this real-time information, operators make decisions on the direction of the drilling.
- Three dimensional seismic techniques provide industry scientists with data that offer detailed information about the rocks below and their capability to contain oil or natural gas. With ultra-modern computer imaging, 3D seismic enables geologists and geophysicists to “see” the subsurface in three dimensions.

STORAGE AND TERMINALS (2)

- According to the Industry Trends Report commissioned by StocExpo, the rise of niche storage areas are expected to grow over the next two years, including chemical and specialty chemical storage, according to 48% and 43% of the report respondents, respectively, as well as the storage of biodiesels (43%) and vegetable oils (28%).
- While only 22% and 6% of the report respondents are currently storing LNG and hydrogen, the growth of these bulk storage items is on the diversification agenda for more than half of storage terminal respondents.

(1) American Petroleum Institute.

(2) Tank Storage Magazine.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

PIPELINES

- Shell Midstream Partners LP announced that it is considering expanding its 163-mile-long Mars crude oil pipeline in the Gulf of Mexico. The current pipeline has the capacity to move between 400,000 and 600,000 barrels per day of oil produced in the Mississippi Canyon area to the LOOP salt dome caverns in Clovelly, Louisiana.⁽¹⁾
- Five new oil pipelines are set to open in the Permian Basin through 2021, expanding a gap between production and takeaway capacity. Most of the planned projects were announced when the Permian was posting annual growth rates in excess of 1 million barrels a day.⁽²⁾

TRUCKERS ⁽³⁾

- The annual cost to the trucking industry as a result of congestion on the nation's highways is \$74.5 billion.
- The number of lost hours of trucking industry productivity due to congestion is 1.2 billion hours per year.

(1) Oilprice.com.

(2) Worldoil.com.

(3) American Transportation Research Institute.

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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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