ENERGY LOGISTICS & DISTRIBUTION

Industry In-Sight™

SPRING/SUMMER 2023






JORDAN KNAUFF & COMPANY

ENERGY EQUIPMENT & INFRASTRUCTURE ALLIANCE

The Voice of the Energy Supply Chain

ENERGYBUILDERS

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

INTRODUCTION ... About This Report

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

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

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

Segments covered in this Industry In-Sight™ include:

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

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

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

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

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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. EEIA mobilizes and leads 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. It also works for widespread public support for energy development.

EEIA is active on all fronts: federal and state legislative, regulatory, judicial and public opinion. Its strength is based upon the supply chain's enormous fifty-state contributions to jobs, economic growth and community prosperity. EEIA conducts economic research that measures and reports the facts about the energy supply chain's tremendous contributions to the American economy.

EEIA is an organization of leading supply chain companies, trade associations and labor organizations. It is the voice 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.

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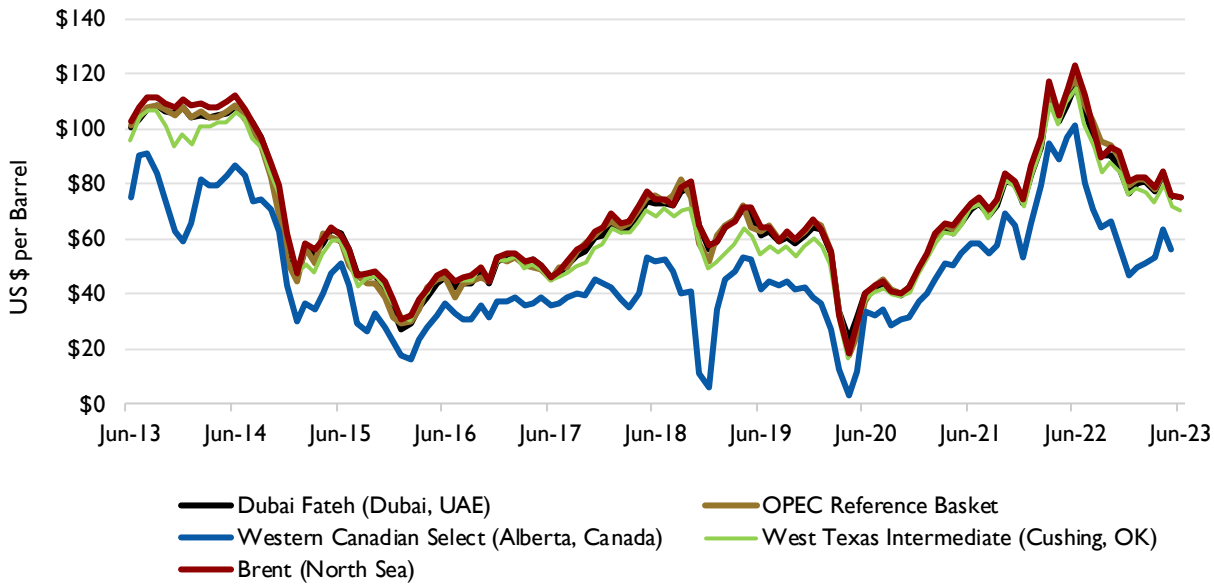
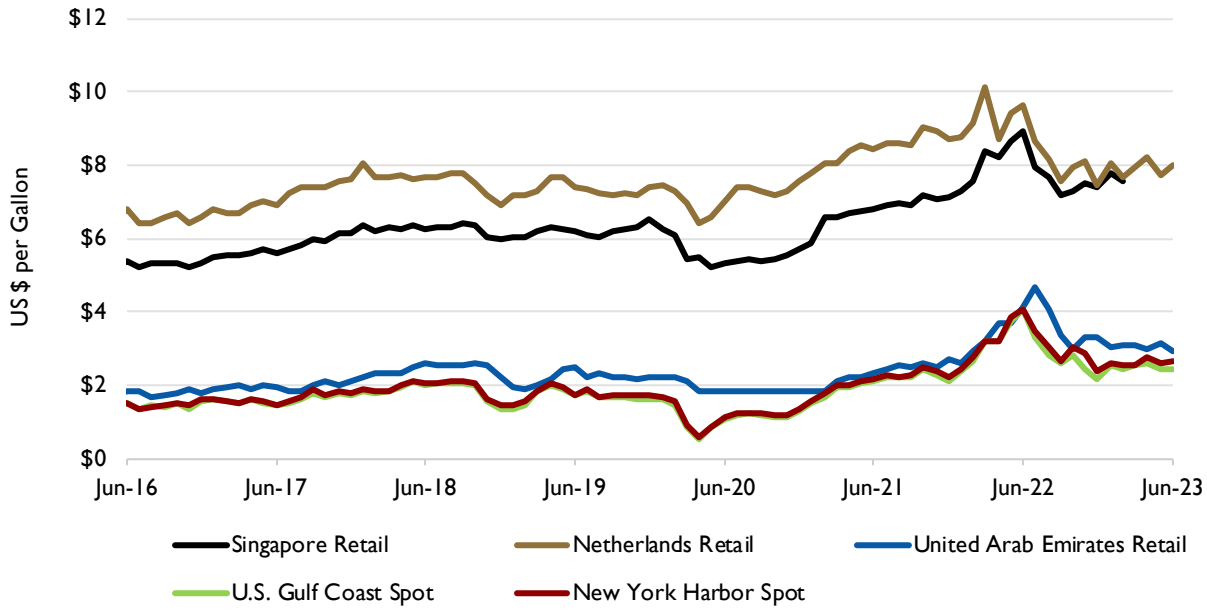
DATA CENTER

OIL

CRUDE OIL PRICES (MONTHLY AVERAGE) (1)



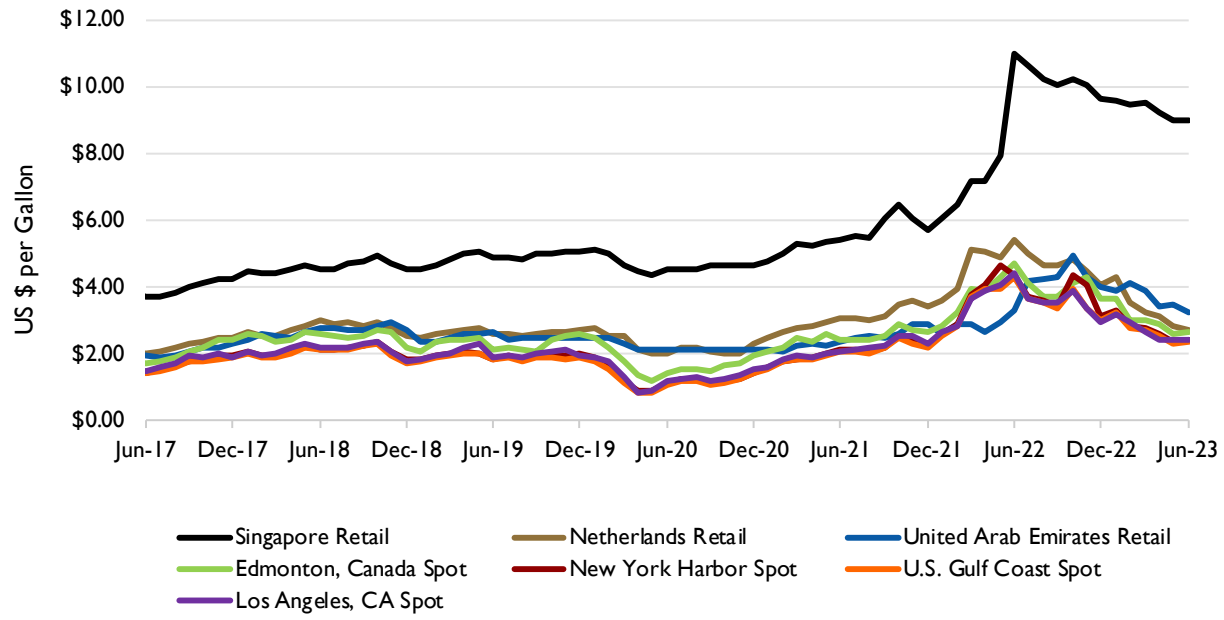
GASOLINE PRICES (MONTHLY AVERAGE) (2)



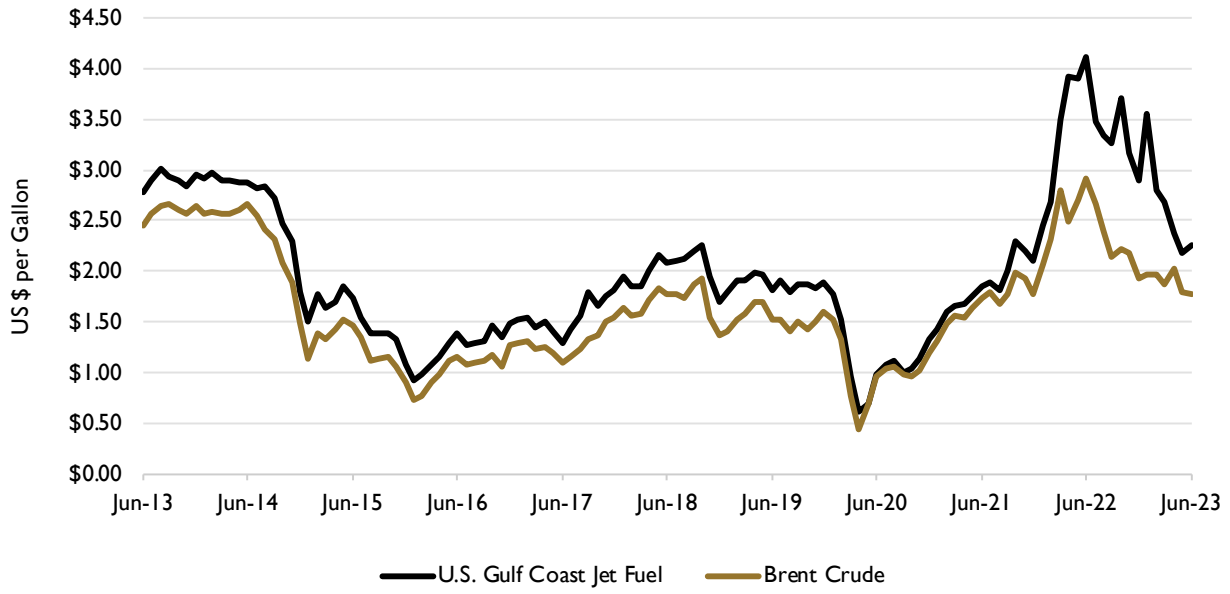
DATA CENTER

OIL

DIESEL PRICES (MONTHLY AVERAGE) (3)



JET FUEL PRICES (MONTHLY AVERAGE) (4)



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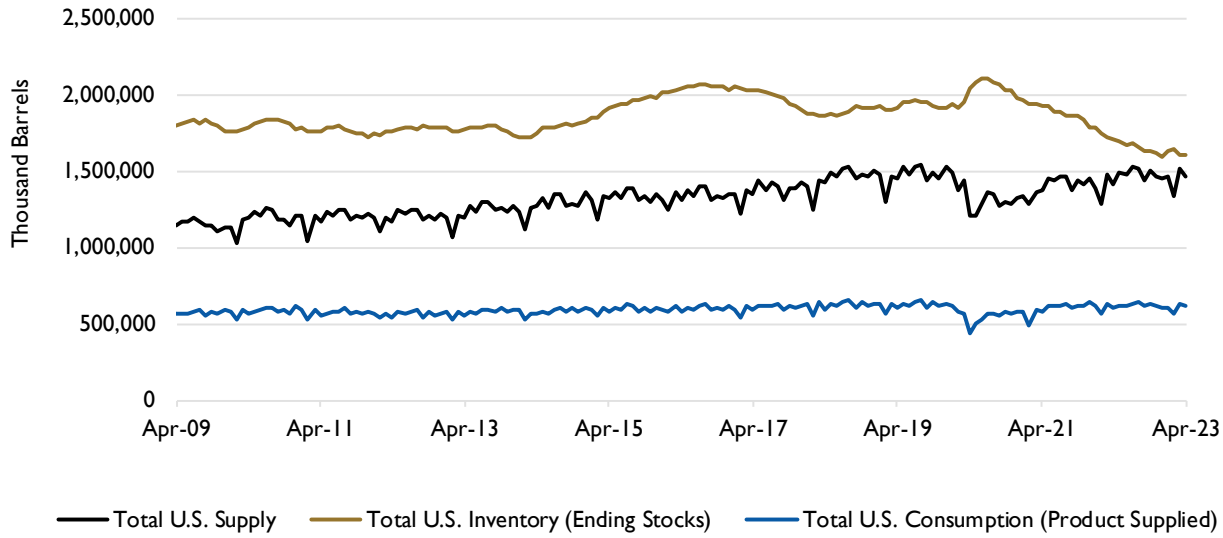
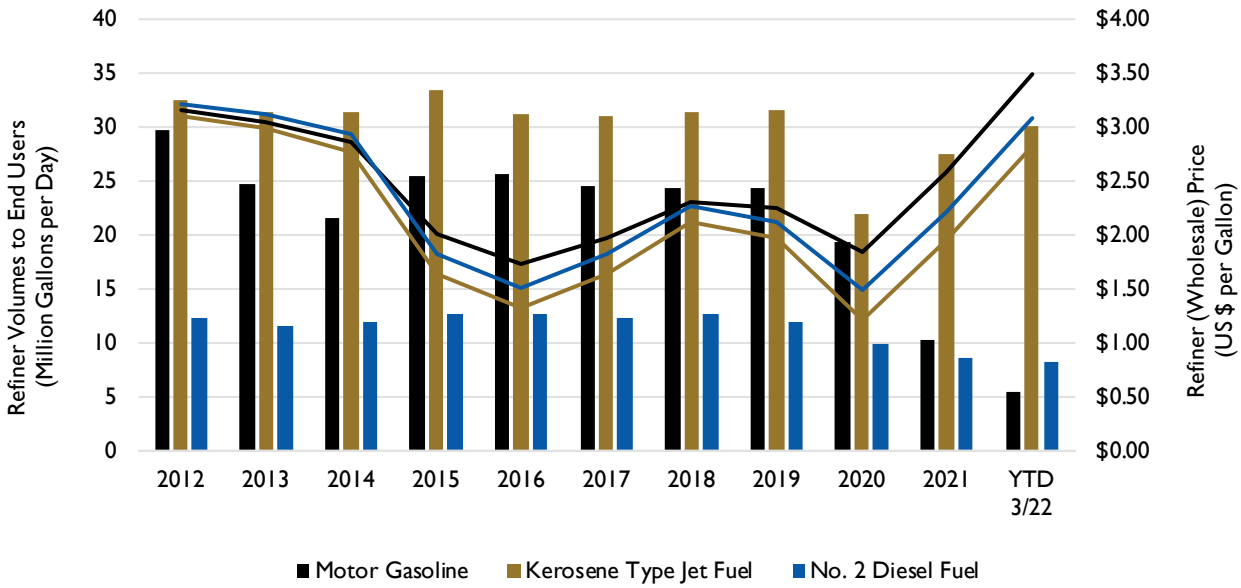
DATA CENTER

OIL

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



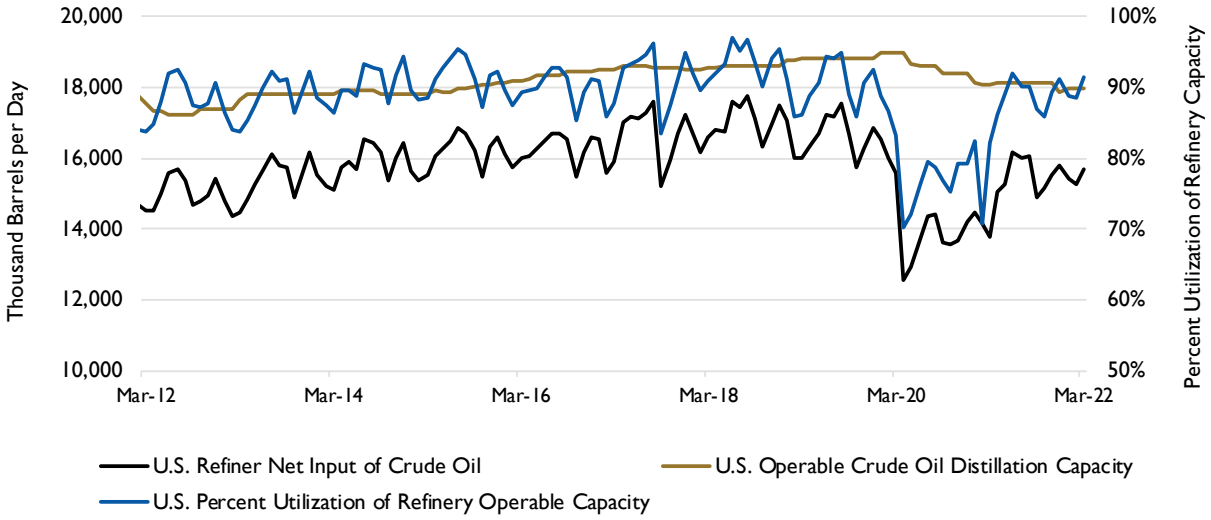
U.S. Refinery Volumes and Wholesale Prices of Petroleum Products (Annual Average) (6) (Latest Available Data)



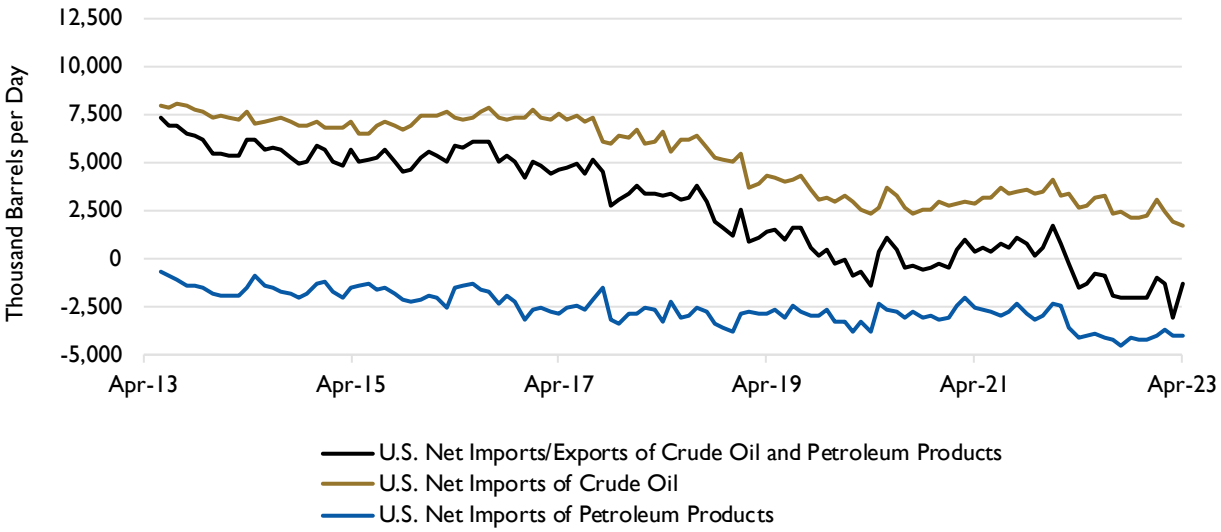
DATA CENTER

OIL

U.S. Crude Oil Refinery Input, Distillation Capacity and Refinery Utilization (Monthly Average) (7) (Latest Available Data)



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



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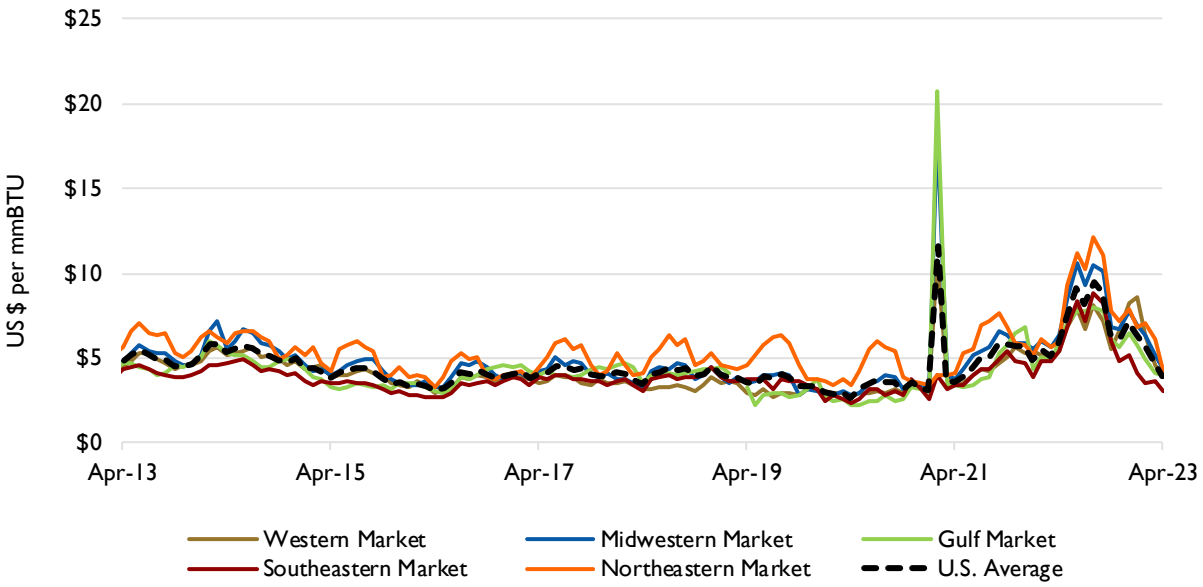
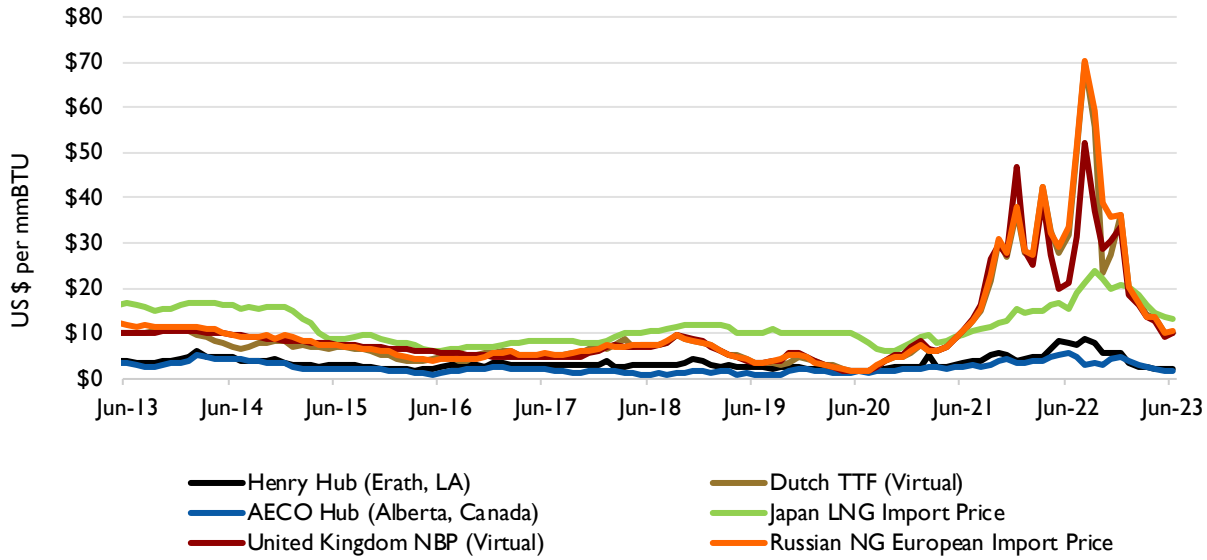
DATA CENTER

NATURAL GAS

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



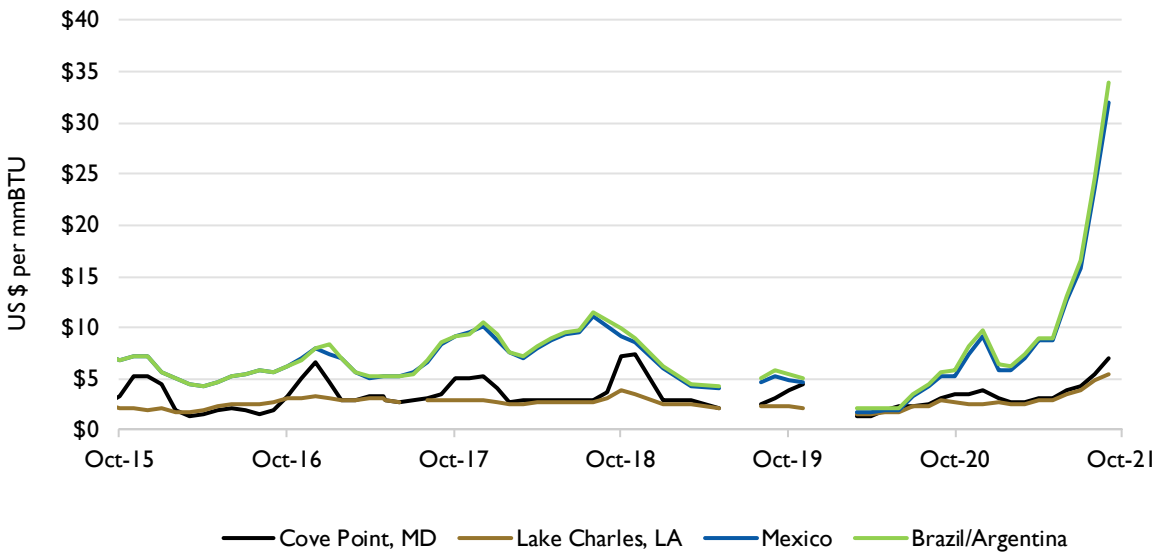
INTERNATIONAL NATURAL GAS PRICES (MONTHLY AVERAGE) (10)



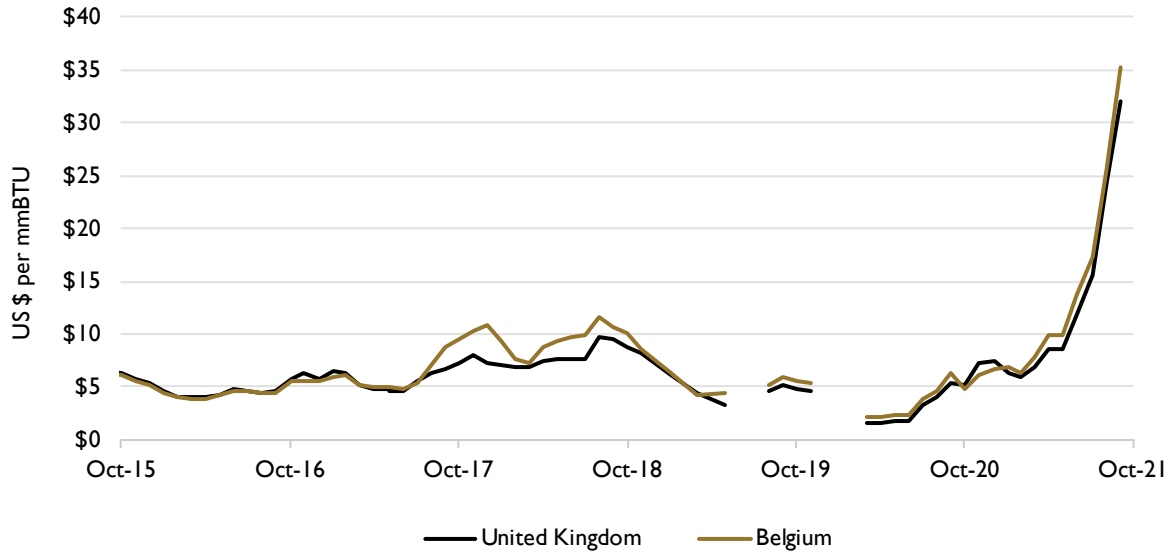
DATA CENTER

NATURAL GAS

AMERICAS LIQUEFIED NATURAL GAS PRICES (MONTHLY AVERAGE) (11) (LATEST AVAILABLE DATA)



WESTERN EUROPE LIQUEFIED NATURAL GAS PRICES (MONTHLY AVERAGE) (12) (LATEST AVAILABLE DATA)



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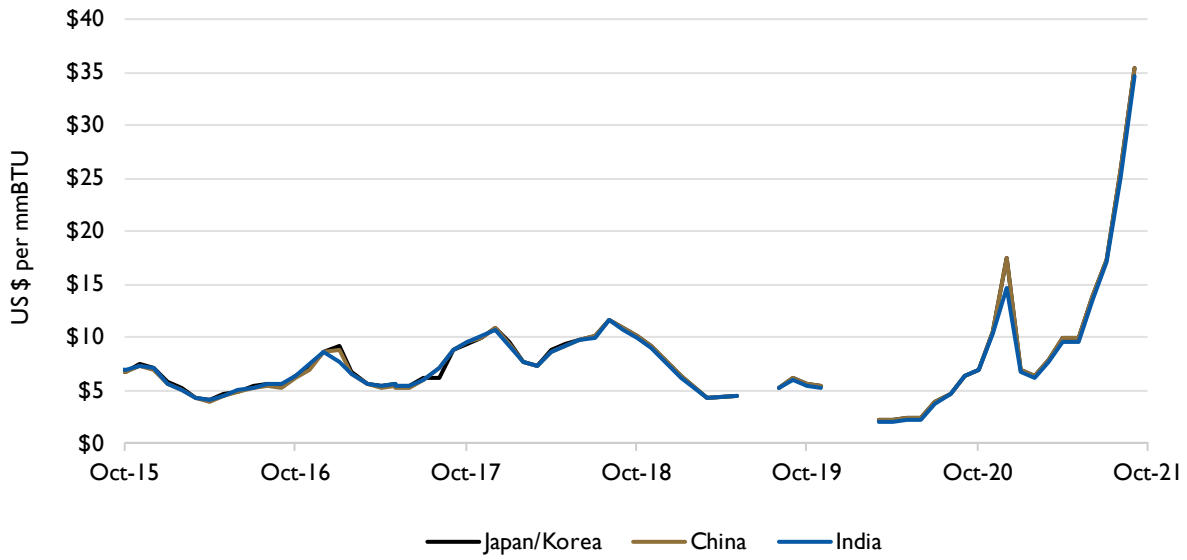
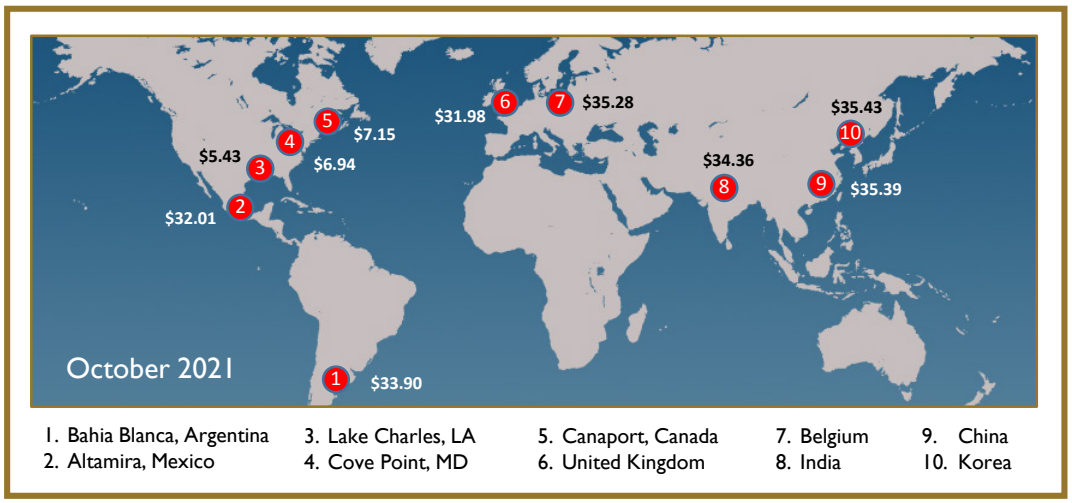
DATA CENTER

NATURAL GAS

ASIA LIQUEFIED NATURAL GAS PRICES (MONTHLY AVERAGE) (13) (LATEST AVAILABLE DATA)



WORLD LIQUEFIED NATURAL GAS PRICES MAP (MONTHLY AVERAGE) (14) (LATEST AVAILABLE DATA)

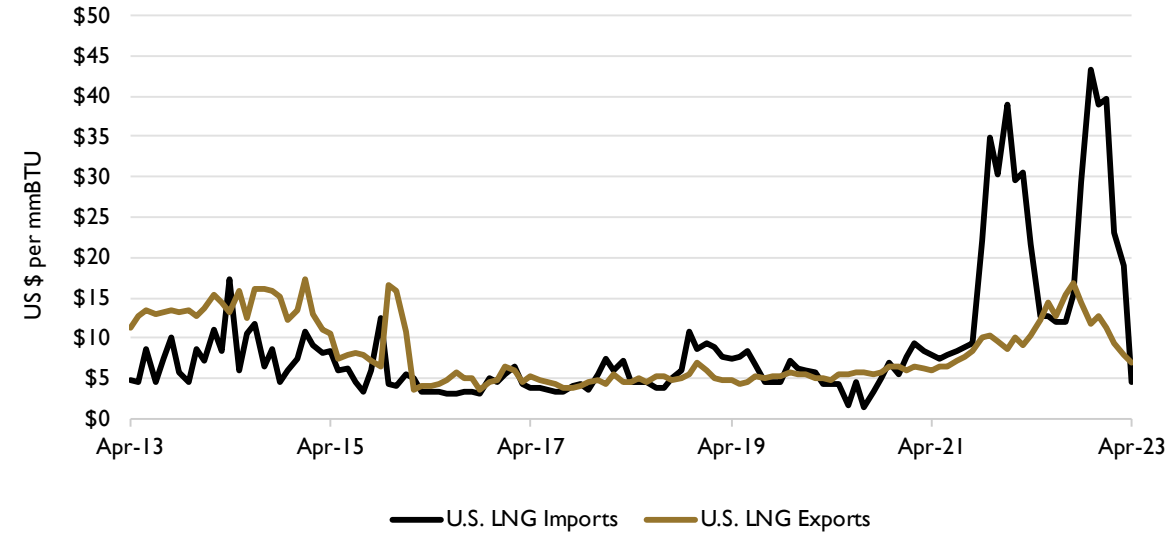


1. Bahia Blanca, Argentina
2. Altamira, Mexico
3. Lake Charles, LA
4. Cove Point, MD
5. Canaport, Canada
6. United Kingdom
7. Belgium
8. India
9. China
10. Korea

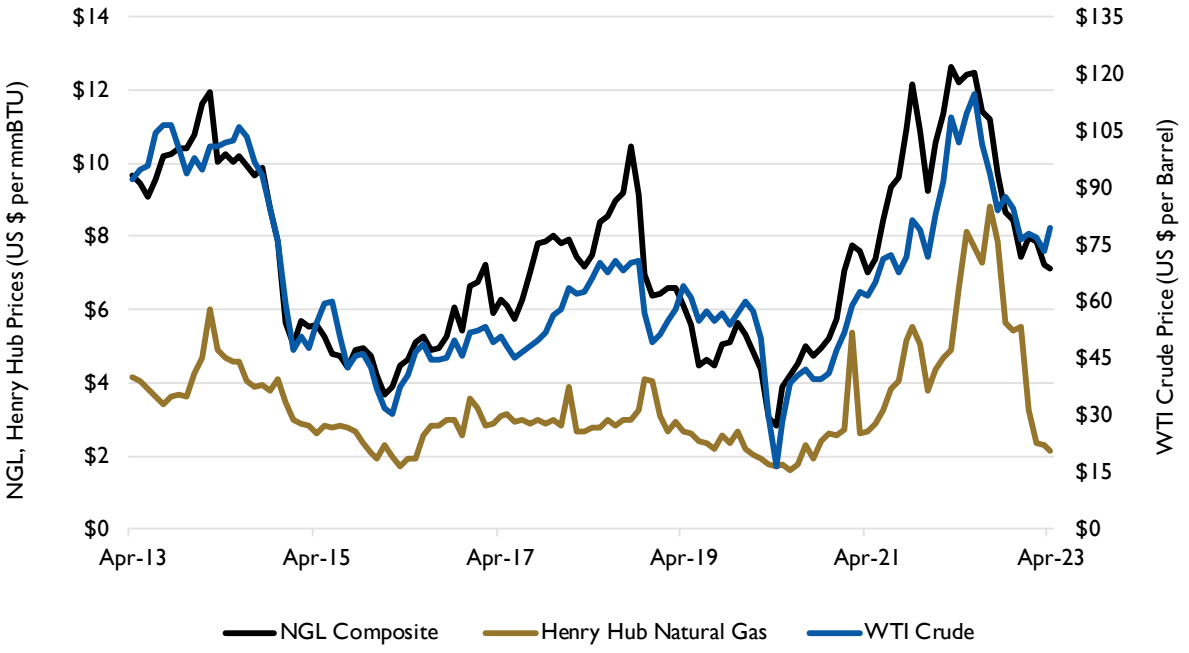
DATA CENTER

NATURAL GAS

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



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



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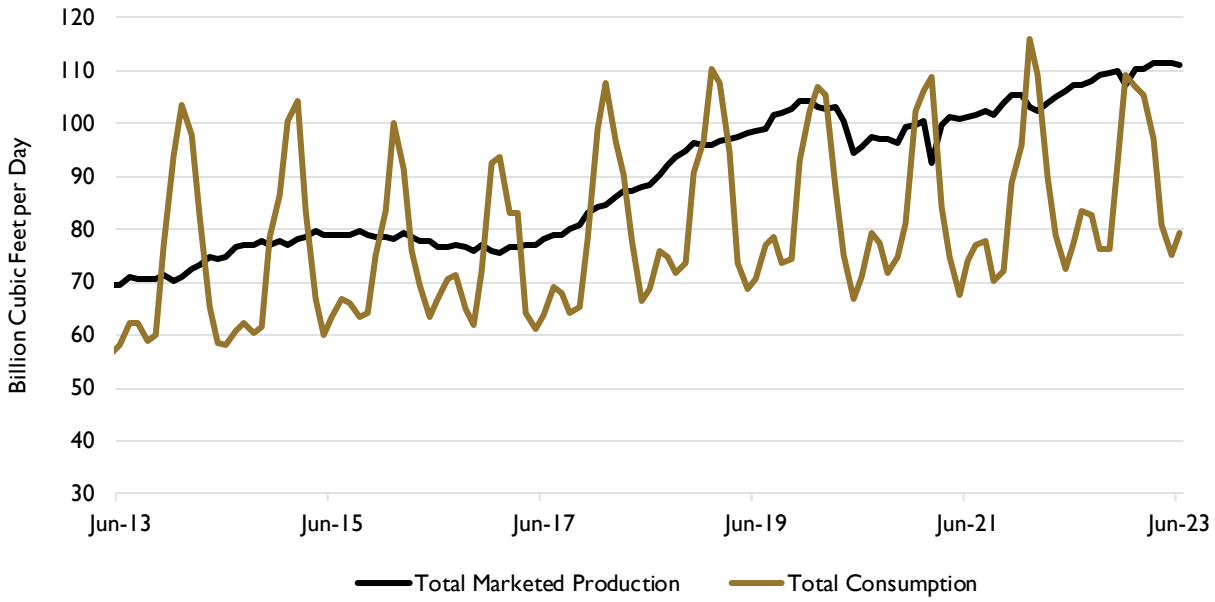
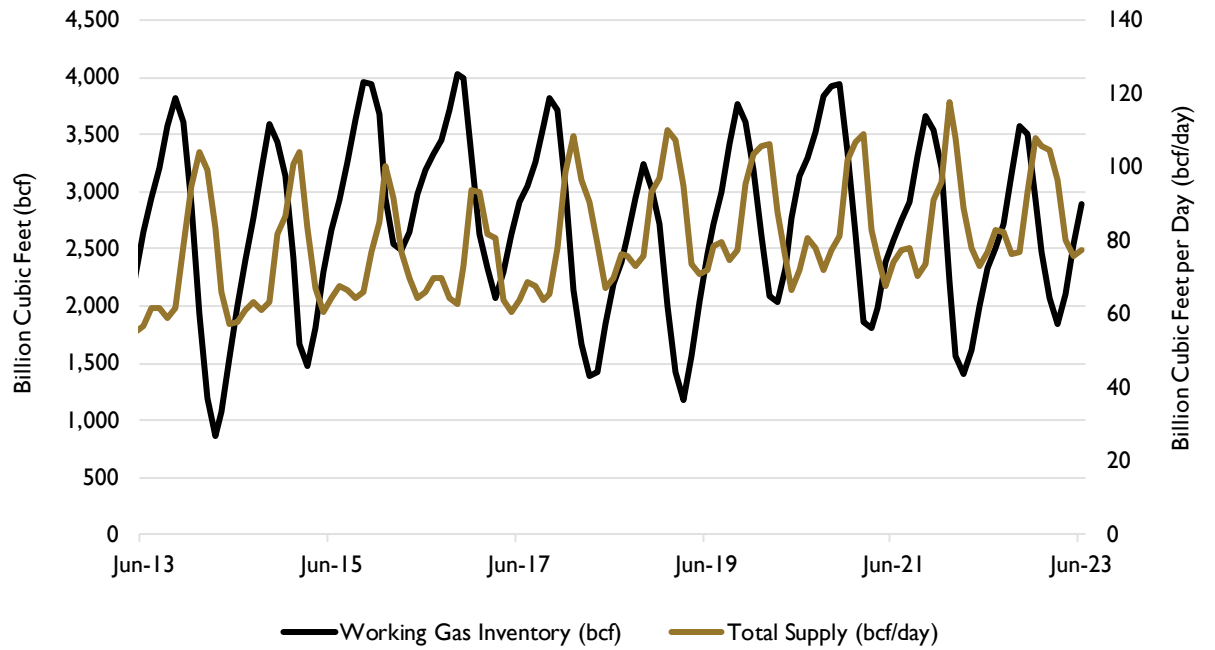
DATA CENTER

NATURAL GAS

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



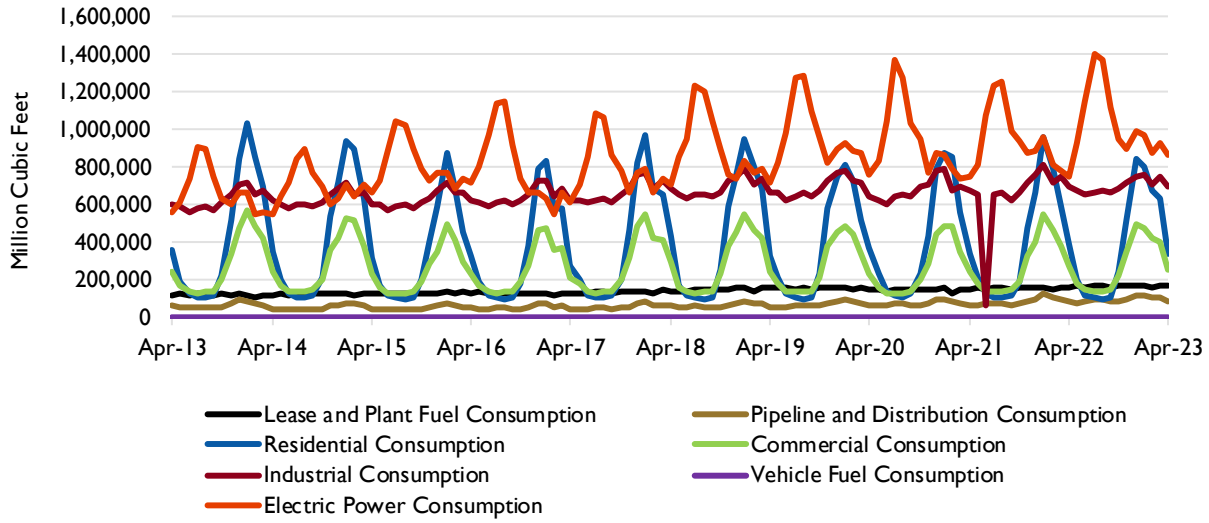
U.S. Natural Gas Supply and Inventory (Monthly) (18)



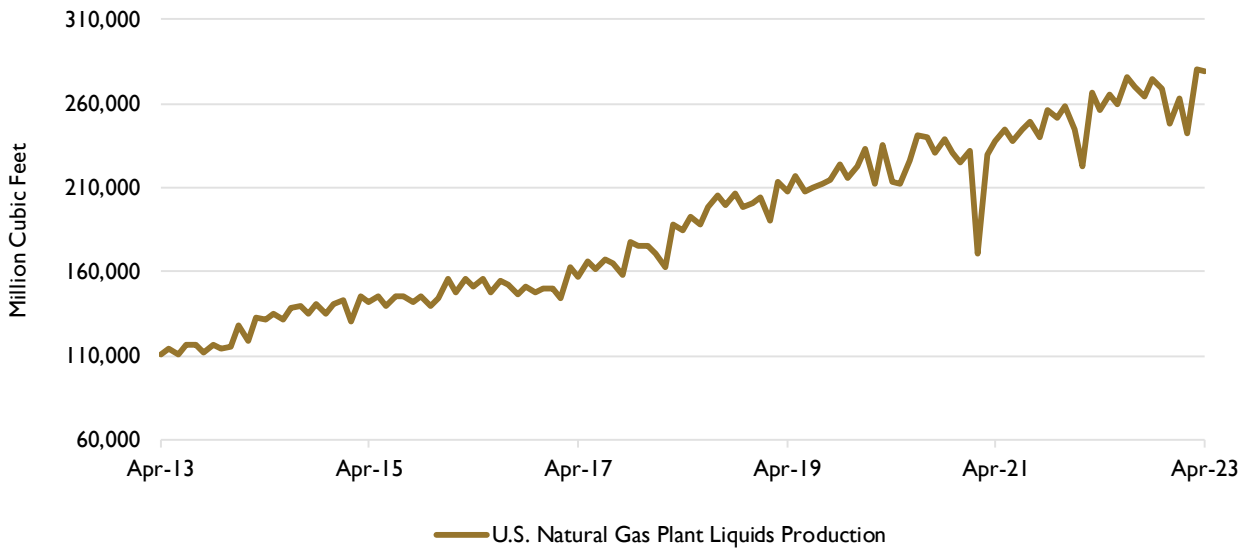
DATA CENTER

NATURAL GAS

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



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



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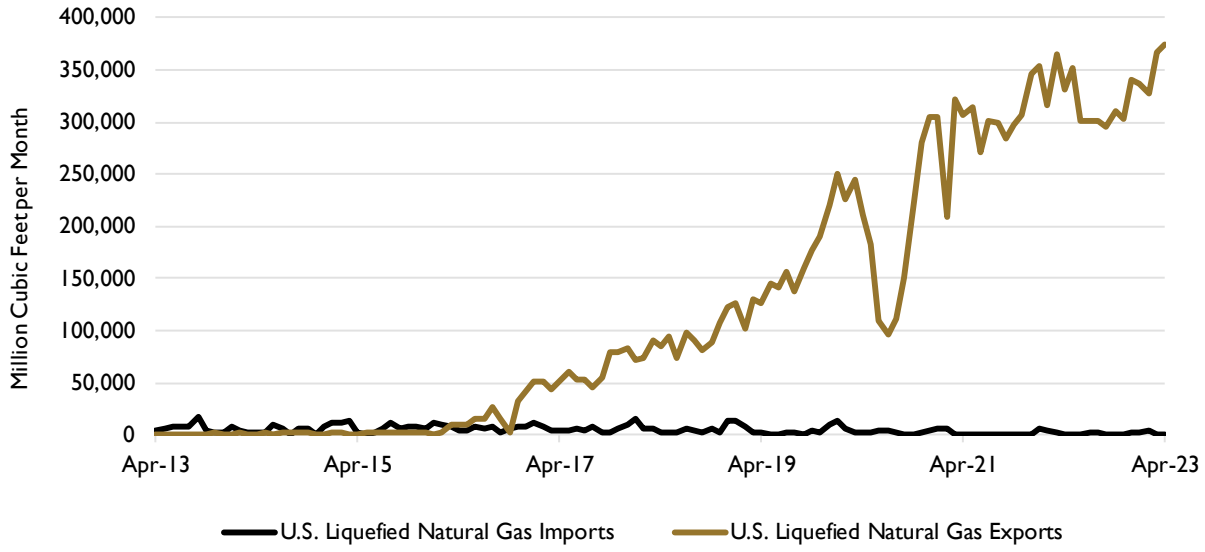
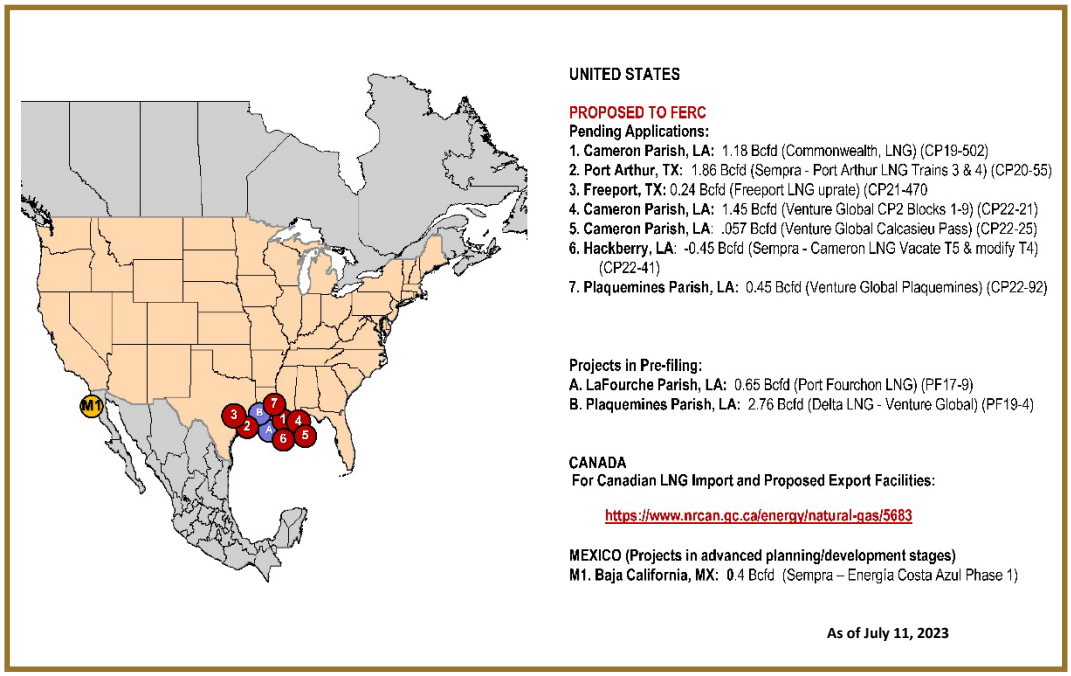
DATA CENTER

NATURAL GAS

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



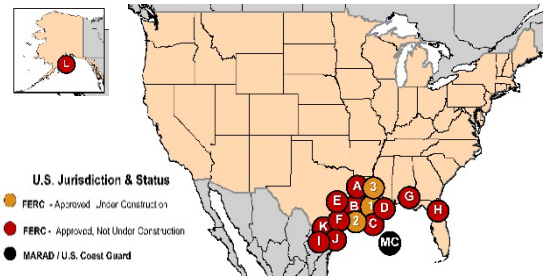
NORTH AMERICAN LNG EXPORT TERMINALS – *PROPOSED* (22)



DATA CENTER

NATURAL GAS

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



Import Terminals (Not Shown on Map)

UNITED STATES As of July 11, 2023

APPROVED - UNDER CONSTRUCTION - FERC
None

APPROVED – NOT UNDER CONSTRUCTION – FERC
1. Kenai, AK: .007 Bcfd (Trans-Foreland – Kenai LNG) (CP15-521)

APPROVED - NOT UNDER CONSTRUCTION - MARAD/Coast Guard
A. Gulf of Mexico: 1.0 Bcfd (Main Pass Energy Hub)
B. Gulf of Mexico: 1.4 Bcfd (TORP Technology-Bienville LNG)

CANADA
For Canadian LNG Import and Proposed Export Facilities go to:
https://www.nrcan.gc.ca/energy/natural-gas/5683

Export Terminals (Shown on Map)

UNITED STATES As of July 11, 2023

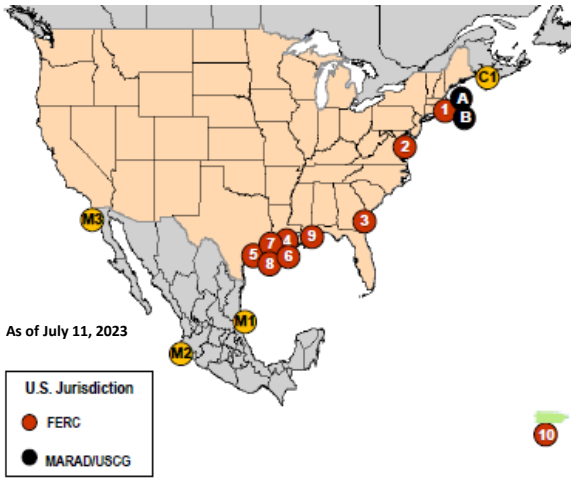
FERC – APPROVED, UNDER CONSTRUCTION
1. Cameron Parish, LA: 0.92 Bcfd (Venture Global Calcasieu Pass Units 5-9) (CP15-550)
2. Sabine Pass, TX: 2.26 Bcfd (ExxonMobil – Golden Pass) (CP14-517, CP20-459)
3. Plaquemines Parish, LA: 3.40 Bcfd (Venture Global Plaquemines) (CP17-66)

FERC – APPROVED, NOT UNDER CONSTRUCTION
A. Lake Charles, LA: 2.2 Bcfd (Lake Charles LNG) (CP14-120)
B. Lake Charles, LA: 1.186 Bcfd (Magnolia LNG) (CP14-347)
C. Hackberry, LA: 1.41 Bcfd (Sempra - Cameron LNG Trains 4 & 5) (CP15-560)
D. Calcasieu Parish, LA: 4.0 Bcfd (Driftwood LNG) (CP17-117)
E. Port Arthur, TX: 1.86 Bcfd (Sempra - Port Arthur LNG Trains 1 & 2) (CP17-20)
F. Freeport, TX: 0.72 Bcfd (Freeport LNG Dev Train 4) (CP17-470)
G. Pascagoula, MS: 1.5 Bcfd (Gulf LNG Liquefaction) (CP15-521)
H. Jacksonville, FL: 0.132 Bcf/d (Eagle LNG Partners) (CP17-41)
I. Brownsville, TX: 0.55 Bcfd (Texas LNG Brownsville) (CP16-116)
J. Brownsville, TX: 3.6 Bcfd (Rio Grande LNG – NextDecade) (CP16-454)
K. Corpus Christi, TX: 1.86 Bcfd (Cheniere Corpus Christi Stage III) (CP18-512)
L. Nikiski, AK: 2.63 Bcfd (Alaska Gasline) (CP17-178)

MARAD/USCG – APPROVED, NOT UNDER CONSTRUCTION
MC. Gulf of Mexico: 1.8 Bcfd (Delfin LNG)

CANADA - LNG IMPORT AND PROPOSED EXPORT FACILITIES
https://www.nrcan.gc.ca/energy/natural-gas/5683

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



★ Authorized to re-export delivered LNG
★ Added liquefaction and export capabilities (also shown on the LNG Export Terminals Existing map)

Import Terminals (Shown on Map)

UNITED STATES
1. Everett, MA: 1.035 Bcfd (GDF SUEZ - DOMAC)
2. Cove Point, MD: 1.8 Bcfd (Dominion - Cove Point LNG) ★
3. Elba Island, GA: 1.6 Bcfd (El Paso - Southern LNG) ★
4. Lake Charles, LA: 2.1 Bcfd (Southern Union – Corpus Christi LNG) ★
5. Freeport, TX: 1.5 Bcfd (Cheniere/Freeport LNG Dev.) ★★
6. Sabine, LA: 4.0 Bcfd (Cheniere/Sabine Pass LNG) ★★
7. Hackberry, LA: 1.8 Bcfd (Sempra - Cameron LNG) ★
8. Sabine Pass, TX: 2.0 Bcfd (ExxonMobil – Golden Pass) (Phase I & II)
9. Pascagoula, MS: 1.5 Bcfd (El Paso/Crest/Sonangol - Gulf LNG Energy)
10. Peñuelas, PR: 0.3 Bcfd (EcoElectrica)

MARAD/USCG
A. Offshore MA: 0.8 Bcfd (Excelerate Energy – Northeast Gateway)
B. Offshore MA: 0.4 Bcfd (GDF SUEZ – Neptune LNG)

CANADA
C1. Saint John, NB: 1.0 Bcfd (Repsol/Fort Reliance - Canaport LNG)

MEXICO
M1. Altamira, Tamulipas: 0.7 Bcfd (Shell/Total/Mitsui – Altamira LNG)
M2. Baja California, MX: 1.0 Bcfd (Sempra – Energia Costa Azul)
M3. Manzanillo, MX: 0.5 Bcfd (KMS GNL de Manzanillo)

Export Terminals (Not Shown on Map)

1. Kenai, AK: 0.2 Bcfd (Trans-Foreland)
2. Sabine, LA: 4.55 Bcfd (Cheniere/Sabine Pass LNG – Trains 1-6)
3. Cove Point, MD: 0.82 Bcfd (Dominion–Cove Point LNG)
4. Corpus Christi, TX: 2.40 Bcfd (Cheniere – Corpus Christi LNG Trains 1-3)
5. Hackberry, LA: 2.15 Bcfd (Sempra–Cameron LNG, Trains 1-3)
6. Elba Island, GA: 0.35 Bcd (Southern LNG Company Units 1-10)
7. Freeport, TX: 2.14 Bcfd (Freeport LNG Dev/Freeport LNG Expansion/FLNG Liquefaction Trains 1-3)
8. Cameron Parish, LA: 0.74 Bcfd (Venture Global Calcasieu Pass Units 1-4)

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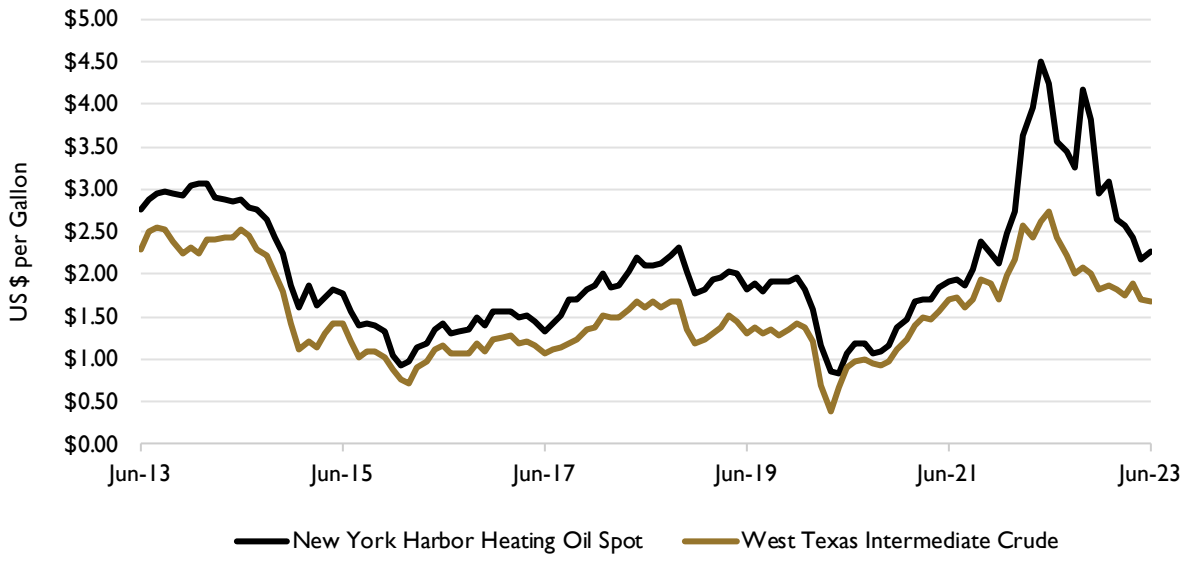
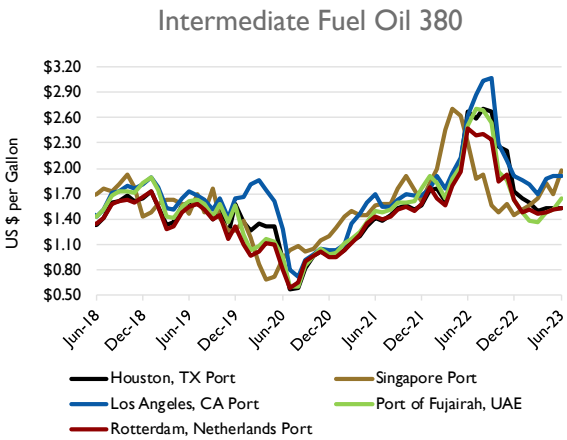
DATA CENTER

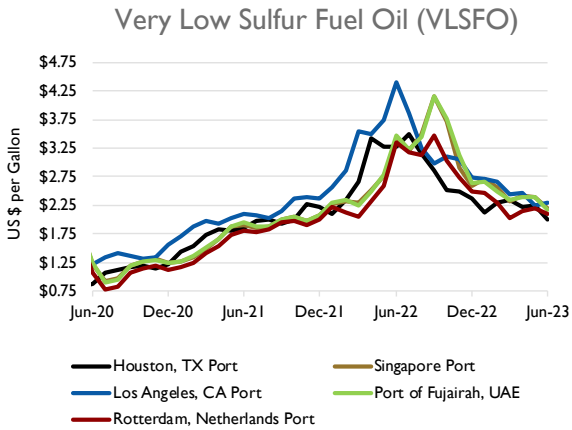
PROPANE AND HEATING/FUEL OIL

HEATING OIL PRICES (MONTHLY AVERAGE) (25)



INTERMEDIATE FUEL OIL AKA "BUNKER FUEL" PRICES (MONTHLY AVERAGE) (26)

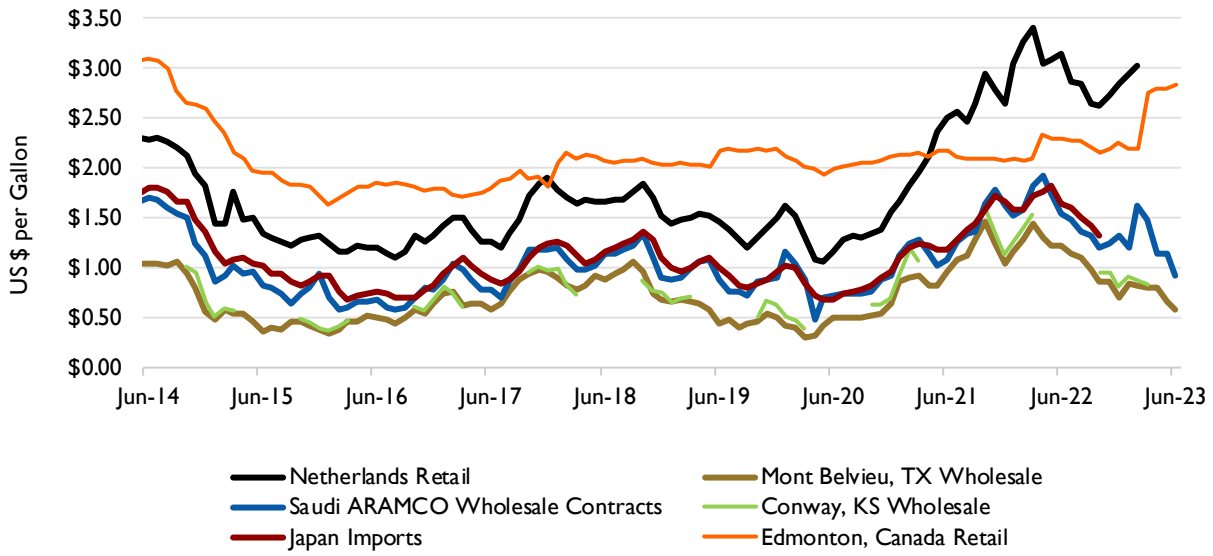




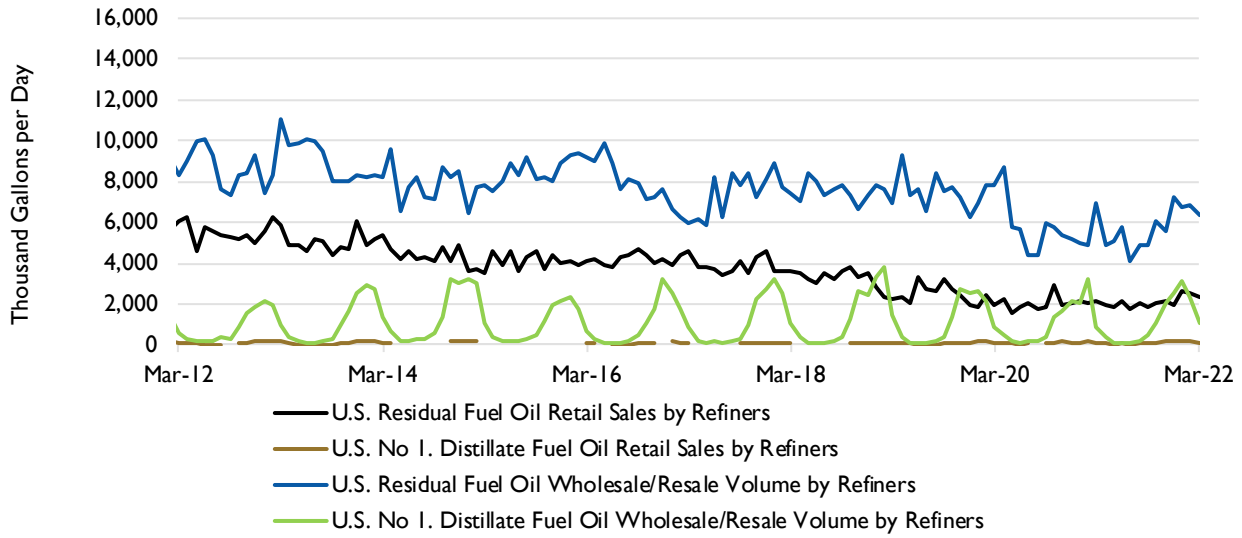
DATA CENTER

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)



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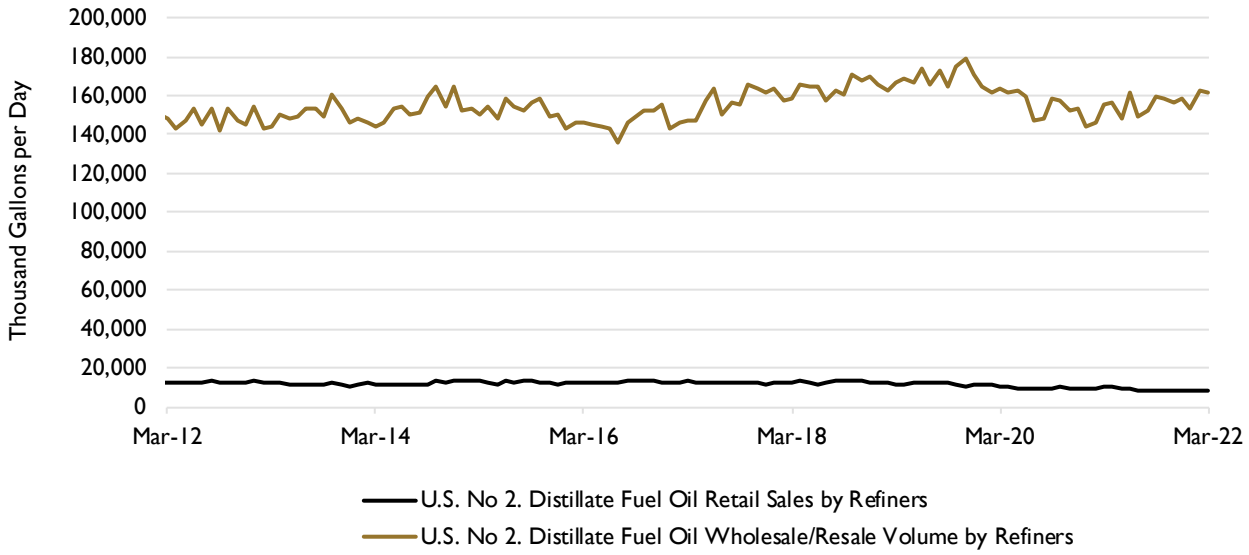
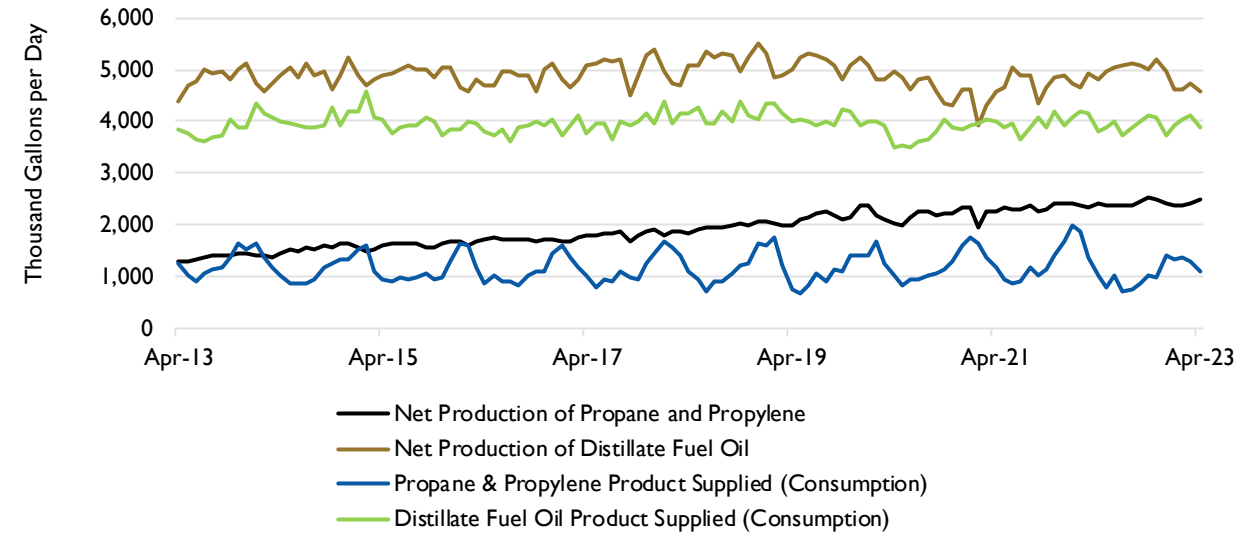
DATA CENTER

PROPANE AND HEATING/FUEL OIL

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



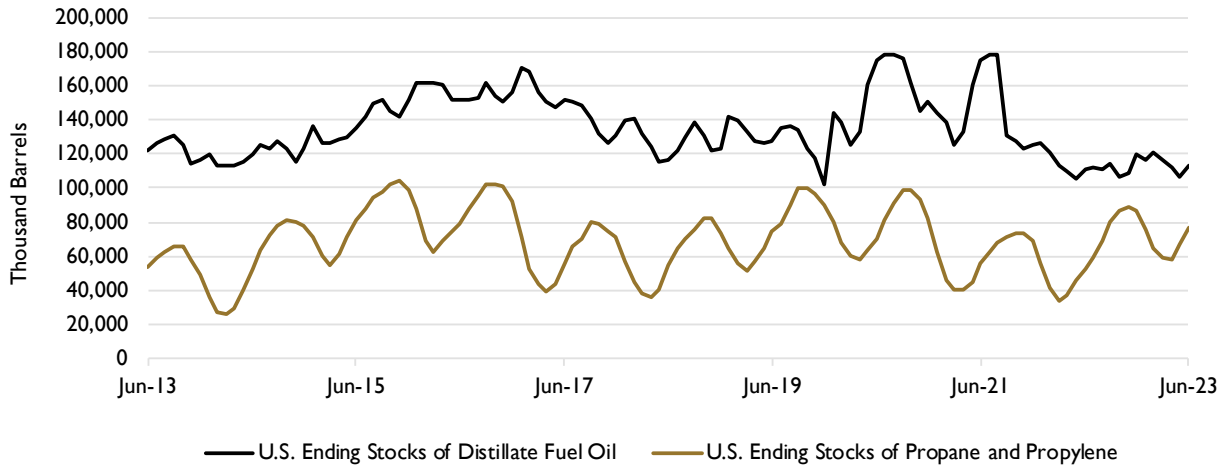
Propane & Propylene and Distillate Fuel Oil Production and Consumption (Monthly) (30)



DATA CENTER

PROPANE AND HEATING/FUEL OIL

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



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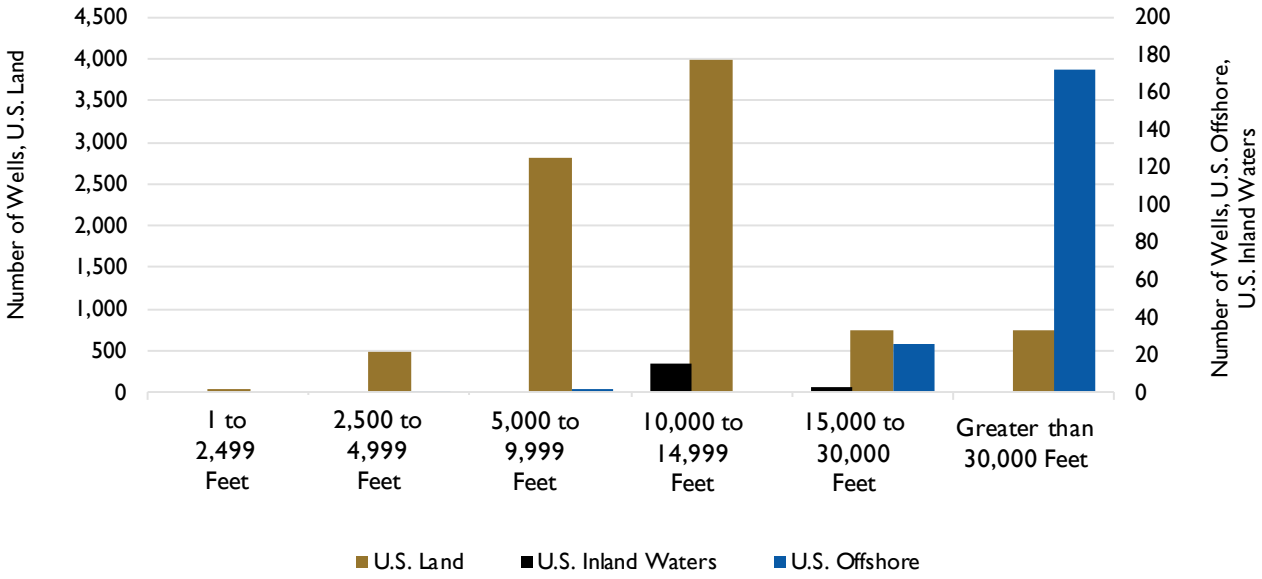
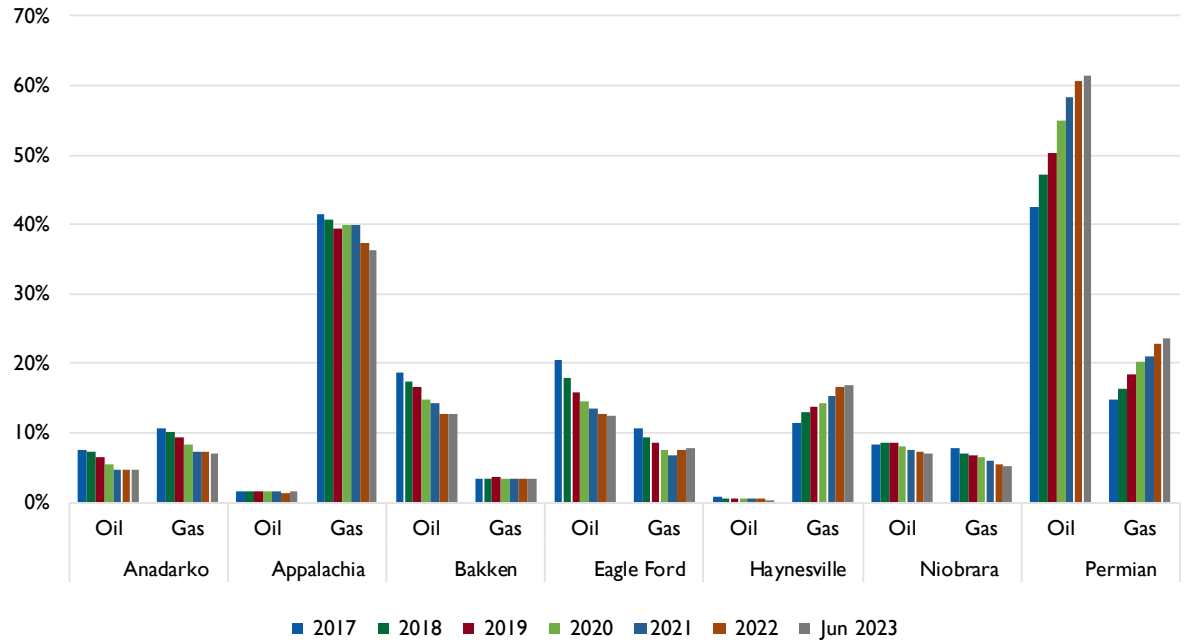
DRILLING ACTIVITY

U.S. WELL STARTS BY DEPTH (YEAR TO DATE JUNE 30, 2023) (32)



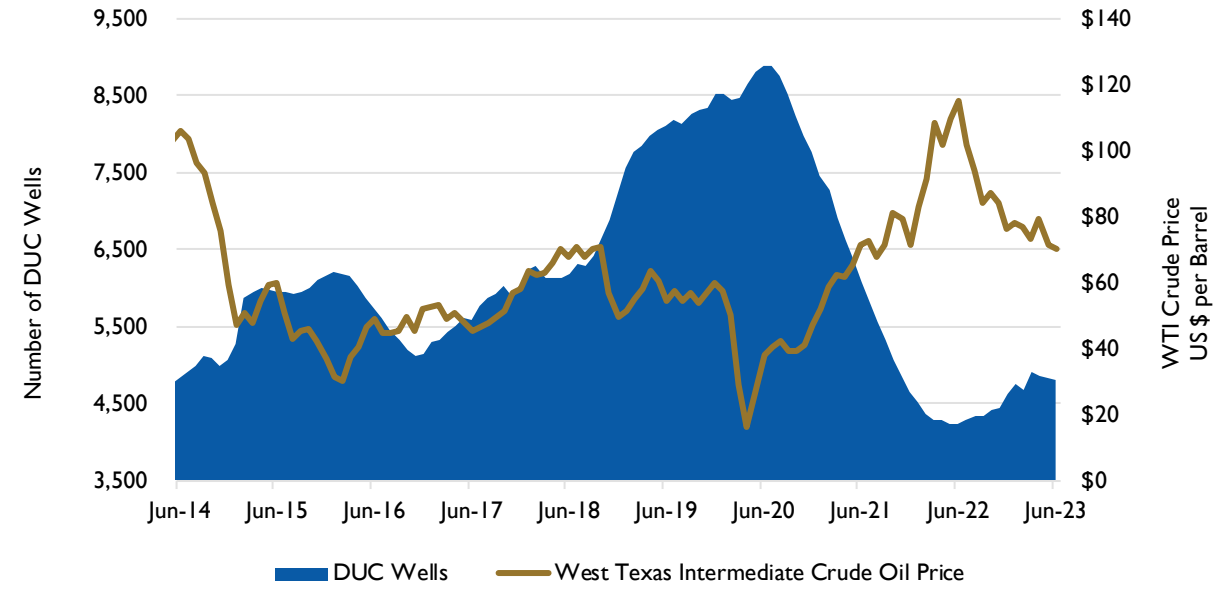
PERCENTAGE OF CRUDE OIL AND NATURAL GAS PRODUCTION PER SHALE REGION (ANNUAL) (33)



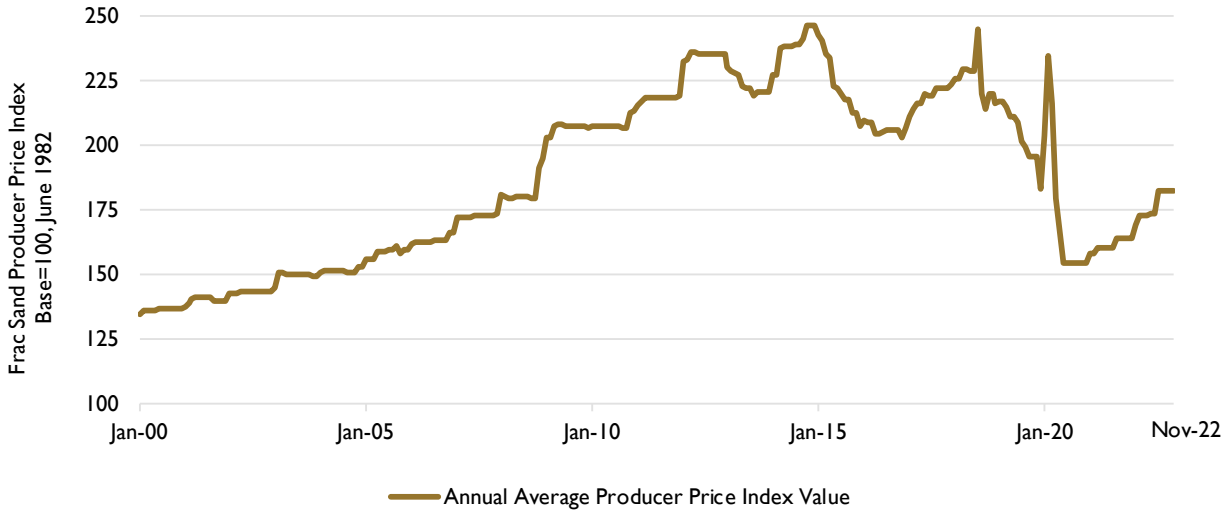
DATA CENTER

DRILLING ACTIVITY

DRILLED BUT UNCOMPLETED (DUC) WELLS VS. CRUDE OIL PRICE (MONTHLY) (34)



HYDRAULIC FRACTURING SAND PRODUCER PRICE INDEX (MONTHLY) (35)



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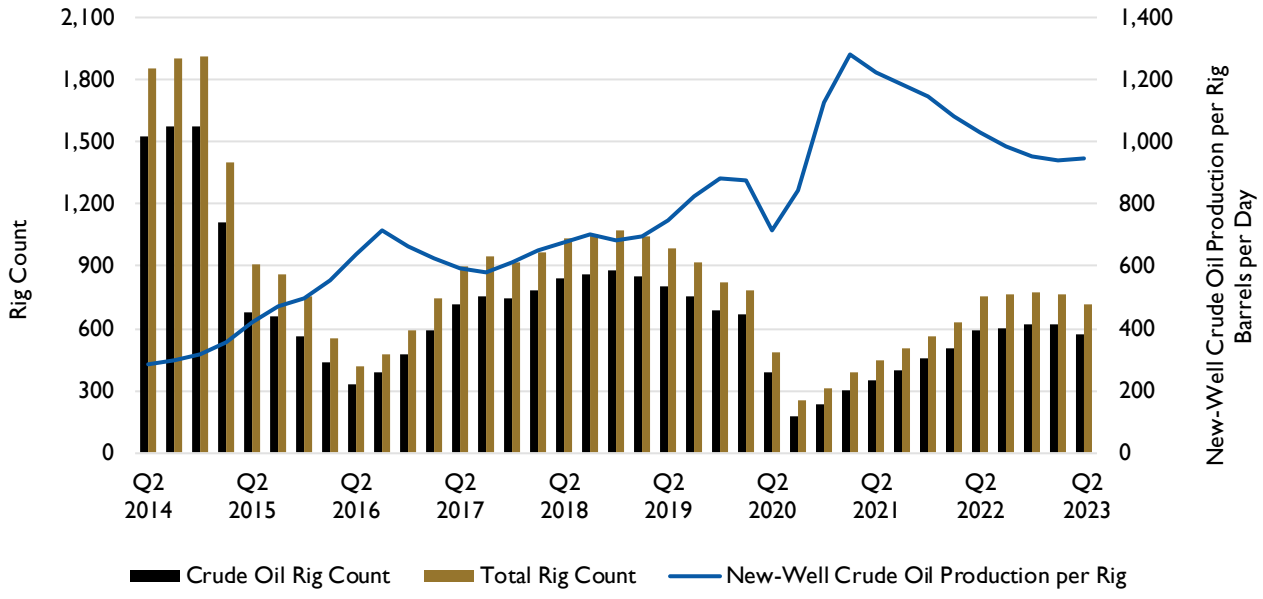
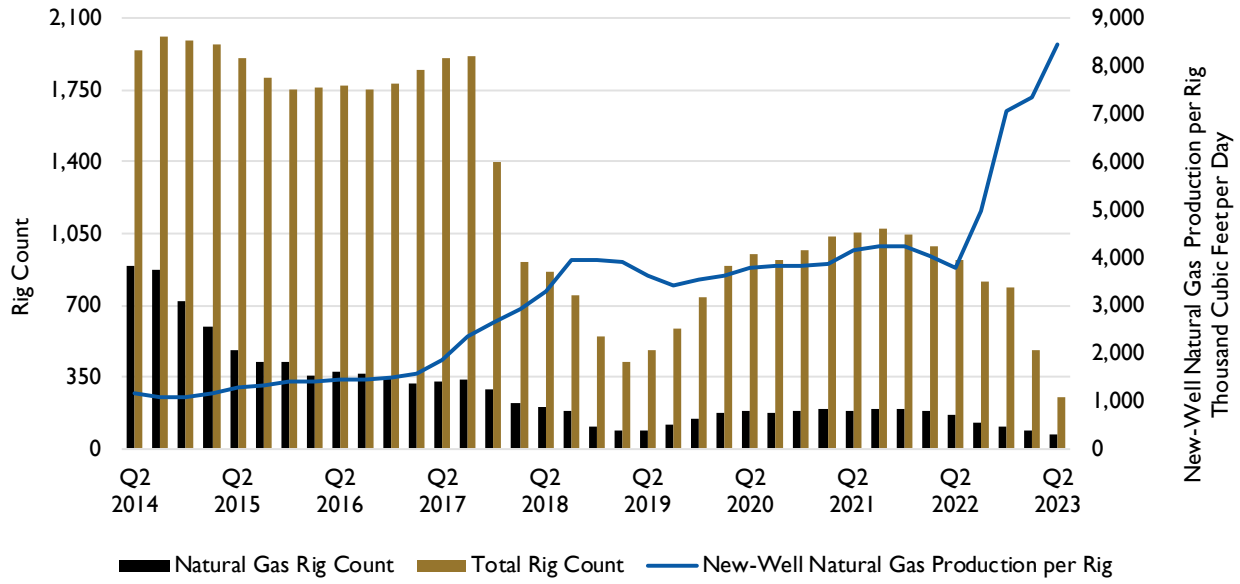
DRILLING ACTIVITY

CRUDE OIL PRODUCTION, RIG COUNT AND PRODUCTION PER RIG (QUARTERLY) (36)



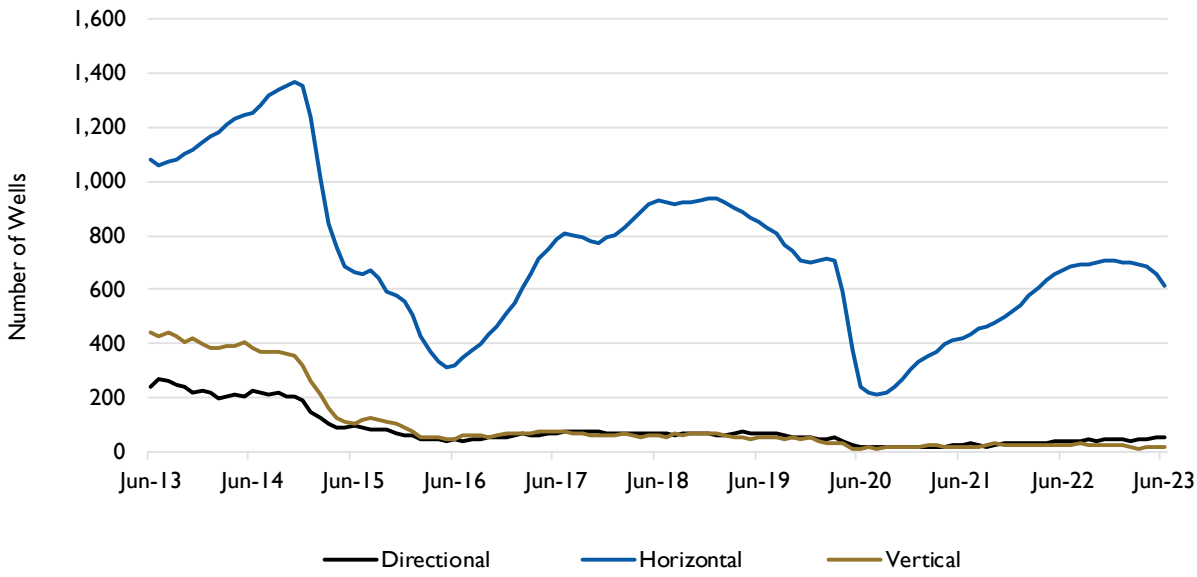
NATURAL GAS PRODUCTION, RIG COUNT AND PRODUCTION PER RIG (QUARTERLY) (37)



DATA CENTER

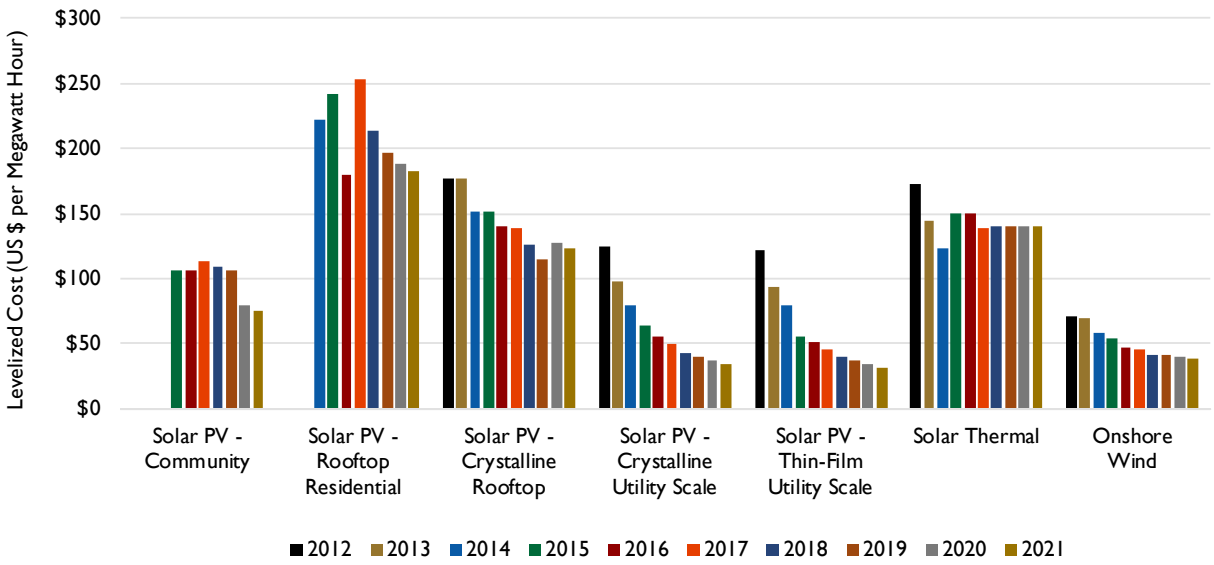
DRILLING ACTIVITY

U.S. DRILLING RIGS BY TYPE (MONTHLY) (38)



RENEWABLES

WIND AND SOLAR PRICES (ANNUAL AVERAGE) (39)



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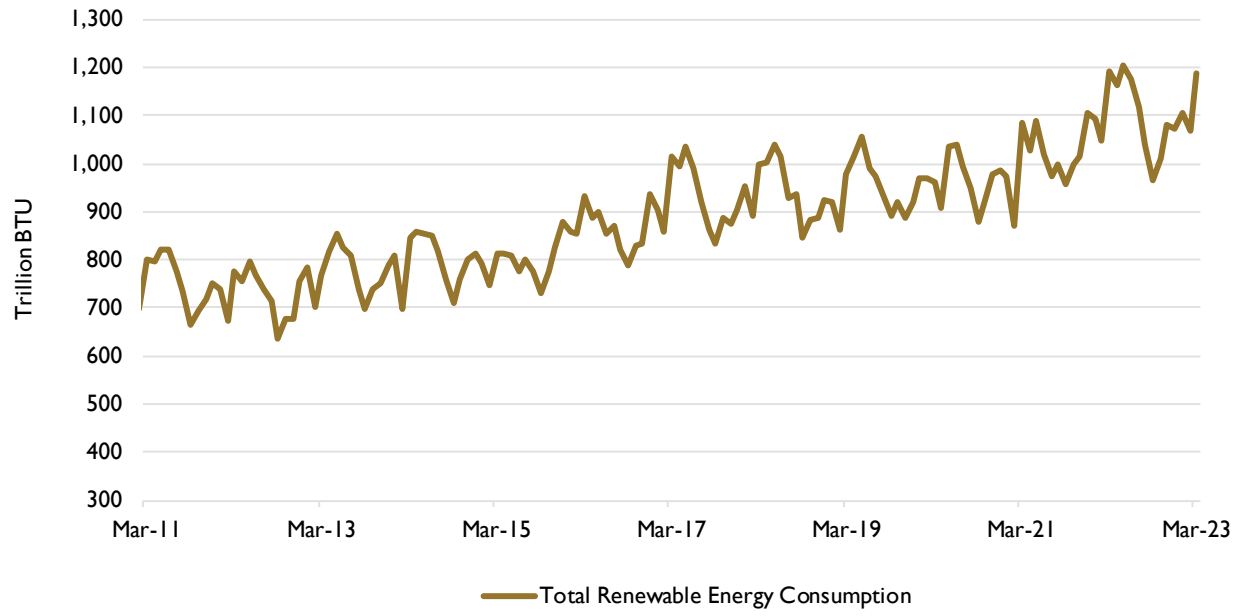
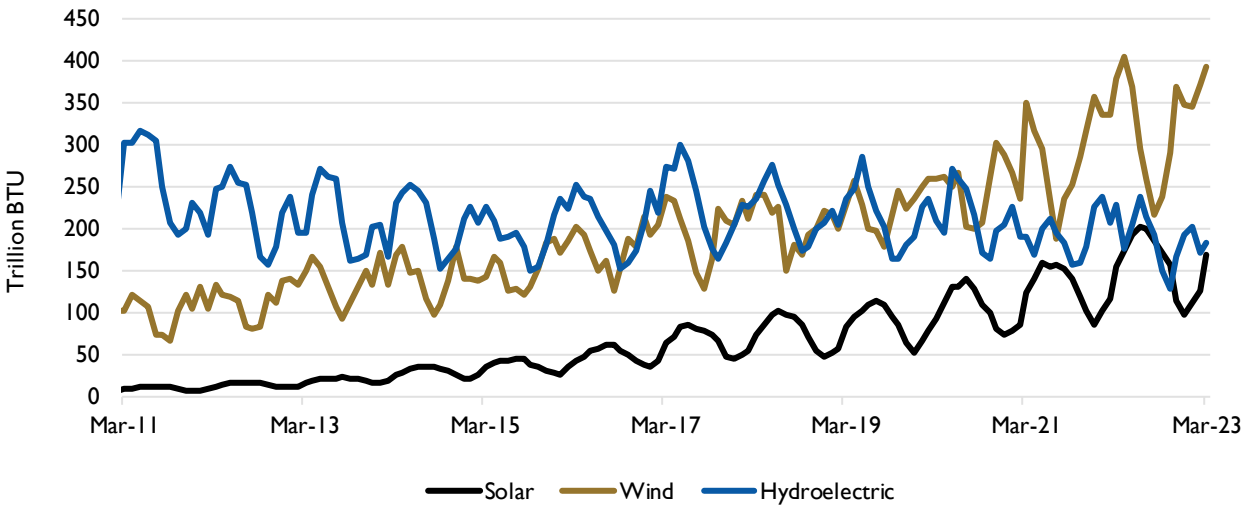
RENEWABLES

U.S. TOTAL RENEWABLE ENERGY CONSUMPTION (MONTHLY) (40)



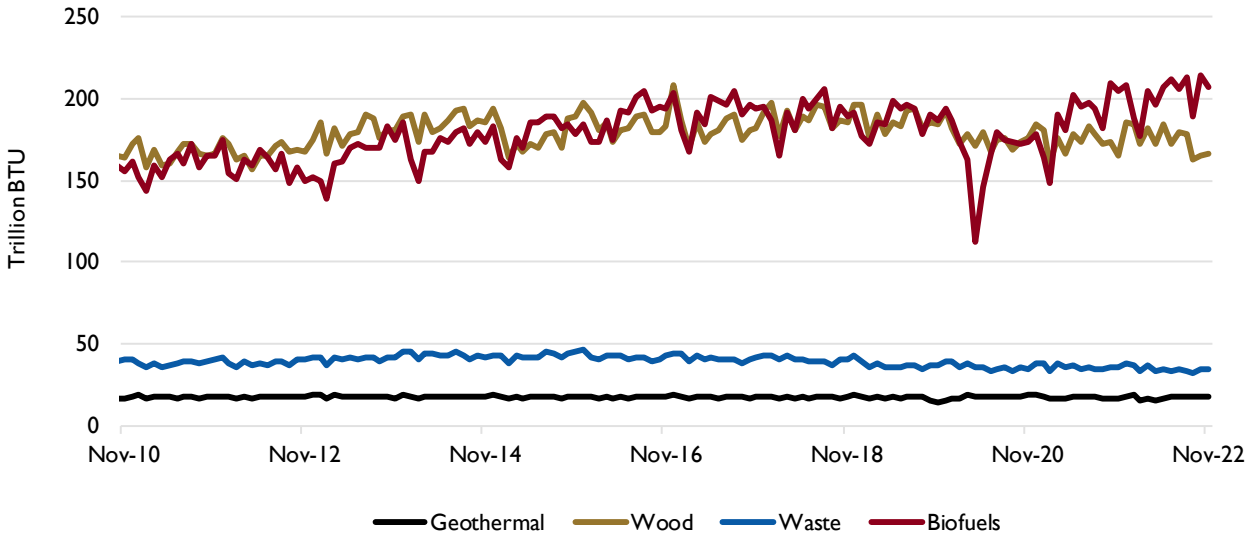
U.S. SOLAR, WIND AND HYRDOELECTRIC ENERGY CONSUMPTION (MONTHLY) (41)



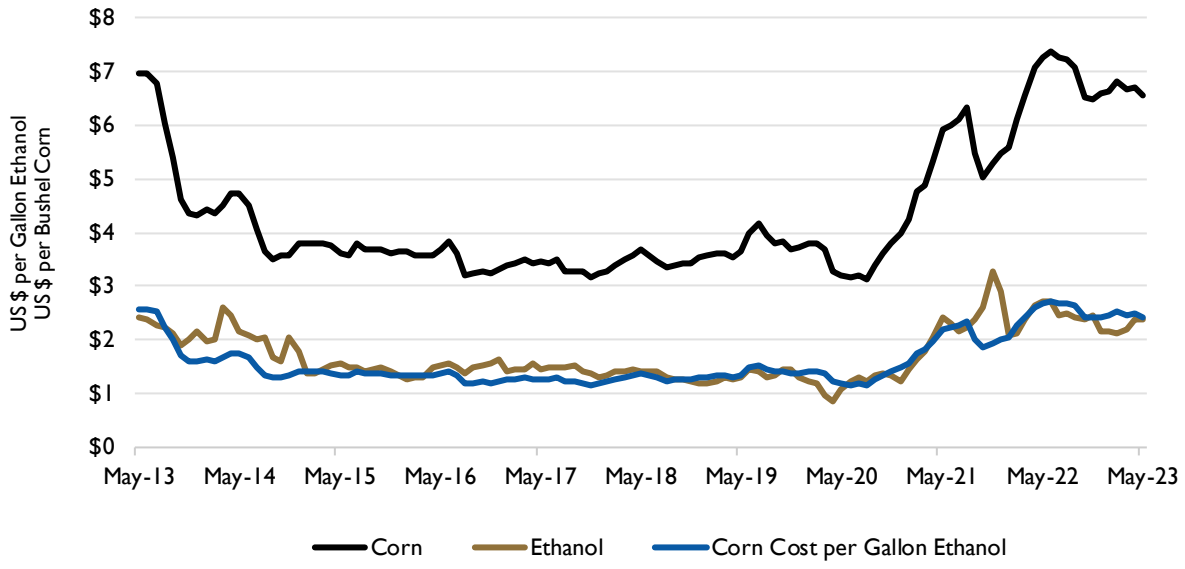
DATA CENTER

RENEWABLES

U.S. WOOD, WASTE, BIOFUELS AND GEOTHERMAL ENERGY CONSUMPTION (MONTHLY) (42)



CORN AND ETHANOL PRICES AND CORN COST PER GALLON OF ETHANOL (QUARTERLY) (43)



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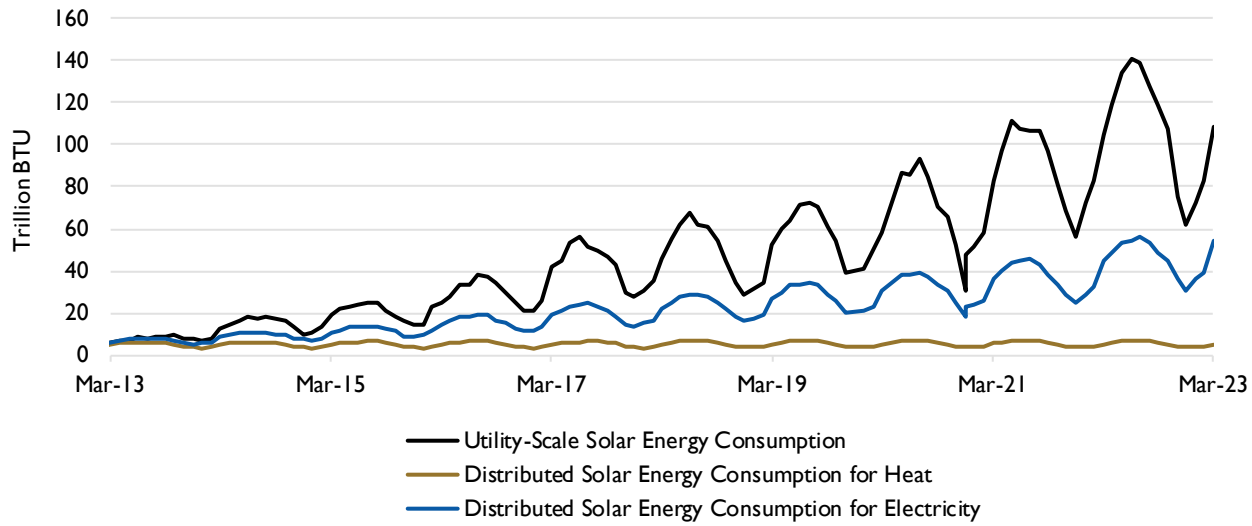
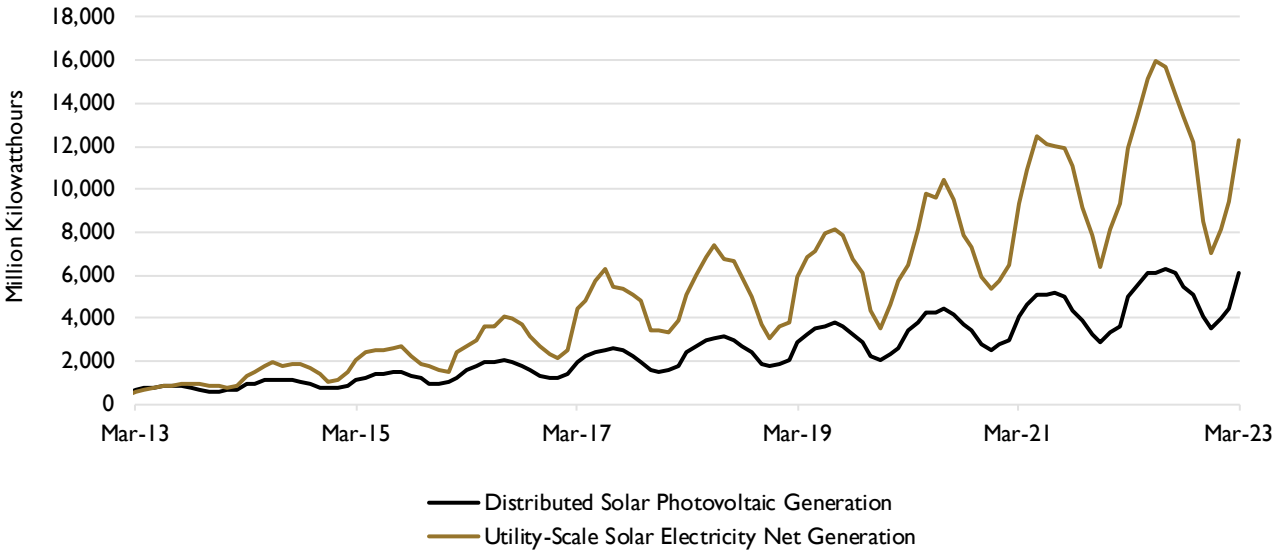
RENEWABLES

U.S. Solar Energy Consumption (Monthly) (44)



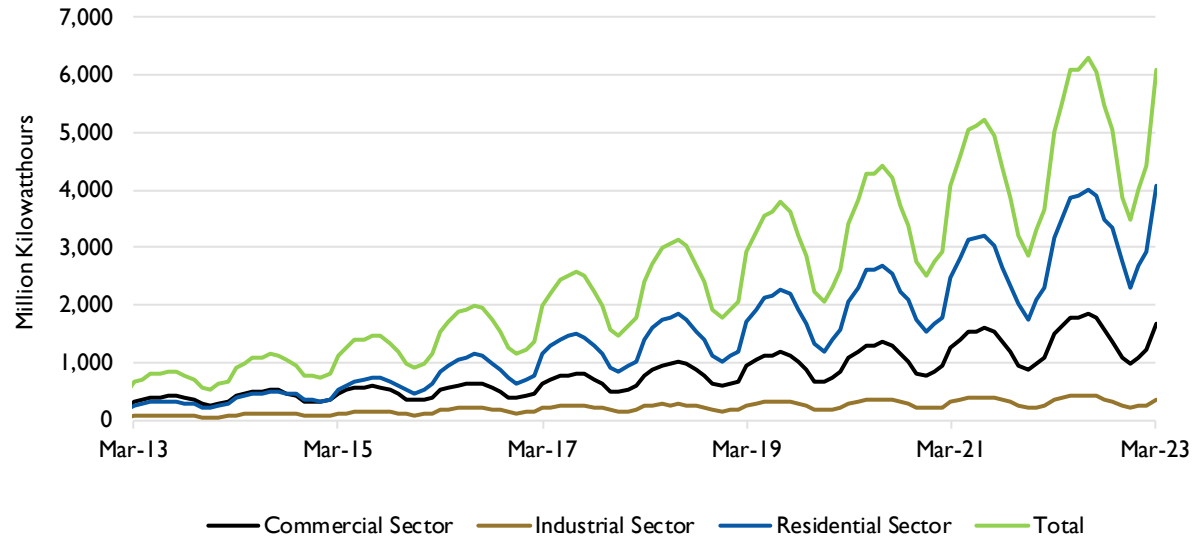
U.S. Solar Energy Net Generation (Monthly) (45)



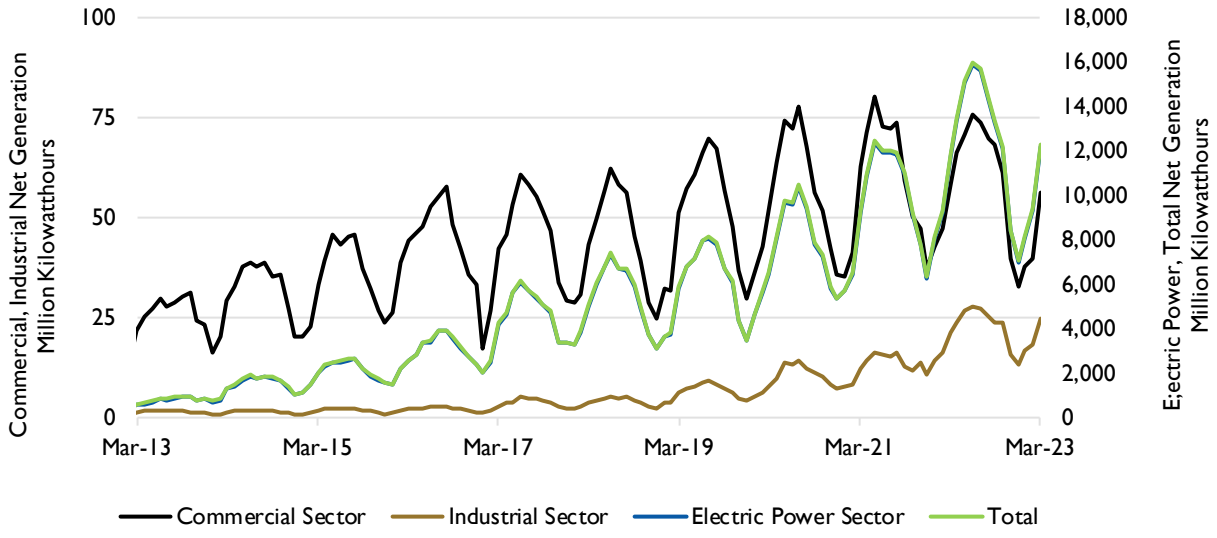
DATA CENTER

RENEWABLES

DISTRIBUTED SOLAR PHOTOVOLTAIC GENERATION BY SECTOR (MONTHLY) (46)



UTILITY-SCALE SOLAR ELECTRICITY NET GENERATION BY SECTOR (MONTHLY) (47)



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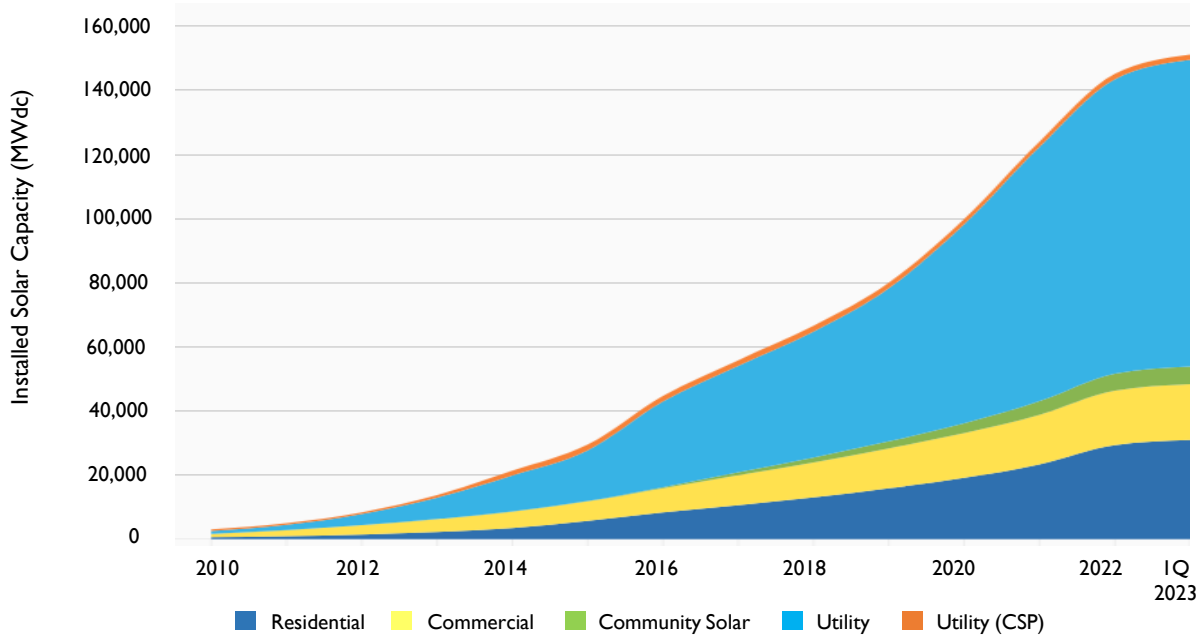
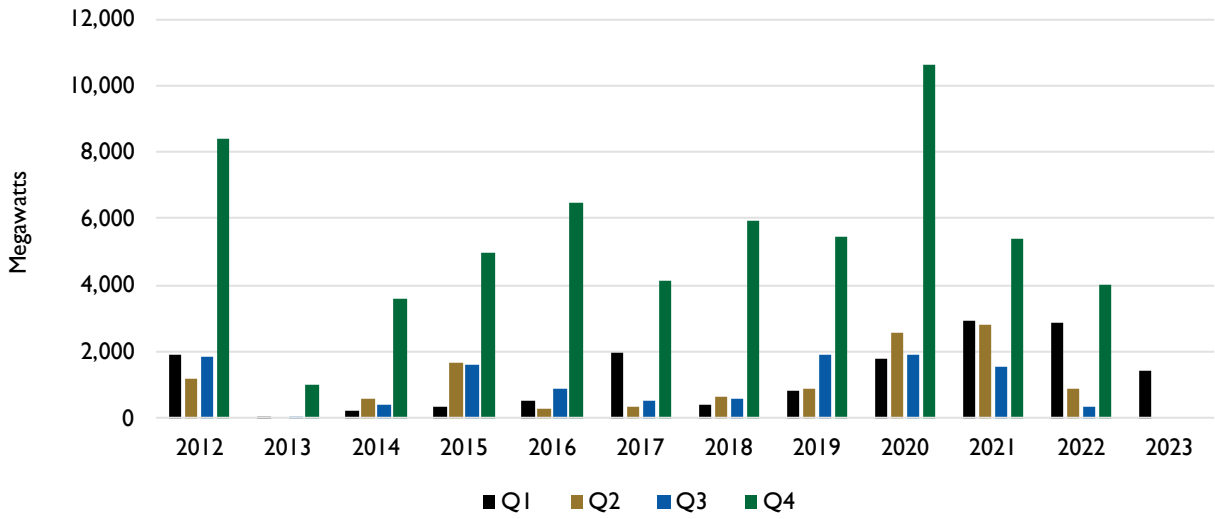
RENEWABLES

U.S. Cumulative Solar Installations (Quarterly) (48)



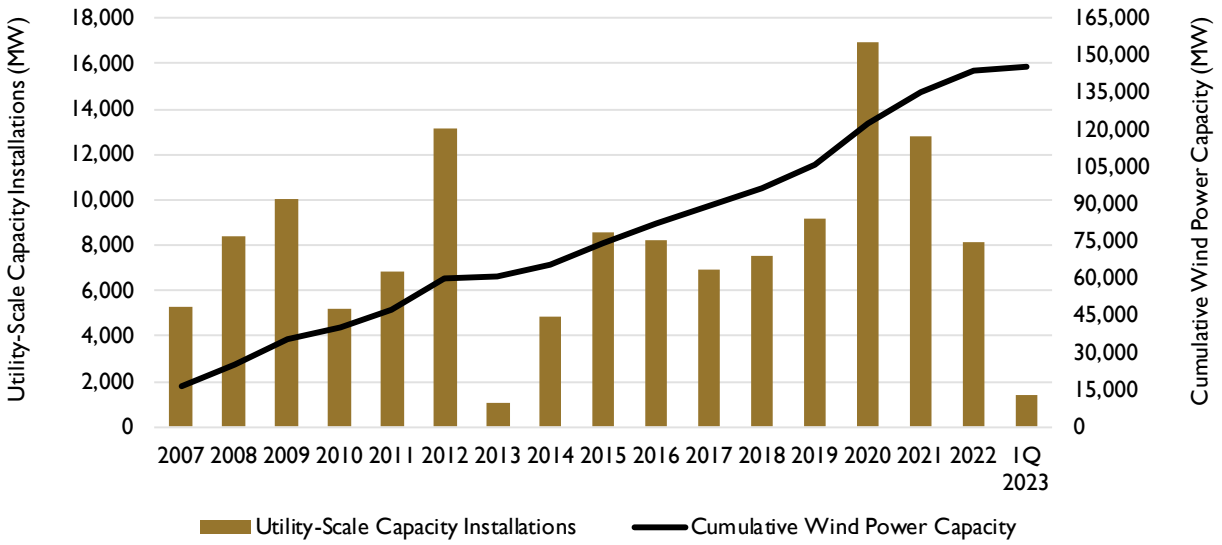
U.S. Wind Power Capacity Installations (Quarterly) (49)



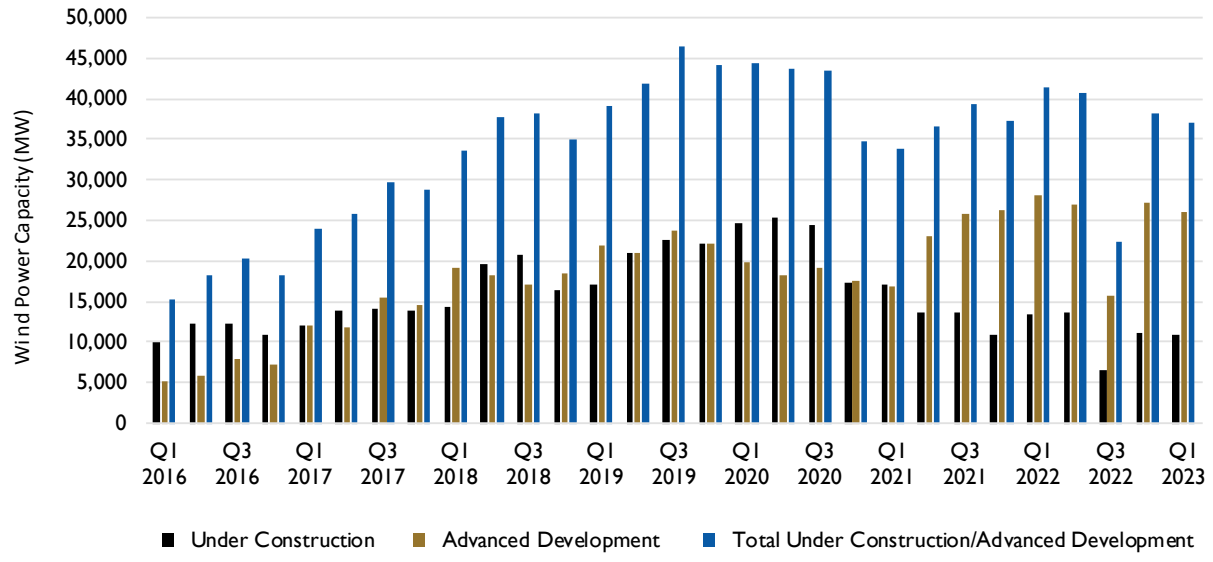
DATA CENTER

RENEWABLES

UTILITY-SCALE WIND POWER CAPACITY INSTALLATIONS (QUARTERLY) (50)



WIND POWER UNDER CONSTRUCTION OR IN ADVANCED DEVELOPMENT (QUARTERLY) (51)



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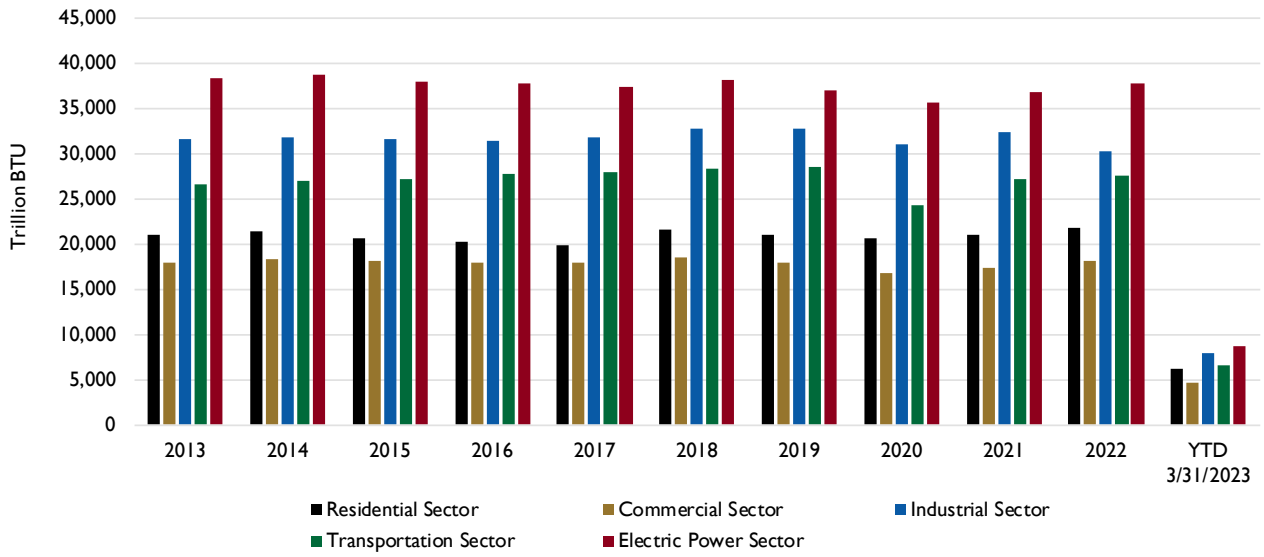
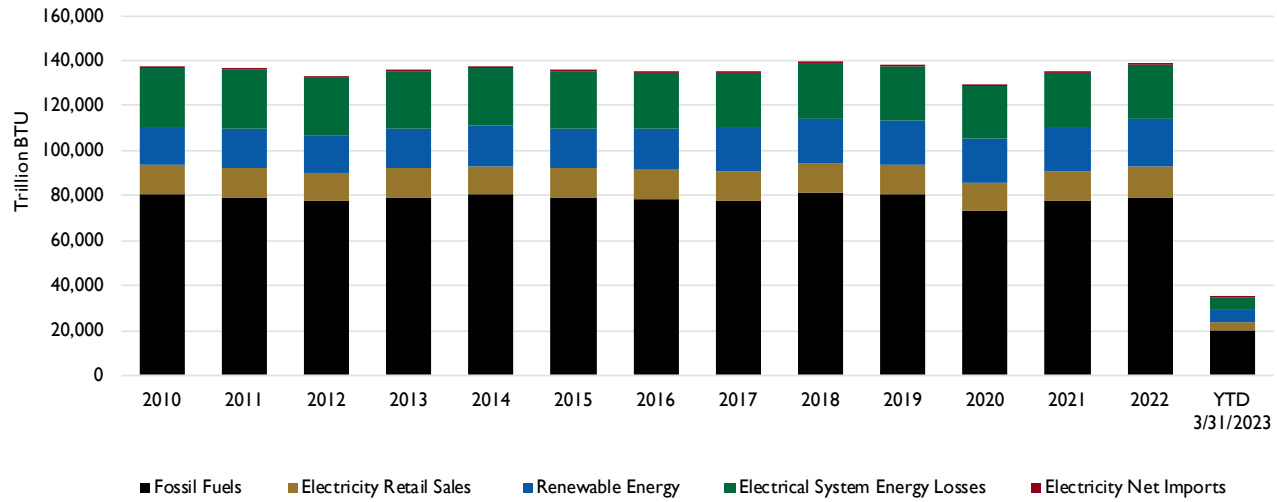
U.S. AGGREGATED ENERGY CONSUMPTION

Energy Consumption by Sector (Annual) (52)



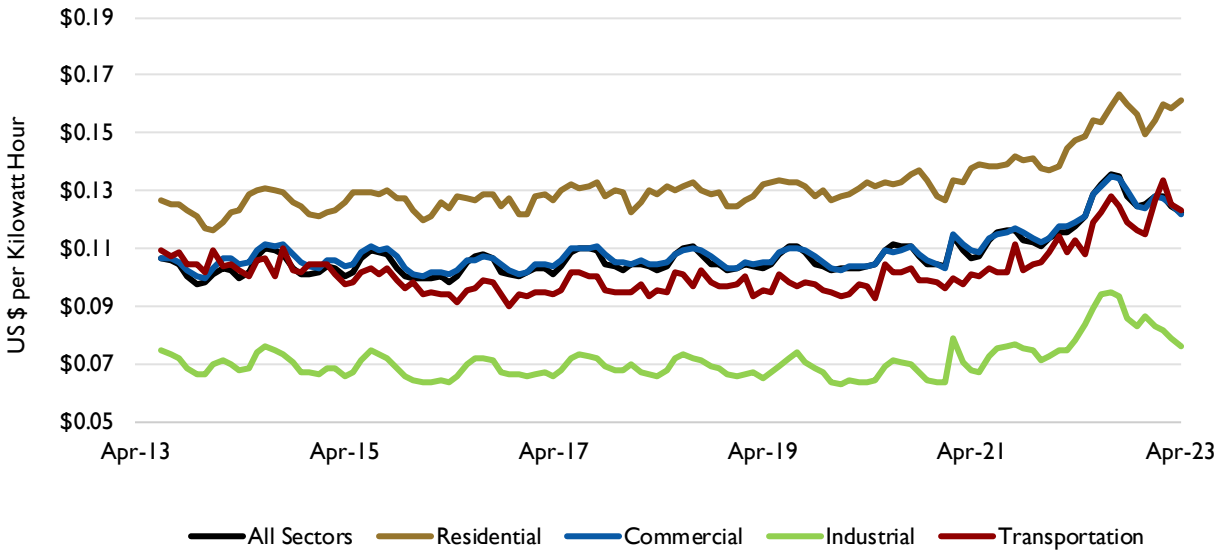
Energy Consumption by Source (Annual) (53)



DATA CENTER

U.S. AGGREGATED ENERGY CONSUMPTION

ELECTRICITY PRICES BY SECTOR (MONTHLY AVERAGE) (54)



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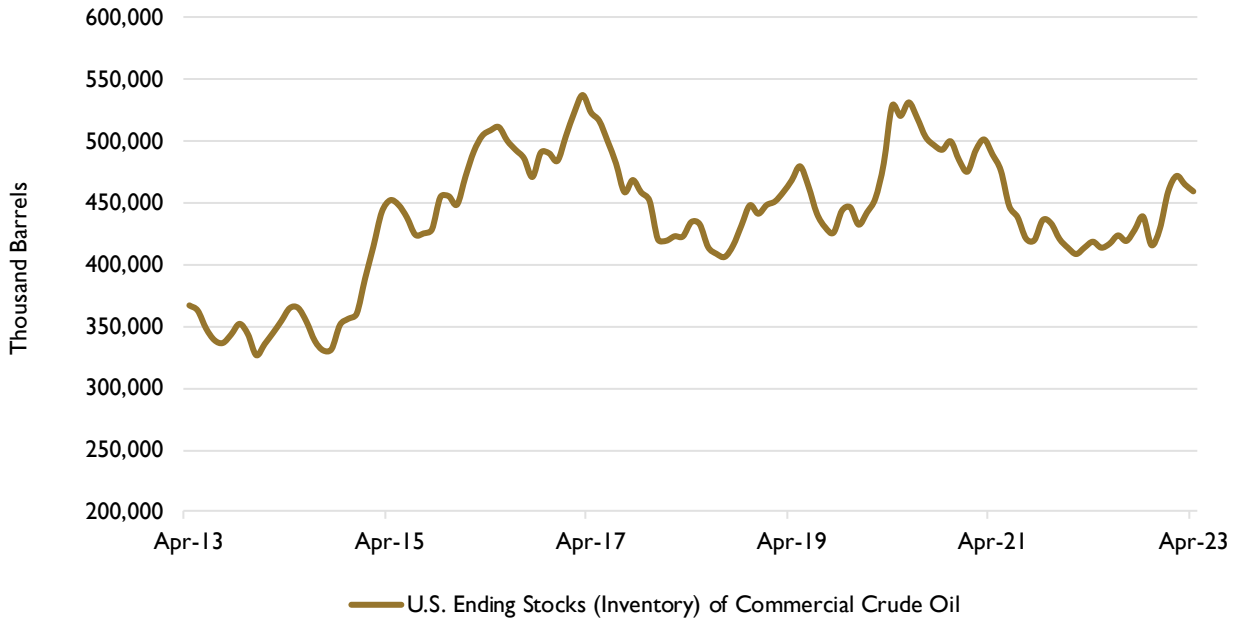
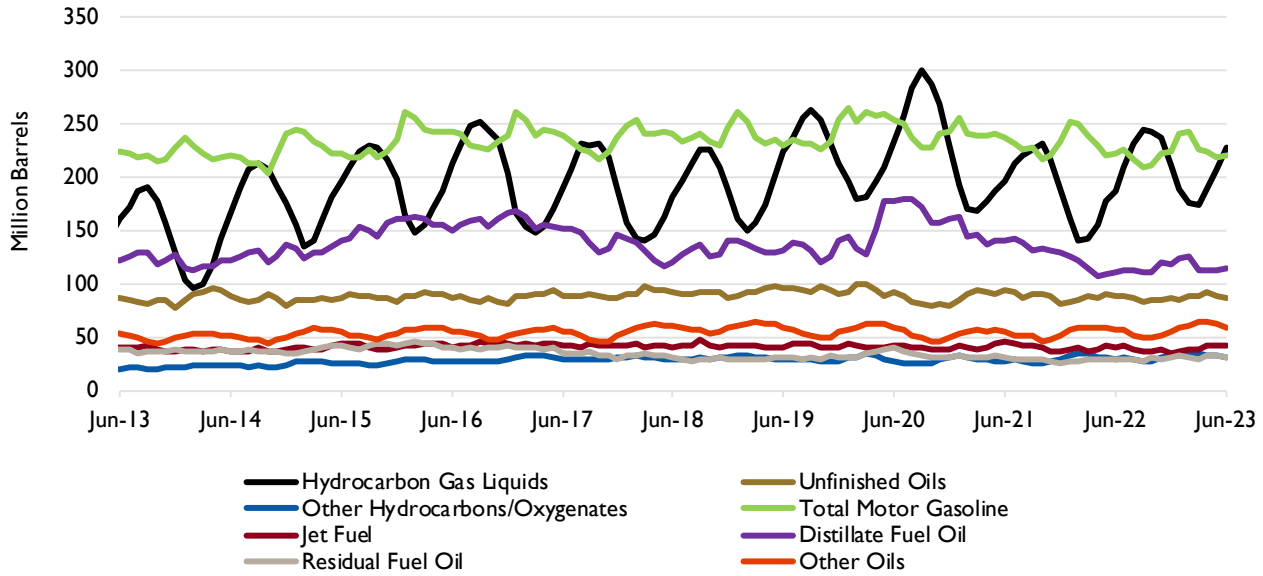
LOGISTICS - STORAGE AND TERMINALS

COMMERCIAL CRUDE OIL INVENTORY (MONTHLY) (55)



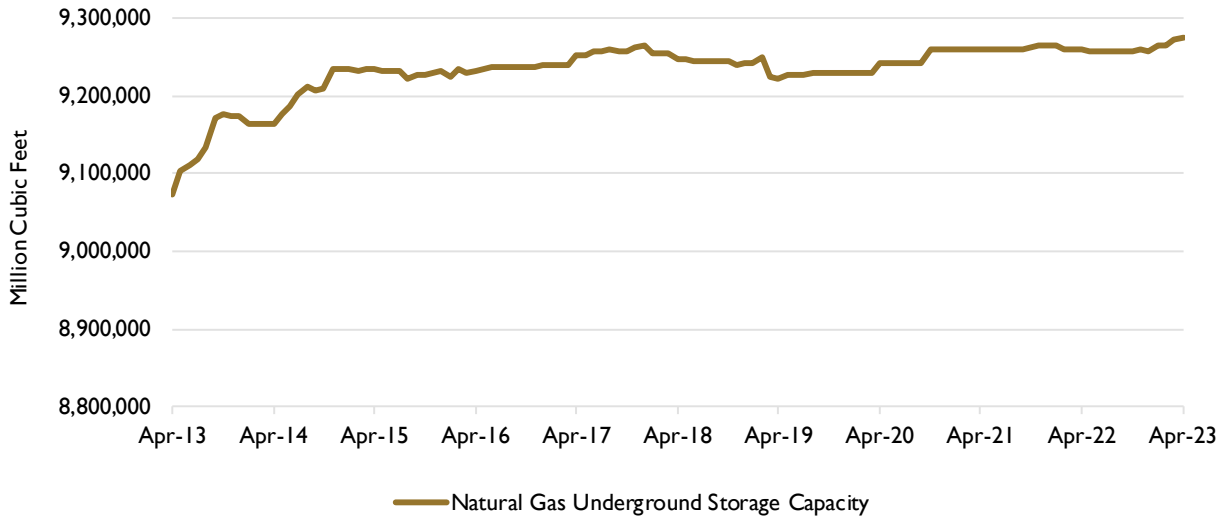
PETROLEUM AND OTHER LIQUIDS COMMERCIAL INVENTORY (MONTHLY) (56)



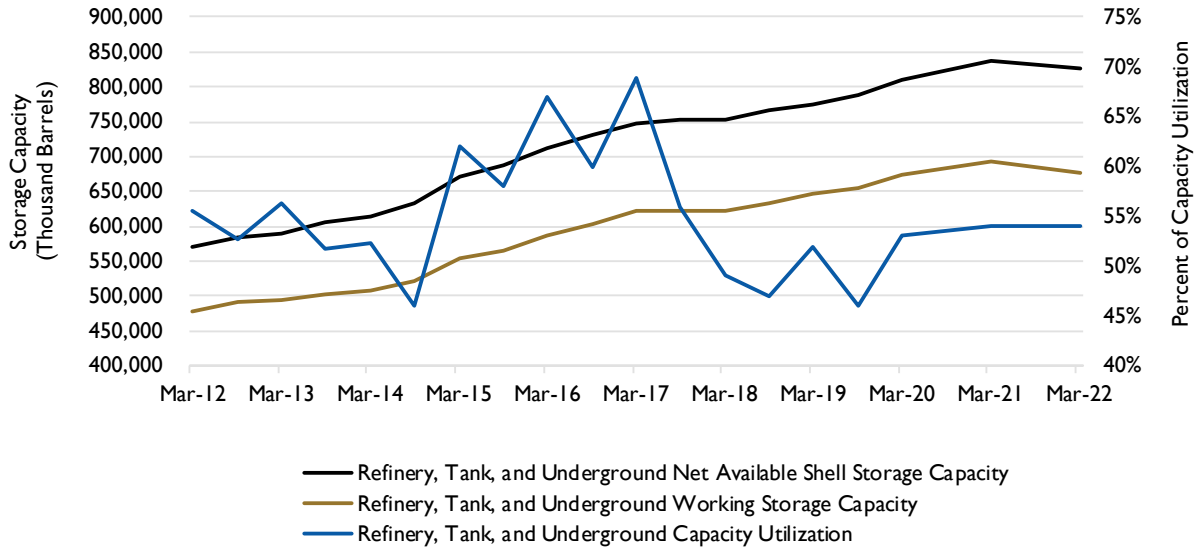
DATA CENTER

LOGISTICS - STORAGE AND TERMINALS

NATURAL GAS UNDERGROUND STORAGE CAPACITY (MONTHLY) (57)



COMMERCIAL CRUDE OIL REFINERY, TANK AND UNDERGROUND STORAGE CAPACITY AND UTILIZATION (ANNUAL) (58)



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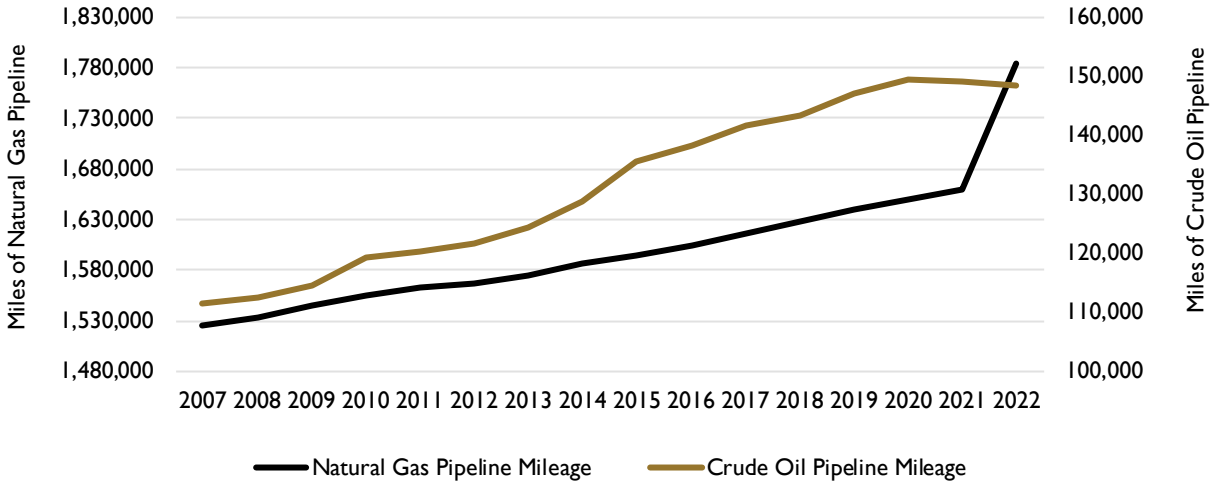
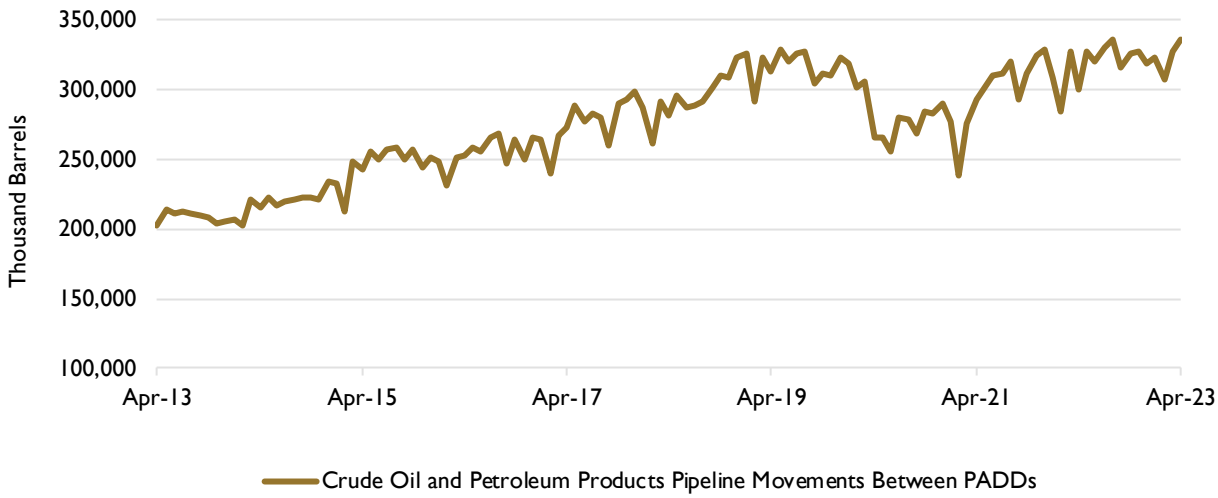
LOGISTICS - PIPELINES

CRUDE OIL AND NATURAL GAS PIPELINE MILEAGE (ANNUAL) (59)



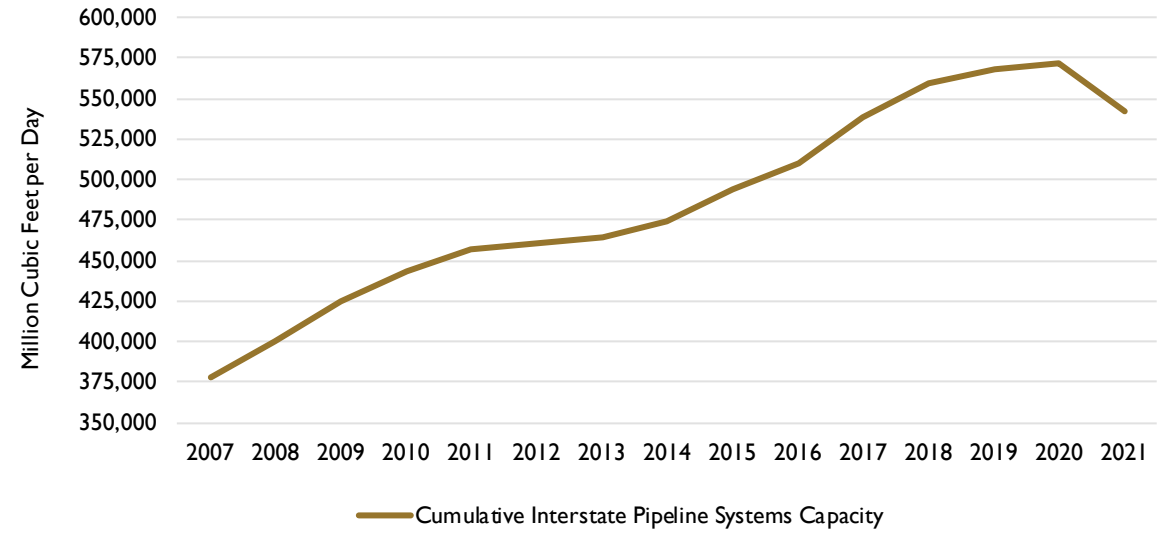
CRUDE OIL AND PETROLEUM PRODUCTS PIPELINE MOVEMENTS BETWEEN PETROLEUM ADMINISTRATION FOR DEFENSE DISTRICTS (PADDS) (MONTHLY) (60)



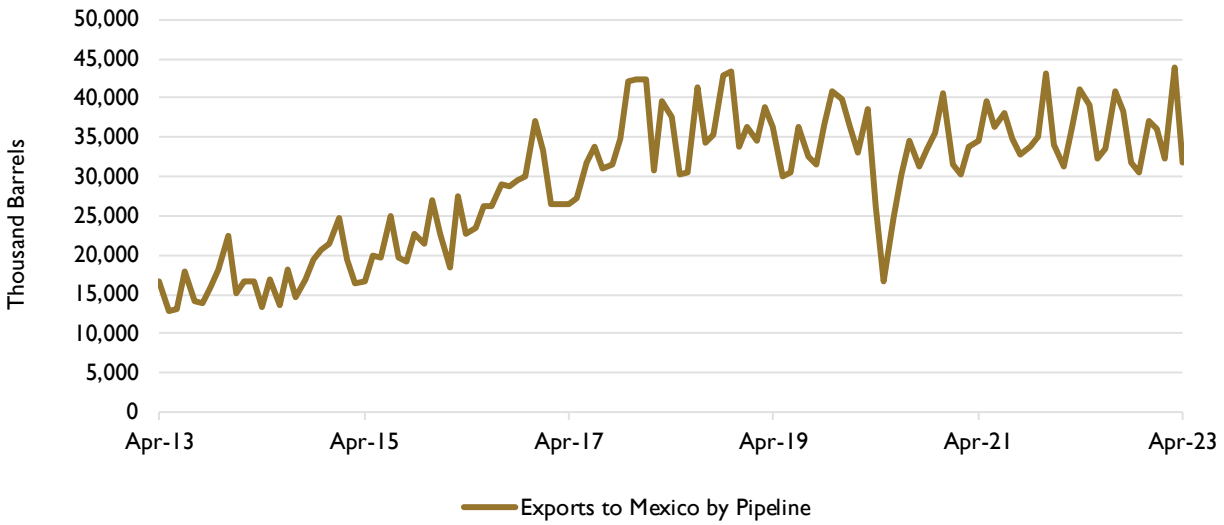
DATA CENTER

LOGISTICS - PIPELINES

NATURAL GAS CUMULATIVE INTERSTATE PIPELINE SYSTEMS CAPACITY (ANNUAL) (61)



CRUDE OIL AND PETROLEUM PRODUCTS EXPORTS TO MEXICO (MONTHLY) (62)



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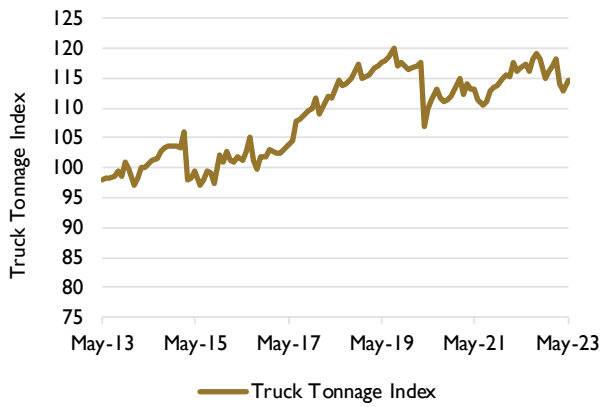
LOGISTICS - TRUCKERS

TRUCK TONNAGE INDEX (MONTHLY) (63)

MEASURES GROSS TONNAGE OF FREIGHT

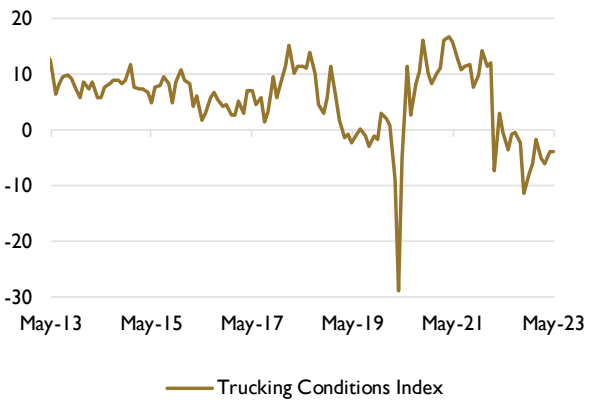


HEAVY TRUCK SALES (MONTHLY) (64)



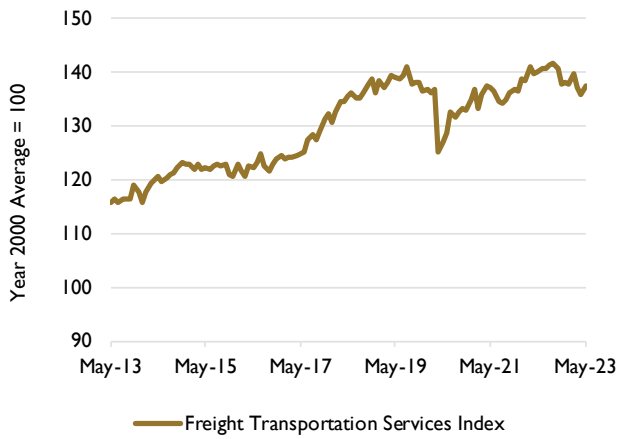
TRUCKING CONDITIONS INDEX (MONTHLY) (65)

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



FREIGHT TRANSPORTATION SERVICES INDEX (MONTHLY) (66)

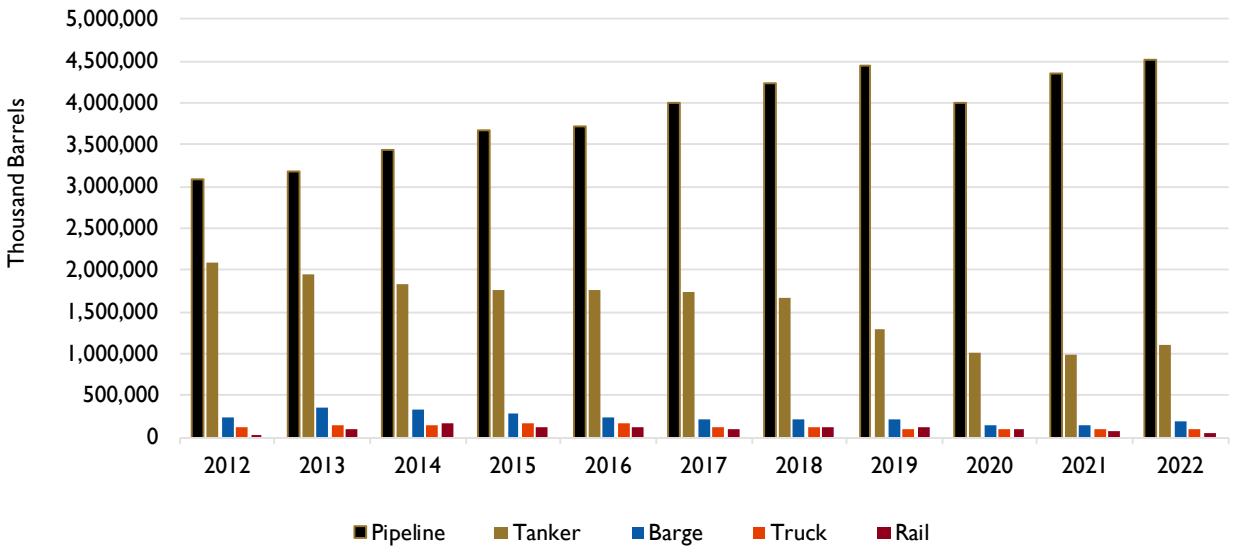
INCLUDES TRUCKING, RAIL, WATERWAYS, PIPELINES AND AIR FRIGHT



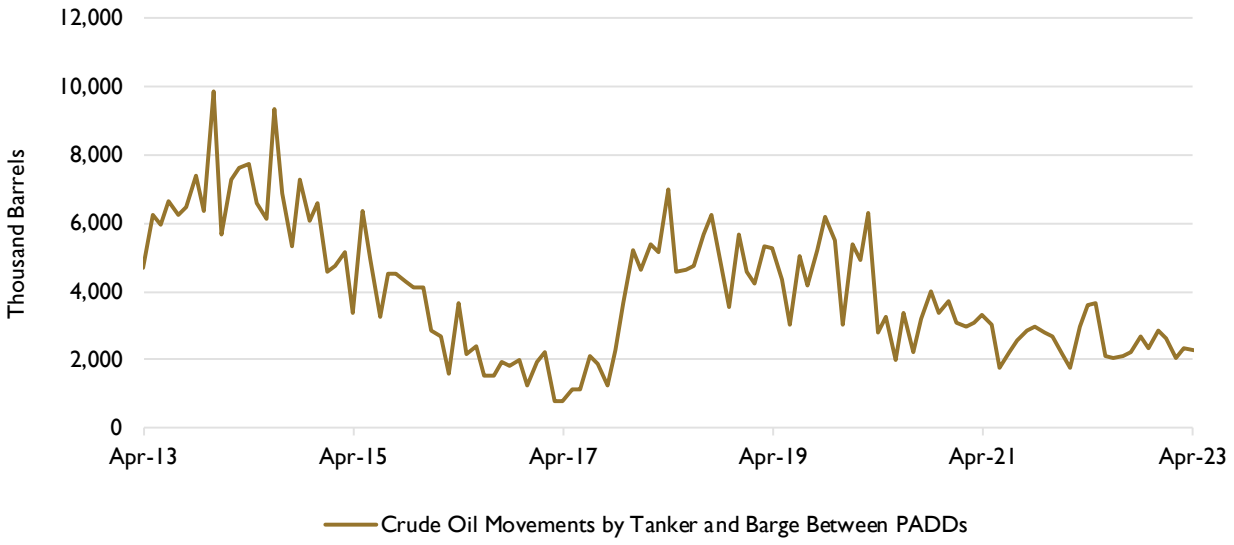
DATA CENTER

LOGISTICS - SHIPPING

CRUDE OIL REFINERY RECEIPTS BY TRANSPORTATION METHOD (ANNUAL) (67)



CRUDE OIL MOVEMENTS BY TANKER AND BARGE BETWEEN PETROLEUM ADMINISTRATION FOR DEFENSE DISTRICTS (PADDS) (MONTHLY) (68)



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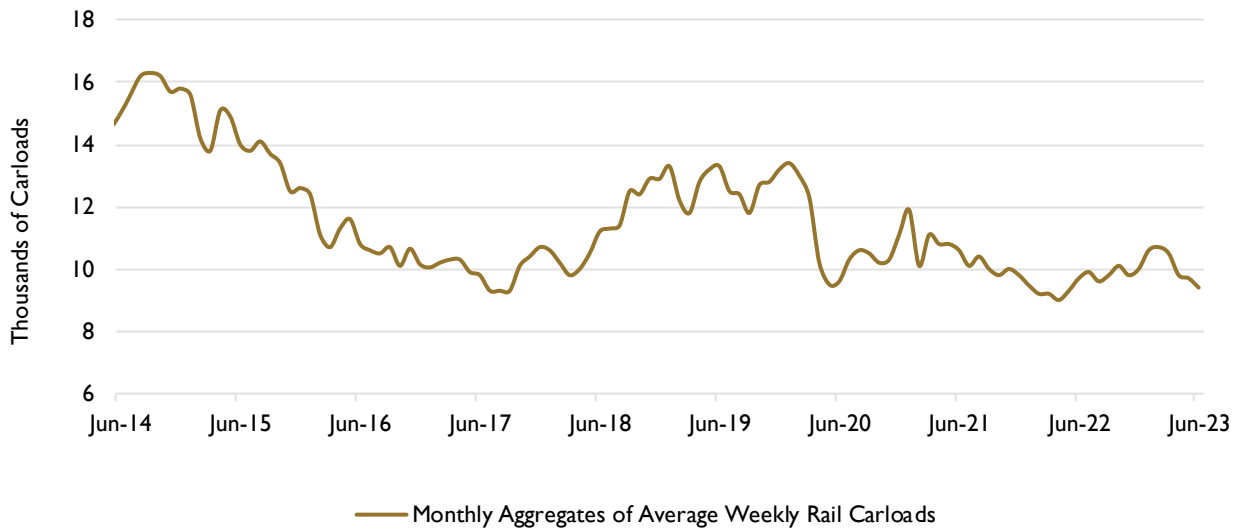
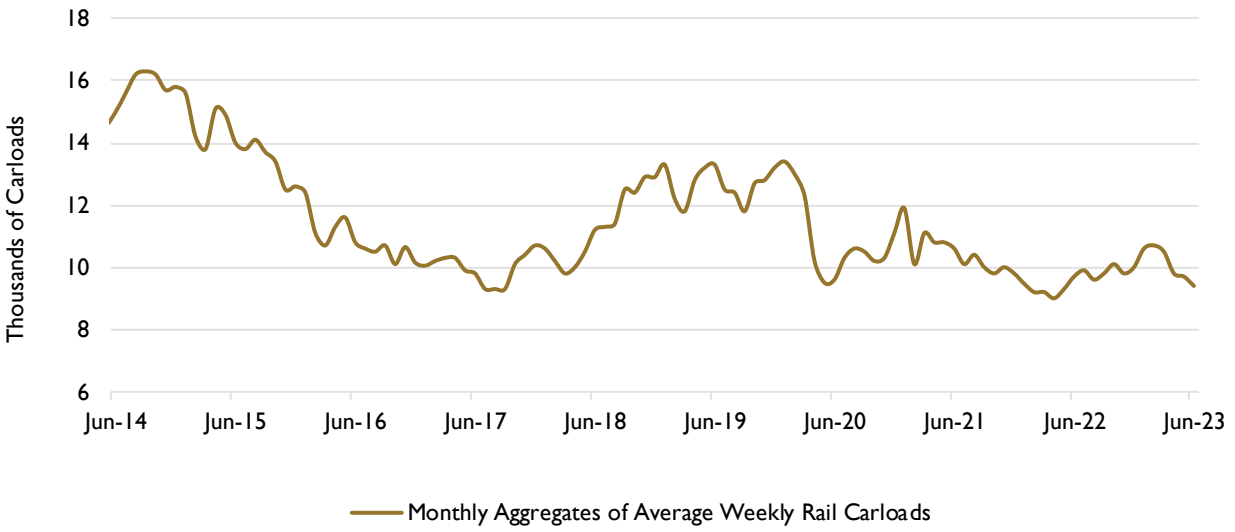
DATA CENTER

LOGISTICS - RAIL

MOVEMENTS OF CRUDE OIL BY RAIL (MONTHLY) (69)



AVERAGE WEEKLY RAIL CARLOADS OF PETROLEUM AND PETROLEUM PRODUCTS (MONTHLY AGGREGATE) (70)



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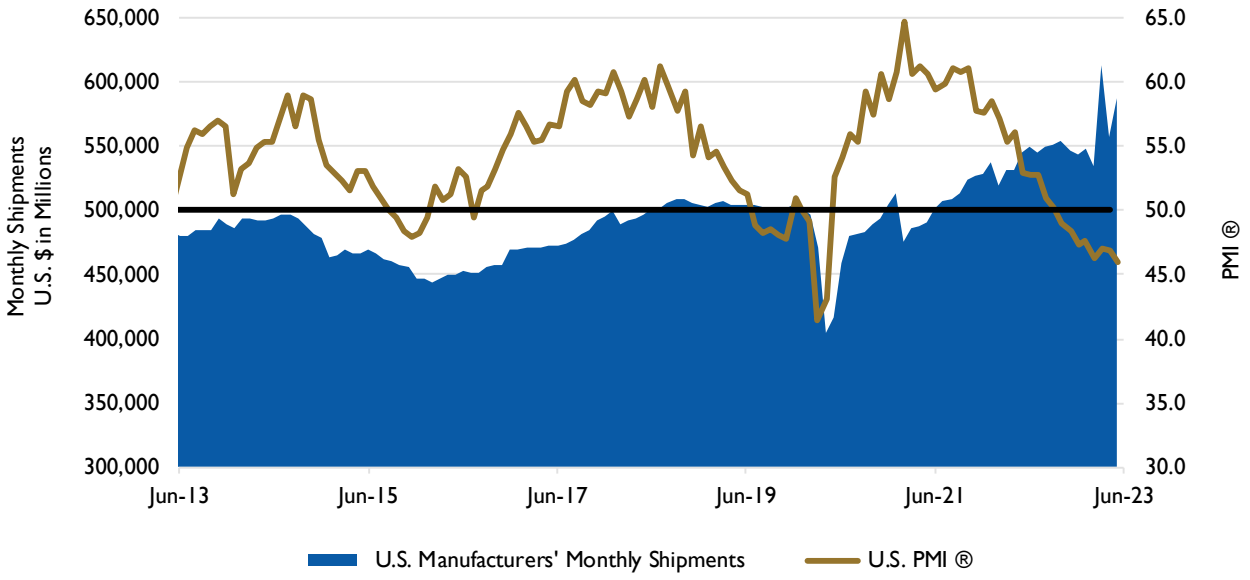
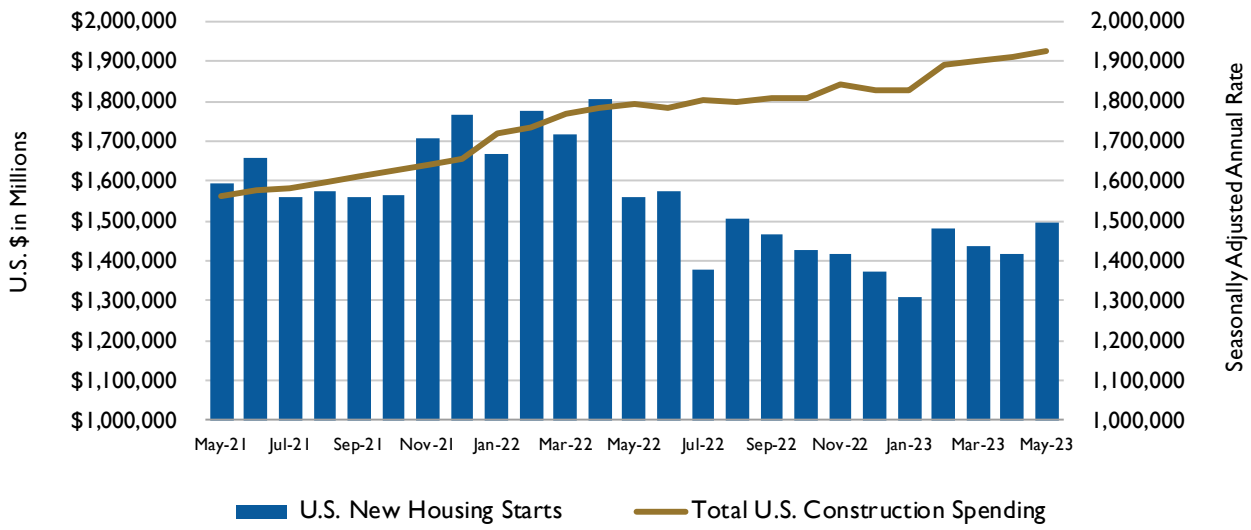
ECONOMIC / FINANCIAL

U.S. Manufacturers' Monthly Shipments and U.S. Purchasing Managers' Index (PMI®) (Monthly) (71)



U.S. New Housing Starts and Total U.S. Construction Spending (Monthly) (72)



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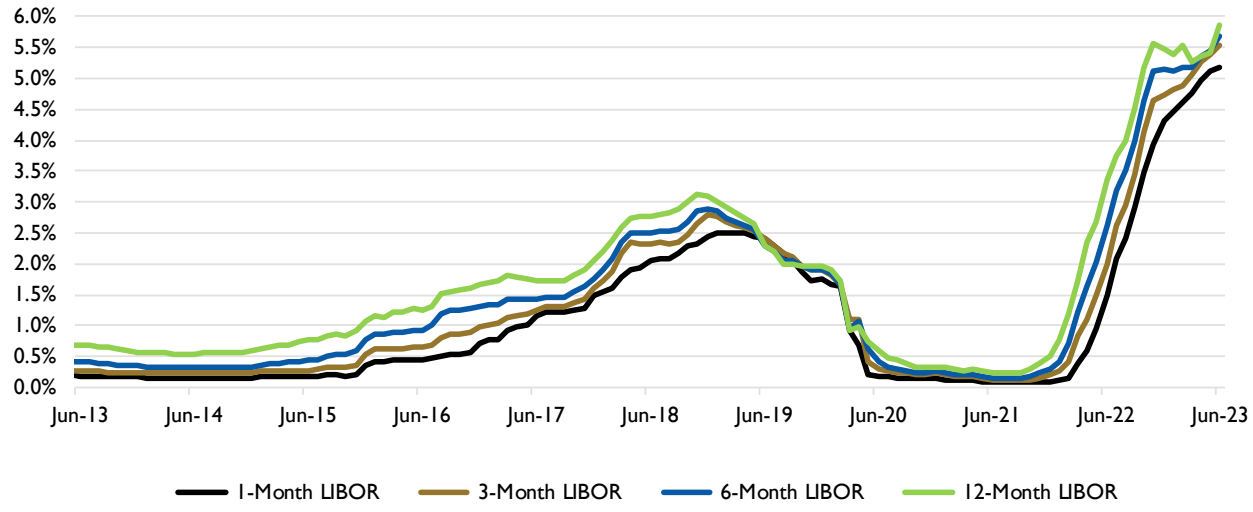
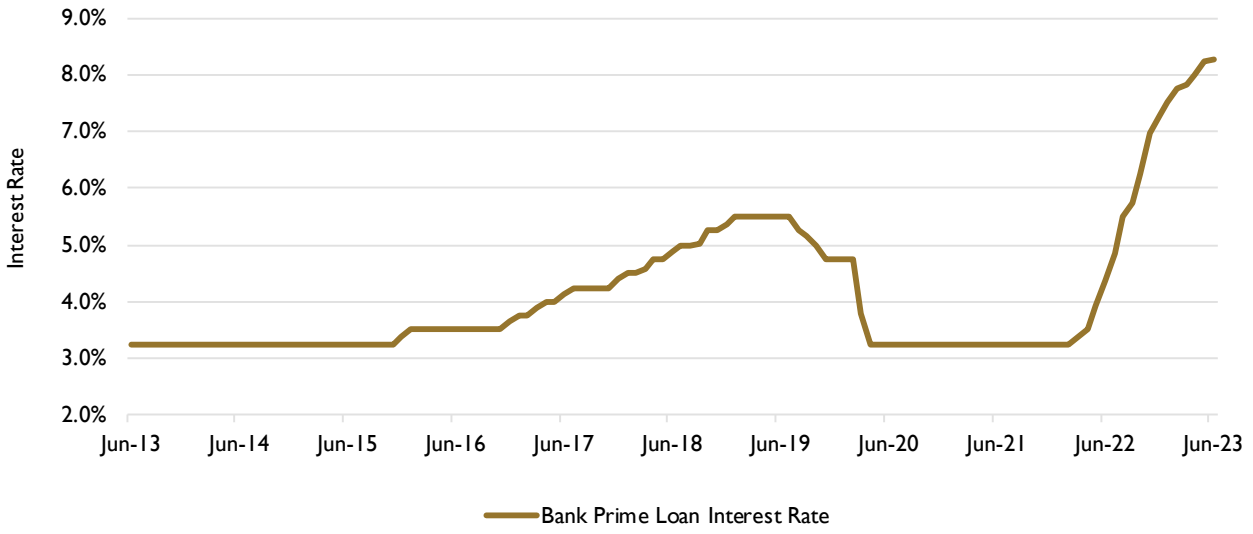
ECONOMIC / FINANCIAL

LONDON INTERBANK OFFERED RATE (LIBOR) (MONTHLY AVERAGE) BASED ON U.S. DOLLAR (73)



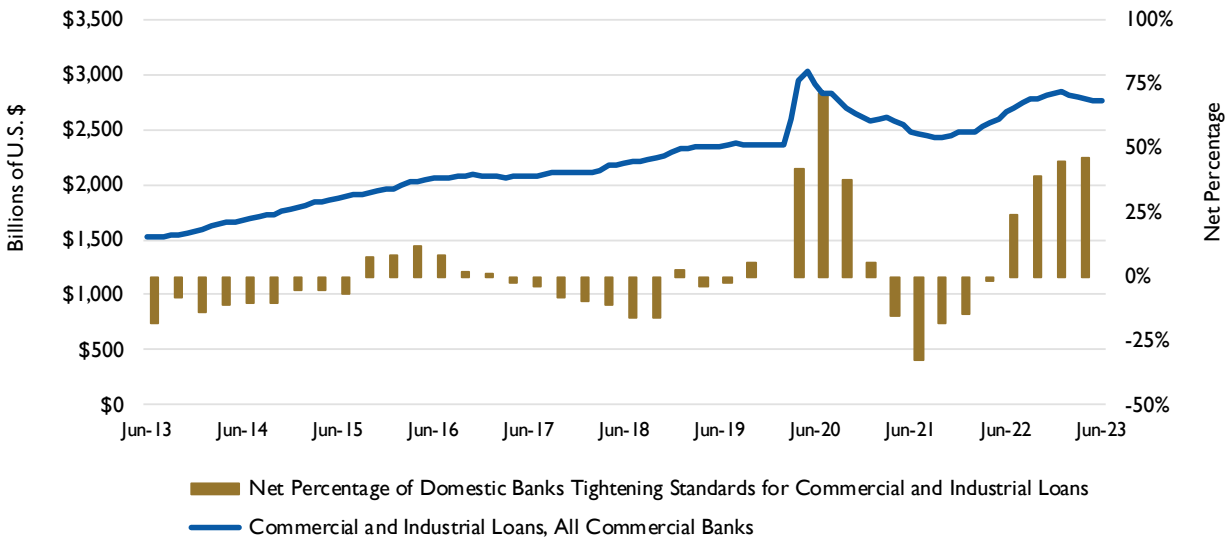
BANK PRIME LOAN INTEREST RATES (MONTHLY AVERAGE) (74)



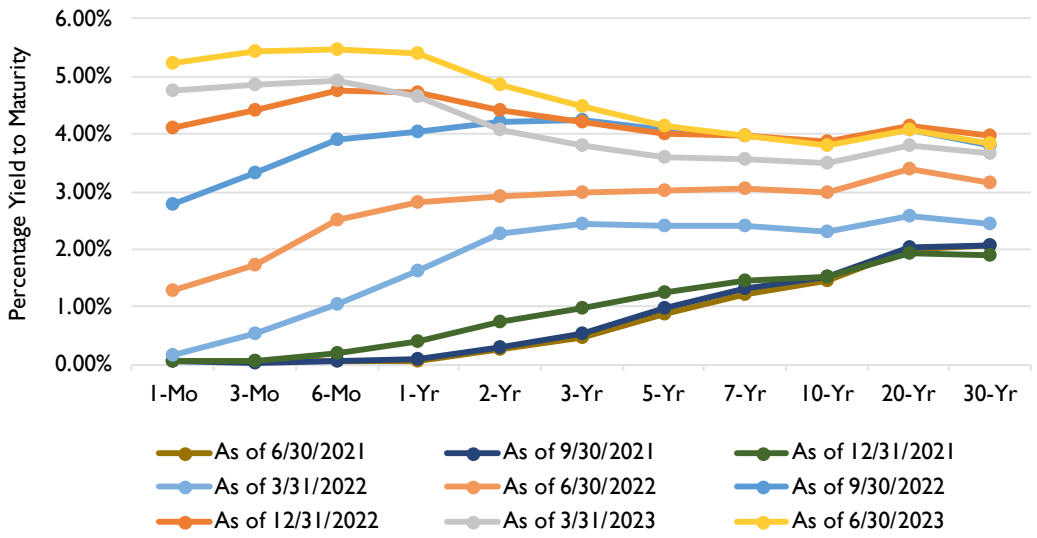
DATA CENTER

ECONOMIC / FINANCIAL

COMMERCIAL AND INDUSTRIAL LOANS VS. BANKING STANDARDS (QUARTERLY, MONTHLY) (75)



U.S. TREASURY YIELD CURVE (MONTHLY, ANNUAL) (76)



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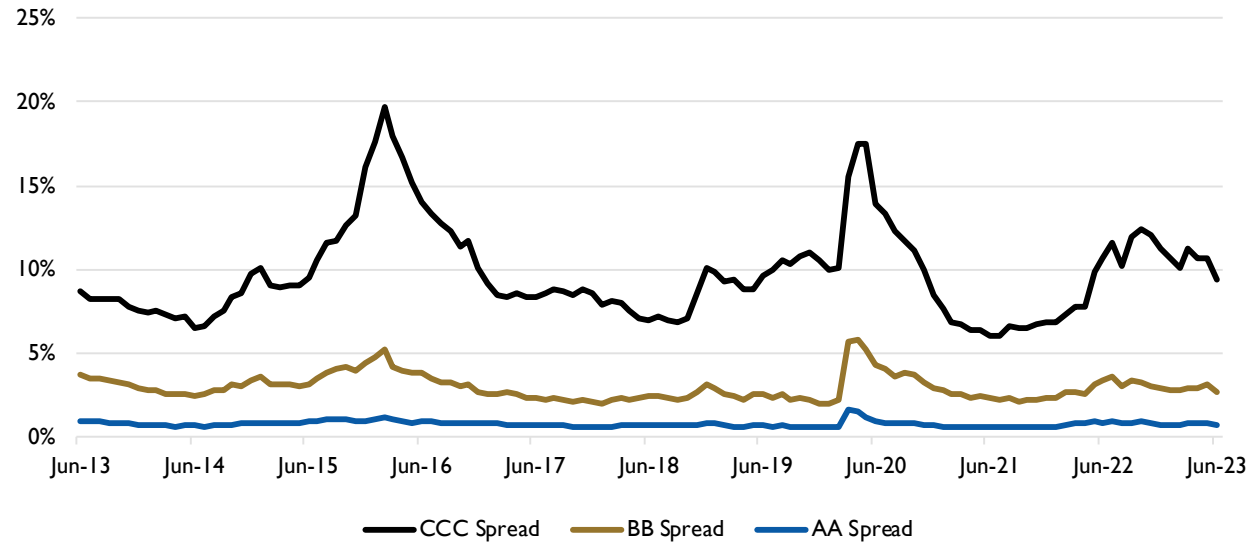
ECONOMIC / FINANCIAL

CORPORATE SPREADS TO TREASURIES BY QUALITY
(MONTHLY AVERAGE) (77)



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

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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.

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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.euopa.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, napthas, 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.

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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 re-pressuring, 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 and is comprised of 98% residual fuel oil and 2% distillate fuel oil. Under new regulations from the International Maritime Organization, ships must burn fuel with a sulfur content of not more than 0.5 percent or install costly emissions-cleaning scrubbers. Very Low Sulfur Fuel Oil (VLSFO) contains a maximum sulfur content of 0.5 percent.

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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.euopa.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. 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.

(33) 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.

(34) 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.

(35) Hydraulic Fracturing Sand Producer Price Index
- Source: U.S. Bureau of Labor Statistics.
- 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.
- 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.
- Hydraulic Fracturing Sand Producer Price Index Base = 100 at June 1982.
- Not seasonally adjusted.

(36) and (37) 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.

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(38) 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.

(39) Wind and Solar Prices

- Source: Lazard's Levelized Cost of Energy Analysis 2012-2020.
- 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.

(40) 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.

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

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

(42) 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.

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

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

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(44) 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.

(45) 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.

(46) 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.

(47) 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.

(48) 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.

(49) 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.

(50) 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.

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(51) 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.

(52) 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.

(53) 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.

(54) Electricity Prices by Sector

- Source: U.S. Energy Information Administration.

(55) 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.

(56) 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 napthas 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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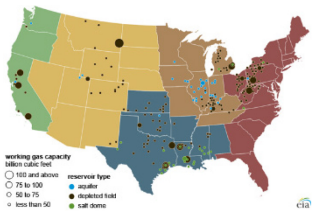
(56) Petroleum and Other Liquids Commercial Inventory (continued)

- 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 napthas, lubricants, waxes, petroleum coke, asphalt and road oil, still gas and miscellaneous products.

(57) 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)



(58) 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.

(59) 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.

(60) 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.

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(61) 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.

(62) 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 napthas, residual fuel oil, waxes, petroleum coke, asphalt and road oil, lubricants and miscellaneous products.

(63) 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.

(64) Heavy Truck Sales

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

(65) 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.

(66) 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.

(67) 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.

(68) 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.

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(69) Movements of Crude Oil by Rail
- Source: U.S. Energy Information Administration.

(70) 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.

(71) 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.

(72) U.S. New Housing Starts and Total U.S. Construction Spending
- Source: U.S. Census Bureau.

(73) London Interbank Offered Rate (LIBOR), Based on U.S. Dollar
- Source: ICE Benchmark Administration Limited via Moody's Analytics.
- 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.

(74) 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.

(75) 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.

(76) 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.

(77) 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.

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HOT TOPICS

ESSENTIAL READING ON ENERGY SECURITY

As summer wears on and Congress is off for the next several weeks, we're paying close attention to wise voices that bring facts, science and rational economics into the debate over America's energy policies. We are pleased to share some important recently-appearing analysis that strengthens a growing sense that the rush to eliminate fossil fuels is a prescription for energy insecurity. All point strongly to the conclusion that America's plentiful, affordable and clean natural gas is the ultimate cure to rapid global emissions growth.

Nevertheless, whether or not this summer's high temperatures are natural variation or point to climate change, alarmists are making hay while the sun shines, citing wildfires, storm frequency and intensity, threats to human health and survival of animal species.

But as Bjorn Lomberg, author of "False Alarm: How Climate Change Panic Costs Us Trillions, Hurts the Poor, and Fails to Fix the Planet", and a visiting fellow at Stanford University's Hoover Institution, writes in last Monday's Wall Street Journal (Climate Change Hasn't Set the World on Fire, July 31) the percentage of the globe that burns each year has been declining since 2001. (Link to article: https://www.wsj.com/articles/climate-change-hasnt-set-the-world-on-fire-global-warming-burn-record-low-713ad3a6?page=1)

He continues:

"In the case of American fires, most of the problem is bad land management. A century of fire suppression has left more fuel for stronger fires. Even so, last year U.S. fires burned less than one-fifth of the average burn in the 1930s and likely only one-tenth of what caught fire in the early 20th century.

"When reading headlines about fires, remember the other climate scare tactics that proved duds. Polar bears were once the poster cubs for climate action, yet are now estimated to be more populous than at any time in the past half-century. We were told climate change would produce more hurricanes, yet satellite data shows that the number of hurricanes globally since 1980 has trended slightly downward."

Similarly, senior scientists Chris Landsea and Tom Knutson of the National Oceanic and Atmospheric Administration published a monograph on NOAA's website dated May 12, 2022, asking the question, "Can we detect a change in Atlantic hurricanes today due to human-caused climate change?" Their extensively supported conclusion: "Therefore, in summary, we cannot yet say with confidence whether there is any detectable human

HOT TOPICS

ESSENTIAL READING ON ENERGY SECURITY (CONTINUED)

influence on past Atlantic hurricane activity, and this is particularly the case for any greenhouse gas-induced changes. A temporary period of decreasing man-made aerosol emissions likely contributed, along with natural variability, to increased Atlantic hurricane activity since 1980, although its relative contribution remains uncertain." (Link to article: https://www.climate.gov/news-features/blogs/beyond-data/can-we-detect-change-atlantic-hurricanes-today-due-human-caused)

Meanwhile, a real threat to human health lurks in predictions for rapid growth in U.S. electricity demand while projected additions to generating capacity – whether from renewables, fossil fuels or nuclear – fall far short of meeting anticipated demand. From power-hungry AI applications to electric vehicle adoption to electrification of buildings and appliances, Elon Musk is predicting a tripling of electricity demand by 2045 ("Elon Musk's Latest Mission: Rev Up the Electric Industry", WSJ July 31, 2023). (Link to article: https://www.wsj.com/articles/elon-musks-latest-mission-rev-up-the-electricity-industry-1583a184?page=1)

While some of that may be wishful thinking about the pace of EV adoption, even PG&E's CEO Patti Poppe sees an "unprecedented" demand rise of 70% over the next 20 years. To hope and pray that might be generated and transmitted by a supply-chain and permitting-constrained wind and solar sector is to gamble with the adequacy and reliability of life-sustaining heat and air conditioning.

Underscoring the risks of the rush to electrification, veteran energy analyst Amy Myers Jaffe writes in the Wall Street Journal's July 23 edition: "The Five Things Keeping Us From Going All-Electric". She posits that "'The electrification of everything' gets talked about a lot these days. But it isn't going to happen soon. Nor should we want it to." Her five things: (1) Some things can't be electrified; (2) Cheaper alternatives may be coming for the most difficult-to-electrify areas; (3) Access to land, and a surfeit of complaints; (4) Difficulty of getting the necessary permits; (5) Electricity grids are highly interruptible. (Link to article: https://www.wsj.com/articles/all-electric-energy-roadblocks-68c5f3b9)

All of this uncertainty and concern around the U.S. emissions, climate, electric demand and reliability is playing out against a backdrop of record and growing coal consumption in Asia, according to Robert Bryce. This points to the inescapable conclusion that any progress made in the U.S. and EU to reduce CO2 emissions will be overwhelmed by emissions from Asia and other developing economies.

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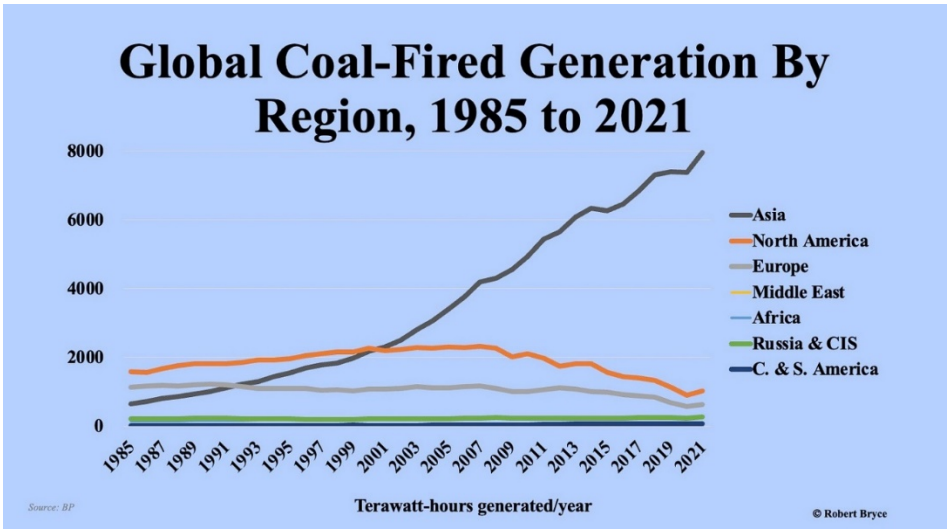
ESSENTIAL READING ON ENERGY SECURITY (CONTINUED)

(Link to article: https://robertbryce.substack.com/p/the-iron-law-of-electricity-strikes?utm_source=post-emailtitle&publication_id=630873&post_id=128805963&isFreemail=true&utm_medium=email)



This is accompanied by record U.S. feed gas supplies to American LNG exporters with a growing share going to Asia as Europe seems to have successfully repositioned its gas supply chain without Russian natural gas.

Clearly and obviously America's plentiful, affordable and clean natural gas is the ultimate cure to rapid global emissions growth, with nuclear waiting in the wings to help if and when technology and permitting challenges are solved. Slow but sure progress is being made on permitting, as EEIA continues to work with Congressional and Administration staff on changes that will speed approvals of both new pipeline and transmission infrastructure.

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HOT TOPICS

HOW MUCH OIL WILL THE WORLD NEED BY 2050?

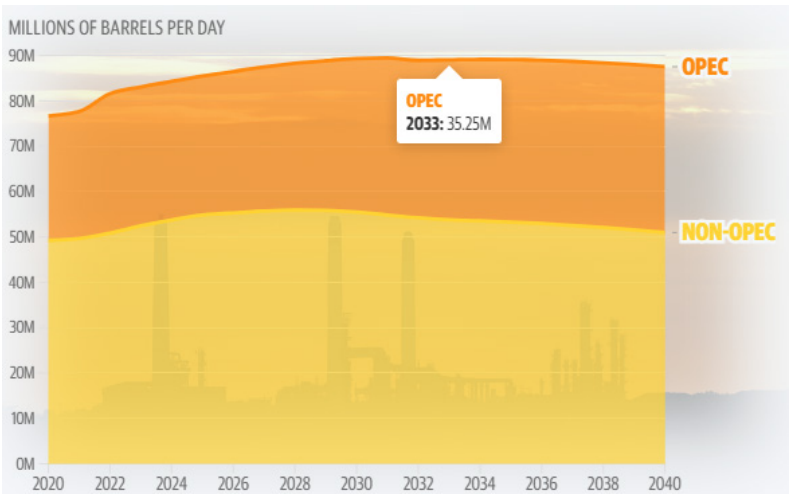
Global oil markets are slowly recovering after three turbulent years in which they were upended first by the COVID-19 pandemic and then by Russia's invasion of Ukraine. Global oil demand is projected to climb by 2.2 million barrels per day (b/d) this year to reach a new record of 102.1 million b/d. Growth will slow to 1.1 million b/d in 2024 as macroeconomic headwinds are seen in a deepening manufacturing slump.[1] Due to surging petrochemical use, China will account for 70% of global demand gains, while demand remains slow in the 37 economies that make up the Organization for Economic Co-operation and Development (OECD).

But what will the world's energy consumption look like in 2050? Economic growth remains a key driver for energy demand, along with technological developments, climate policy and geopolitics. Geopolitical tensions in the wake of the Russian invasion of Ukraine could lead to long lasting effects on economic development and government policy, especially in the European Union, the former republics of the Soviet Union (Commonwealth of Independent States) and China. Within energy circles, estimates of how much oil will be needed in 2050 range anywhere from 80% less than today to business as usual.

Most major U.S. oil companies are in the "high demand" camp, according to a report from the energy consulting firm WK Associates that compiled 2050 oil forecasts. ExxonMobil Corporation expects global oil demand to still be roughly 100 million b/d by 2050 and is speculating that technologies such as carbon capture and storage, as well as methane abatement, will allow the world to use fossil fuels for decades.[2]

S&P Global Commodity Insights believes global demand for oil will peak around 2031. But instead of declining, they predict demand for oil will more likely stay close to peak levels for years, maybe decades (see the chart below).[3] By 2050, oil demand will be about where it is today.

Forecasted Oil Production Through 2040[3]



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HOT TOPICS

HOW MUCH OIL WILL THE WORLD NEED BY 2050? (CONTINUED)

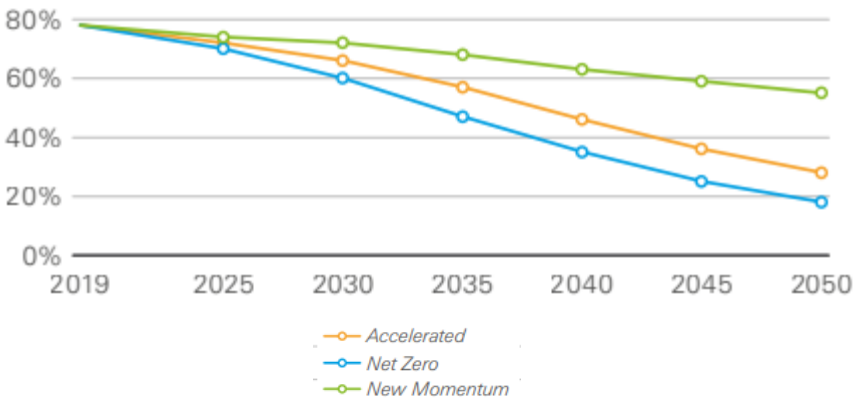
The 2023 Annual Energy Outlook report from the U.S. Energy Information Administration (EIA) predicts that U.S. oil production may even increase between now and 2050 even as clean energy sources like wind and solar power increase dramatically as well. The report says that U.S. demand for oil and gas is likely to remain remarkably steady for decades and also expects U.S. oil production to remain at historically high volumes as exports of finished products increase. In addition, the U.S. is expected to remain a net exporter of petroleum products and natural gas through 2050.[3] The report follows the Biden administration's approval of the ConocoPhillips's Willow drilling project in Alaska which will produce new oil for years.

The Organization of Petroleum Exporting Countries (OPEC) forecasts that global demand for oil will hit 110 million barrels a day by 2045 (as far out as OPEC currently projects). This is roughly a 10% increase from current rates. Natural gas, renewable power and hydrogen will all play bigger roles, but oil will remain at the center.[2]

It is a different story in Europe where Shell, BP and TotalEnergies are under pressure from investors to address climate change. Even with no new climate policies, Shell's latest energy security report shows that demand for oil will fall around 10% by the middle of the century. And it sees a sharper drop if world governments get serious about reducing emissions.[2]

BP looked at three "what if" scenarios, and estimates that oil production would decline by roughly 25% based on trends it is already seeing in the market, or close to 60% in its "accelerated" scenario in which climate regulations get tighter.[2] The share of fossil fuels as a primary energy source will fall from 80% in 2019 to between 55% and 20% by 2050, according to BP's report. Renewables' share will grow from 10% to between 35% and 65% over the same time period.[4] The scenarios are based on existing technologies and do not consider the possible impact of entirely new or unknown technologies. But neither European entity is seriously preparing for these challenging outcomes. Both Shell and BP recently reversed plans to cut oil production aggressively this decade.

Fossil Fuels' Share of Primary Energy[4]



HOT TOPICS

HOW MUCH OIL WILL THE WORLD NEED BY 2050? (CONTINUED)

According to the International Energy Agency (IEA), rising demand for crude oil is set to slow to a trickle within five years and peak before the end of the decade, as electric vehicle adoption surges and developed nations rapidly transition to cleaner sources of energy. In particular, the IEA forecasts that the use of oil for transportation fuels will go into decline after 2026 as the expansion of electric vehicles, the growth of biofuels and improving fuel economy reduce consumption.[4]

Around the world, governments and automakers are focused on selling newer, cleaner electric vehicles. The European Union has the strongest regulatory pressure and shows the highest auto maker ambition to phase out internal combustion engine vehicles. Electric vehicles (EVs) currently make up 16% of passenger car sales globally. S&P Global forecasts that roughly 64% of passenger cars sold in 2030 will be battery electric vehicles and data provider EV-volumes.com expects this share to rise to 68% by 2035.[5]

The challenge for the United States, and the rest of the world, is making the transition to green energy without prematurely shutting off supplies of oil and natural gas that still power most of the world economy.

Sources:
1) The International Energy Agency, Oil Market Report, July 2023.
2) The Wall Street Journal, Big Oil Mulls a Slippery Future, June 23, 2023.
3) Yahoo, How Biden is Wrong about the Future of Oil, February 16, 2023.
4) CNBC, BP says Demand for Oil and Gas will Drop Dramatically by 2050 in 'Decisive Shift', January 30, 2023.
5) The Wall Street Journal, Oil Demand Expected to Peak This Decade as EVs Boom, June 14, 2023.

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PETROLEUM PRODUCTS

EQUITY COMPARABLES (1)

Petroleum Products (United States & Canada)

Company	LTM(2) Revenues	LTM(2) EBITDA	LTM(2) Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value(3)	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt(4)/ EBITDA
Calumet Specialty Products Partners, L.P.	$4,626	$302	6.5%	$17.38	84.8%	$1,388	$3,492	0.8x	11.6x	6.6x
Chevron Corporation	214,194	51,040	23.8	163.16	86.0	311,093	321,522	1.5x	6.3x	0.1x
CVR Energy, Inc.	10,809	1,373	12.7	32.78	75.2	3,295	4,676	0.4x	3.4x	0.8x
EnLink Midstream, LLC	9,025	1,370	15.2	10.84	79.8	5,102	11,501	1.3x	8.4x	3.5x
Gibson Energy Inc.	7,918	361	4.6	15.96	77.8	2,277	3,486	0.4x	9.7x	3.3x
Exxon Mobil Corporation	367,977	83,739	22.8	109.66	91.7	446,424	471,126	1.3x	5.6x	0.1x
HF Sinclair Corporation	38,311	4,778	12.5	48.38	73.1	9,492	12,321	0.3x	2.6x	0.5x
Keyera Corp.	5,292	786	14.9	21.87	83.4	5,012	7,897	1.5x	10.0x	4.0x
Marathon Petroleum Corporation	174,917	25,295	14.5	134.83	98.8	59,544	83,055	0.5x	3.3x	0.7x
Parkland Corporation	26,616	1,062	4.0	23.95	82.1	4,203	8,873	0.3x	8.4x	4.4x
Phillips 66	168,207	13,216	7.9	101.38	89.3	46,727	63,423	0.4x	4.8x	1.0x
NuStar Energy L.P.	1,667	732	43.9	15.64	88.1	1,735	6,283	3.8x	8.6x	4.3x
Valero Energy Corporation	151,760	17,604	11.6	139.60	92.8	51,350	61,117	0.4x	3.5x	0.3x
Median			**12.7%**		**84.8%**			**0.5x**	**6.3x**	**1.0x**
Mean			**15.0%**		**84.8%**			**1.0x**	**6.6x**	**2.3x**

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
6/16/2023	Ranger Oil	Baytex Energy (TSE: BTE)	$2,487.7	2.2x	2.7x
5/22/2023	PDC Energy, Inc. (NasdaqGS:PDCE)	Chevron Corporation (NYSE:CVX)	$6,353.6	2.0x	2.2x
8/17/2022	DCP Midstream, LP (NYSE:DCP)	Phillips 66 (NYSE:PSX)	$13,227.8	0.7x	7.3x
7/28/2022	PBF Logistics LP (NYSE:PBFX)	PBF Logistics LP (NYSE:PBFX)	$1,661.0	4.8x	7.8x
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

(1) Matching public companies to middle-market companies is an imperfect comparable analysis due to the variables of size, equipment, markets, etc. Nonetheless JKC's research has yielded this list as the closest available.
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(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] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Alliant Energy Corporation	$4,214	$1,546	36.7%	$53.40	81.7%	$13,411	$22,261	5.3x	14.4x	5.8x
AltaGas Ltd.	10,295	1,075	10.4	16.65	72.3	4,689	12,721	1.2x	11.8x	6.0x
Atmos Energy Corporation	4,564	1,581	34.6	112.36	91.4	16,234	24,708	5.4x	15.6x	4.0x
Avista Corporation	1,723	444	25.7	42.45	91.1	3,185	6,111	3.5x	13.8x	6.6x
Baytex Energy Corp.	1,545	989	64.0	3.75	55.3	2,042	2,731	1.8x	2.8x	0.7x
Calumet Specialty Products Partners, L.P.	4,626	302	6.5	17.38	84.8	1,388	3,492	0.8x	11.6x	6.6x
Cenovus Energy Inc.	42,310	7,043	16.6	17.43	75.6	33,247	38,901	0.9x	5.5x	1.0x
Chesapeake Utilities Corporation	676	224	33.1	127.99	89.9	2,271	3,081	4.6x	13.8x	3.5x
Crestwood Equity Partners LP	5,680	743	13.1	24.93	75.6	2,626	7,061	1.2x	9.5x	4.5x
Dominion Energy, Inc.	18,147	8,413	46.4	55.91	63.0	46,699	94,332	5.2x	11.2x	5.5x
EnLink Midstream, LLC	9,025	1,370	15.2	10.84	79.8	5,102	11,501	1.3x	8.4x	3.5x
Enbridge Inc.	37,167	9,644	25.9	38.09	86.3	77,121	144,091	3.9x	14.9x	6.1x
Enterprise Products Partners L.P.	57,622	8,825	15.3	25.90	90.4	56,224	85,946	1.5x	9.7x	3.3x
Epsilon Energy Ltd.	66	50	76.4	5.34	66.8	122	77	1.2x	1.5x	(1.0)x
Eversource Energy	12,614	3,703	29.4	78.26	82.7	27,287	50,123	4.0x	13.5x	6.4x
Genesis Energy, L.P.	2,948	572	19.4	11.26	84.4	1,380	6,170	2.1x	10.8x	6.1x
National Fuel Gas Company	2,314	1,217	52.6	57.74	76.0	5,300	7,789	3.4x	6.4x	2.0x
New Jersey Resources Corporation	2,685	593	22.1	53.20	99.4	5,154	8,530	3.2x	14.4x	5.2x
Northwest Natural Holding Company	1,149	330	28.7	47.56	85.0	1,690	3,337	2.9x	10.1x	4.7x
MDU Resources Group, Inc.	7,295	918	12.6	30.48	93.7	6,206	9,334	1.3x	10.2x	3.7x
OGE Energy Corp.	3,344	1,092	32.7	37.66	87.8	7,541	12,036	3.6x	11.0x	4.3x
ONE Gas, Inc.	2,639	606	23.0	79.23	85.9	4,547	7,796	3.0x	12.9x	4.9x
ONEOK, Inc.	21,463	4,180	19.5	63.54	84.6	28,416	41,920	2.0x	10.0x	3.0x
RGC Resources, Inc.	103	27	26.1	23.19	94.5	230	373	3.6x	13.9x	4.8x
Southwest Gas Holdings, Inc.	5,296	934	17.6	62.45	65.3	4,454	10,618	2.0x	11.4x	5.4x
Summit Midstream Partners, LP	387	166	42.9	15.35	71.4	159	1,855	4.8x	11.2x	8.8x
Targa Resources Corp.	20,491	3,487	17.0	72.95	89.5	16,507	30,184	1.5x	8.7x	3.4x
TC Energy Corporation	11,779	7,039	59.8	38.85	70.6	39,736	84,234	7.2x	12.0x	6.1x
Median			**25.8%**		**84.5%**			**2.9x**	**11.2x**	**4.8x**
Mean			**29.4%**		**81.2%**			**2.9x**	**10.7x**	**4.5x**

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

NATURAL GAS

SELECTED TRANSACTIONS (1)

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
6/16/2023	Ranger Oil	Baytex Energy (TSE: BTE)	$2,487.7	2.2x	2.7x
5/22/2023	PDC Energy, Inc. (NasdaqGS:PDCE)	Chevron Corporation (NYSE:CVX)	$6,353.6	2.0x	2.2x
8/17/2022	DCP Midstream, LP (NYSE:DCP)	Phillips 66 (NYSE:PSX)	$13,227.8	0.7x	7.3x
2/24/2022	South Jersey Industries, Inc. (NYSE:SJI)	J.P. Morgan Asset Management, Inc. ; JPMorgan Infrastructure Investments, L.P.	$7,846.1	3.9x	16.6x
10/26/2021	Oasis Midstream Partners LP (NasdaqGS:OMP)	Crestwood Equity Partners LP (NYSE:CEQP)	$1,807.8	4.8x	8.1x
10/14/2021	Southwest Gas Holdings, Inc. (NYSE:SWX)	Icahn Enterprises L.P. (NasdaqGS:IEP)	$8,571.9	2.3x	10.6x
2/17/2021	Enable Midstream Partners, LP (NYSE:ENBL)	Energy Transfer LP (NYSE:ET)	$7,329.7	3.1x	9.5x
1/13/2021	Corning Natural Gas Holding Corporation (OTCPK:CNIG)	Argo Infrastructure Partners LP	$172.0	4.6x	17.2x
7/27/2020	CNX Midstream Partners LP (NYSE:CNXM)	CNX Resources Corporation (NYSE:CNX)	$764.2	5.1x	6.6x
2/27/2020	EQM Midstream Partners, LP	Equitrans Midstream Corporation (NYSE:ETRN)	$4,395.8	7.6x	8.1x
10/21/2019	AltaGas Canada Inc. (TSX:ACI)	Alberta Teachers' Retirement Fund Board; Public Sector Pension Investment Board	$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

(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] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Ferrellgas Partners, L.P.	$2,072	$342	16.5%	$8.35	48.7%	$41	$2,021	1.0x	5.9x	6.0x
NGL Energy Partners LP	8,695	660	7.6	2.90	72.0	381	4,551	0.5x	6.9x	4.5x
Spire Inc.	2,700	706	26.1	70.14	88.5	3,686	8,563	3.2x	12.1x	6.4x
Star Group, L.P.	2,122	61	2.9	12.97	97.3	463	832	0.4x	13.6x	4.9x
Suburban Propane Partners, L.P.	1,462	227	15.6	15.32	86.3	973	2,210	1.5x	9.7x	6.0x
UGI Corporation	9,832	196	2.0	34.76	78.0	7,284	14,858	1.5x	75.8x	35.2x
Median			**11.6%**		**82.2%**			**1.2x**	**10.9x**	**6.0x**
Mean			**11.8%**		**78.5%**			**1.3x**	**20.7x**	**10.5x**

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
2/16/2023	Propane Distribution Assets of Mountain Flame Propane, Inc.	Superior Plus Corp. (TSX:SPB)	$7.4	-	-
2/16/2023	Acme Propane Gas Co., Inc.	Superior Plus Corp. (TSX:SPB)	$3.3	-	-
9/30/2022	Brown's Gas Company, Inc.	Ferrellgas Partners, LP (OTCPK:FGPR)	$7.5	-	-
8/4/2022	Propane Business in Northern New Mexico	Suburban Propane Partners, LP (NYSE:SPH)	-	-	-
3/28//22	Retail Propane Distribution and Refined Fuels Assets of Quarles Petroleum Inc.	Superior Plus Corp. (TSX:SPB)	$145.0	-	-
7/14/2021	Kamps Propane, Inc.	Superior Plus Corp. (TSX:SPB)	$240.0	-	8.9x
4/22/2021	Assets of Freeman Gas, Inc.	Superior Plus Corp. (TSX:SPB)	$170.0	-	-
2/11/2021	Assets of Highlands Propane Inc.	Superior Plus Corp. (TSX:SPB)	$10.9	-	-
2/11/2021	Miller Propane Inc.	Superior Plus Corp. (TSX:SPB)	$5.9	-	-
1/26/2021	All of the Assets of Holden Oil, Inc.	Superior Plus Corp. (TSX:SPB)	$17.8	-	-
11/11/2020	Assets of Petroleum Heat and Power Co., Inc.	Superior Plus Corp. (TSX:SPB)	$6.1	-	-
10/15/2020	Central Coast Propane, Inc.	Superior Plus Corp. (TSX:SPB)	$12.9	-	-
9/1/2020	Simmons Energy Solutions Inc.	MFA Oil Company	-	-	-
8/25/2020	Rymes Propane & Oils, Inc.	Superior Plus Corp. (TSX:SPB)	$159.0	-	-
7/28/2020	Champagne's Energy, Inc.	Superior Plus Corp. (TSX:SPB)	$27.3	-	-

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

DRILLING

EQUITY COMPARABLES (1)

Drilling (United States & Canada)

Company	LTM[2] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
AKITA Drilling Ltd.	$163	$33	20.0%	$1.09	50.0%	$44	$105	0.6x	3.2x	1.9x
Baker Hughes Company	23,304	3,343	14.3	28.86	74.7	29,203	33,565	1.4x	10.0x	1.0x
CES Energy Solutions Corp.	1,536	184	12.0	1.98	82.1	504	912	0.6x	5.0x	2.1x
Ensign Energy Services Inc.	1,278	307	24.0	2.25	60.8	413	1,453	1.1x	4.7x	3.3x
Halliburton Company	22,414	5,062	22.6	31.64	71.9	28,606	35,373	1.6x	7.0x	1.4x
Helmerich & Payne, Inc.	2,844	895	31.5	35.75	65.5	3,735	3,931	1.4x	4.4x	0.3x
Independence Contract Drilling, Inc.	215	55	25.7	3.26	61.0	44	186	0.9x	3.4x	2.9x
NOV Inc.	8,017	934	11.7	18.51	74.5	7,288	8,623	1.1x	9.2x	1.7x
Precision Drilling Corporation	1,453	412	28.3	51.33	59.6	707	1,544	1.1x	3.8x	2.1x
Secure Energy Services Inc.	5,938	401	6.8	4.66	72.0	1,409	2,162	0.4x	5.4x	2.0x
Valaris Limited	1,714	196	11.5	65.06	81.3	4,891	4,727	2.8x	24.1x	(1.4)x
Median			**20.0%**		**71.9%**			**1.1x**	**5.0x**	**1.9x**
Mean			**18.9%**		**68.5%**			**1.2x**	**7.3x**	**1.6x**

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
5/4/2020	Quintana Energy Services Inc.	KLX Energy Services Holdings, Inc. (NasdaqGS:KLXE)	$49.6	0.1x	2.1x
10/8/2018	Rowan Companies plc (NYSE:RDC)	Ensco 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:TDG)	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)	Ensco 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] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Albemarle Corporation	$8,773	$3,668	41.8%	$221.04	66.1%	$25,928	$27,949	3.2x	7.6x	0.5x
Ascent Industries Co.	380	15	3.9	9.15	50.8	93	197	0.5x	13.4x	6.2x
Ashland Inc.	2,306	515	22.3	102.71	89.8	5,574	6,471	2.8x	12.6x	2.1x
Clean Harbors, Inc.	5,305	1,017	19.2	142.56	98.9	7,708	9,847	1.9x	9.7x	2.3x
CSW Industrials, Inc.	758	175	23.0	138.93	93.3	2,150	2,496	3.3x	14.3x	1.7x
FMC Corporation	5,796	1,414	24.4	122.13	86.6	15,284	18,147	3.1x	12.8x	2.7x
HF Sinclair Corporation	38,311	4,778	12.5	48.38	73.1	9,492	12,321	0.3x	2.6x	0.5x
Ingevity Corporation	1,678	437	26.0	71.52	78.8	2,658	4,112	2.5x	9.4x	3.4x
NewMarket Corporation	2,767	555	20.1	364.98	98.5	3,535	4,557	1.6x	8.2x	1.7x
Quaker Chemical Corporation	1,970	258	13.1	197.95	91.5	3,555	4,367	2.2x	16.9x	3.1x
Stepan Company	2,578	215	8.4	103.03	88.3	2,291	2,768	1.1x	12.9x	3.0x
Valvoline Inc.	1,330	262	19.7	34.94	93.6	6,007	8,098	6.1x	30.9x	(1.9)x
Median			**19.9%**		**89.0%**			**2.3x**	**12.7x**	**2.2x**
Mean			**19.5%**		**84.1%**			**2.4x**	**12.6x**	**2.1x**

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
6/22/2022	Ocean Bio-Chem, Inc. (NasdaqCM:OBCI)	OneWater Marine Inc. (NasdaqGM:ONEW)	$122.6	1.9x	10.5x
5/11/2022	Trecora Resources (NYSE:TREC)	Balmoral Funds LLC	$254.3	0.8x	8.8x
9/27/2021	Kraton Corporation (NYSE:KRA)	DL Chemical Co., Ltd.	$2,568.0	1.4x	8.3x
12/7/2020	Gabriel Performance Products, LLC	Huntsman Corporation (NYSE:HUN)	$250.0	2.4x	11.0x
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

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

SOLAR

EQUITY COMPARABLES (1)

Solar (United States & Canada)

Company	LTM[2] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Boralex Inc.	$673	$335	49.8%	$30.41	79.8%	$3,125	$5,791	8.6x	17.3x	6.9x
Capital Power Corporation	2,572	791	30.7	30.78	80.2	3,598	6,689	2.6x	8.5x	3.2x
NextEra Energy Partners, LP	1,218	682	56.0	60.75	70.6	5,401	21,941	18.0x	32.2x	7.5x
NRG Energy, Inc.	31,369	(1,006)	(3.2)	34.29	71.7	7,965	15,837	0.5x	NM	NM
Sunrun Inc.	2,415	(202)	(8.4)	20.15	51.5	4,320	13,925	5.8x	NM	NM
Median			**30.7%**		**71.7%**			**5.8x**	**17.3x**	**6.9x**
Mean			**25.0%**		**70.8%**			**7.1x**	**19.3x**	**5.9x**

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
3/2/2022	New Energy Equity, LLC	ALLETE, Inc. (NYSE:ALE)	$165.5	-	8.3x
6/16/2021	Solarpack Corporacion Tecnologica, S.A. (BME:SPK)	EQT Infrastructure V; EQT Partners AB	$1,543.1	9.5x	20.7x
1/13/2020	TerraForm Power, Inc. (NasdaqGS:TERP)	Brookfield Renewable Partners L.P. (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 1 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] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Algonquin Power & Utilities Corp.	$2,811	$952	33.9%	$8.38	56.2%	$5,768	$15,420	5.5x	16.2x	8.3x
Avangrid, Inc.	8,049	1,779	22.1	39.88	77.1	15,419	25,778	3.2x	14.5x	5.7x
Boralex Inc.	673	335	49.8	30.41	79.8	3,125	5,791	8.6x	17.3x	6.9x
Brookfield Renewable Partners L.P.	4,931	3,126	63.4	31.49	80.2	14,919	55,303	11.2x	17.7x	7.7x
Innergex Renewable Energy Inc.	651	404	62.1	10.85	71.8	2,215	6,770	10.4x	16.7x	10.8x
NextEra Energy Partners, LP	1,218	682	56.0	60.75	70.6	5,401	21,941	18.0x	32.2x	7.5x
Northland Power Inc.	1,756	1,156	65.8	25.04	71.9	6,278	10,752	6.1x	9.3x	3.9x
TransAlta Renewables Inc.	396	190	47.9	9.19	64.0	2,454	3,008	7.6x	15.8x	2.7x
Median			**52.9%**		**71.8%**			**8.1x**	**16.5x**	**7.2x**
Mean			**50.1%**		**71.4%**			**8.8x**	**17.5x**	**6.7x**

SELECTED TRANSACTIONS

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
10/28/2022	Bullfrog Power Inc.	Envest Corp.	$25.7	10.4x	13.6x
1/13/2020	TerraForm Power, Inc. (NasdaqGS:TERP)	Brookfield Renewable Partners L.P. (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 1 LP	$1,651.8	6.6x	17.2x

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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] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Archrock, Inc.	$878	$323	36.7%	$9.77	85.0%	$1,532	$3,096	3.5x	9.6x	4.8x
Baker Hughes Company	23,304	3,343	14.3	28.86	74.7	29,203	33,565	1.4x	10.0x	1.0x
Cathedral Energy Services Ltd.	289	40	13.8	0.73	65.1	164	238	0.8x	5.9x	1.4x
CES Energy Solutions Corp.	1,536	184	12.0	1.98	82.1	504	912	0.6x	5.0x	2.1x
Dawson Geophysical Company	45	(16)	(35.4)	1.55	57.6	37	28	0.6x	NM	NM
ENGlobal Corporation	46	(19)	(41.5)	0.48	21.4	19	26	0.6x	NM	NM
Enservco Corporation	22	(3)	(14.2)	0.48	12.3	7	21	0.9x	NM	NM
Ensign Energy Services Inc.	1,278	307	24.0	2.25	60.8	413	1,453	1.1x	4.7x	3.3x
Enterprise Group, Inc.	22	6	30.0	0.28	82.6	14	24	1.1x	3.8x	1.4x
Essential Energy Services Ltd.	117	11	9.3	0.24	58.9	32	39	0.3x	3.6x	0.7x
High Arctic Energy Services Inc	45	(1)	(2.9)	0.95	65.6	46	36	0.8x	NM	NM
Innospec Inc.	2,001	228	11.4	102.67	88.5	2,543	2,443	1.2x	10.7x	(0.4)x
Matrix Service Company	790	(38)	(4.8)	5.40	56.7	146	157	0.2x	NM	NM
Mullen Group Ltd.	1,520	234	15.4	10.92	92.4	1,007	1,527	1.0x	6.5x	2.4x
Newpark Resources, Inc.	839	63	7.5	3.85	78.4	345	462	0.6x	7.4x	1.5x
North American Construction Group Ltd.	650	157	24.2	16.70	92.8	440	711	1.1x	4.5x	1.9x
Parkland Corporation	26,616	1,062	4.0	23.95	82.1	4,203	8,873	0.3x	8.4x	4.4x
Precision Drilling Corporation	1,453	412	28.3	51.33	59.6	707	1,544	1.1x	3.8x	2.1x
Profire Energy, Inc.	51	9	17.4	1.24	79.0	59	50	1.0x	5.7x	(1.0)x
ProPetro Holding Corp.	1,421	354	24.9	7.19	42.5	827	771	0.5x	2.2x	0.0x
Secure Energy Services Inc.	5,938	401	6.8	4.66	72.0	1,409	2,162	0.4x	5.4x	2.0x
Select Water Solutions, Inc.	1,509	199	13.2	6.96	70.7	770	961	0.6x	4.8x	0.7x
Shawcor Ltd.	999	104	10.4	9.19	83.4	645	650	0.7x	6.3x	0.6x
Smart Sand, Inc.	296	34	11.3	1.76	35.6	72	111	0.4x	3.3x	1.3x
STEP Energy Services Ltd.	763	139	18.2	2.48	49.1	178	297	0.4x	2.1x	0.8x
USA Compression Partners, LP	738	426	57.7	21.13	96.3	2,076	4,682	6.3x	11.0x	5.1x
Median			**12.6%**		**71.4%**			**0.7x**	**5.4x**	**1.4x**
Mean			**11.2%**		**67.1%**			**1.1x**	**5.9x**	**1.7x**

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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] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
AKITA Drilling Ltd.	$163	$33	20.0%	$1.09	50.0%	$44	$105	0.6x	3.2x	1.9x
CSI Compressco LP	365	116	31.9	1.23	76.9	174	839	2.3x	7.2x	5.6x
Enerflex Ltd.	1,685	135	8.0	5.95	79.0	736	1,645	1.0x	12.2x	7.1x
Forum Energy Technologies, Inc.	734	55	7.4	25.43	75.1	262	524	0.7x	9.6x	3.1x
Geospace Technologies Corporation	109	11	9.8	7.05	93.4	93	81	0.7x	7.6x	(2.0)x
Gulf Island Fabrication, Inc.	176	(0)	(0.1)	3.70	64.5	59	19	0.1x	NM	NM
Halliburton Company	22,414	5,062	22.6	31.64	71.9	28,606	35,373	1.6x	7.0x	1.4x
Helix Energy Solutions Group, Inc.	1,119	190	17.0	7.74	84.5	1,178	1,461	1.3x	7.7x	1.5x
Key Energy Services, Inc.	238	(15)	(6.5)	0.75	20.1	10	0	0.0x	NM	NM
KLX Energy Services Holdings, Inc.	869	119	13.7	11.65	62.5	191	485	0.6x	4.1x	2.6x
McCoy Global Inc.	45	6	13.0	0.99	100.0	28	20	0.4x	3.4x	(1.8)x
MIND Technology, Inc.	39	(3)	(7.7)	0.46	30.2	6	45	1.2x	NM	NM
Nabors Industries Ltd.	3,000	896	29.9	121.91	58.7	1,153	4,119	1.4x	4.6x	2.3x
NOV Inc.	8,017	934	11.7	18.51	74.5	7,288	8,623	1.1x	9.2x	1.7x
Natural Gas Services Group, Inc.	91	28	30.7	10.31	68.7	128	150	1.6x	5.4x	1.9x
PHX Energy Services Corp.	438	69	15.8	5.03	76.1	256	289	0.7x	4.2x	0.6x
RPC, Inc.	1,834	483	26.3	7.69	59.6	1,648	1,551	0.8x	3.2x	(0.3)x
Schlumberger Limited	31,191	6,727	21.6	49.10	78.2	70,095	80,430	2.6x	12.0x	1.6x
Solaris Oilfield Infrastructure, Inc.	336	92	27.5	8.54	58.5	286	399	1.2x	4.3x	0.4x
Superior Drilling Products, Inc.	21	4	20.8	0.89	66.6	26	30	1.4x	6.8x	1.0x
TechnipFMC plc	7,117	709	10.0	13.65	85.2	6,024	7,267	1.0x	10.2x	2.5x
TerraVest Industries Inc.	489	75	15.4	20.33	96.1	362	561	1.1x	7.5x	2.6x
TETRA Technologies, Inc.	569	59	10.3	2.65	45.6	341	518	0.9x	8.8x	3.1x
Weatherford International plc	4,789	1,031	21.5	59.35	84.6	4,207	5,722	1.2x	5.6x	1.5x
Median			**15.6%**		**73.2%**			**1.0x**	**7.0x**	**1.7x**
Mean			**15.4%**		**69.2%**			**1.1x**	**6.8x**	**1.8x**

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PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

OIL AND GAS FIELD SERVICES AND EQUIPMENT AND PHYSICAL TECHNOLOGY

SELECTED TRANSACTIONS (1)

Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
6/15/2023	NexTier Oilfield Solutions Inc. (NYSE:NEX)	Patterson-UTI Energy, Inc. (NasdaqGS:PTEN)	$2,230.4	0.6x	2.9x
4/26/2023	Compressor Controls Corporation	Honeywell International Inc. (NasdaqGS:HON)	$670.0	-	15.0x
3/8/2023	Greene's Energy Group, LLC	KLX Energy Services Holdings, Inc. (NasdaqGS:KLXE)	$33.9	0.5x	2.2x
6/21/2022	U.S. Well Services, Inc. (NasdaqCM:USWS)	ProFrac Holding Corp. (NasdaqGS:PFHC)	$270.6	1.3x	13.3x
2/25/2022	Cordy Oilfield Services Inc. (TSXV:CKK)	Vertex Resource Group Ltd. (TSXV:VTX)	$21.3	1.0x	5.2x
2/14/2022	Macro Enterprises Inc. (TSXV:MCR)	-	$111.9	0.4x	3.4x
1/24/2022	Exterran Corporation (NYSE:EXTN)	Enerflex Ltd. (TSX:EFX)	$758.5	1.2x	5.0x
12/13/2021	Nuverra Environmental Solutions, Inc. (NYSEAM:NES)	Select Energy Services, Inc. (NYSE:WTTR)	$51.9	0.5x	20.2x
10/22/2021	FTS International, Inc. (NYSEAM:FTSI)	ProFrac Holding Corp.	$305.1	0.7x	4.0x
8/4/2021	Alamo Pressure Pumping, LLC	NexTier Completion Solutions, Inc.	$238.0	-	3.4x
3/9/2021	Tervita Corporation (TSX:TEV)	Secure Energy Services Inc. (TSX:SES)	$1,022.9	0.9x	6.7x
12/21/2020	RigNet, Inc. (NasdaqGS:RNET)	Viasat, Inc. (NasdaqGS:VSAT)	$235.7	1.0x	8.6x
12/7/2020	SEACOR Holdings Inc. (NYSE:CKH)	American Industrial Partners	$845.5	1.5x	11.1x
9/1/2020	OneStim Business	Liberty Oilfield Services Inc. (NYSE:LBRT)	$427.8	0.1x	1.5x
9/1/2020	Calfrac Well Services Ltd. (TSX:CFW)	THRC Holdings, LP	$675.7	0.8x	34.9x
5/3/2020	Quintana Energy Services Inc. (NYSE:QES)	KLX Energy Services Holdings, Inc. (NasdaqGS:KLXE)	$49.6	0.1x	2.1x
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

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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] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Alliant Energy Corporation	$4,214	$1,546	36.7%	$53.40	81.7%	$13,411	$22,261	5.3x	14.4x	5.8x
AltaGas Ltd.	10,295	1,075	10.4	16.65	72.3	4,689	12,721	1.2x	11.8x	6.0x
Chart Industries, Inc.	2,293	407	17.8	125.40	51.7	5,262	6,925	3.0x	17.0x	10.4x
EnLink Midstream, LLC	9,025	1,370	15.2	10.84	79.8	5,102	11,501	1.3x	8.4x	3.5x
Equitrans Midstream Corporation	1,392	1,096	78.7	5.78	58.4	2,503	10,619	7.6x	9.7x	6.3x
Gibson Energy Inc.	7,918	361	4.6	15.96	77.8	2,277	3,486	0.4x	9.7x	3.3x
Green Plains Partners LP	81	50	61.9	12.70	86.1	295	382	4.7x	7.6x	2.0x
Magellan Midstream Partners, L.P.	3,395	1,361	40.1	54.26	89.6	11,031	16,192	4.8x	11.9x	3.8x
MPLX LP	11,187	5,731	51.2	34.45	97.1	34,486	56,365	5.0x	9.8x	3.6x
NuStar Energy L.P.	1,667	732	43.9	15.64	88.1	1,735	6,283	3.8x	8.6x	4.3x
Median			**38.4%**		**80.8%**			**4.2x**	**9.8x**	**4.0x**
Mean			**36.0%**		**78.3%**			**3.7x**	**10.9x**	**4.9x**

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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
5/4/2023	Holly Energy Partners, L.P. (NYSE:HEP)	HF Sinclair Corporation (NYSE:DINO)	$3,705.2	2.0x	11.0x
8/17/2022	DCP Midstream, LP (NYSE:DCP)	Phillips 66 (NYSE:PSX)	$13,227.8	0.7x	7.3x
7/28/2022	PBF Logistics LP (NYSE:PBFX)	PBF Logistics LP (NYSE:PBFX)	$1,661.0	4.8x	7.8x
10/26/2021	Oasis Midstream Partners LP (NasdaqGS:OMP)	Crestwood Equity Partners LP (NYSE:CEQP)	$1,807.8	4.8x	8.1x
8/5/2021	BP Midstream Partners LP (NYSE:BPMP)	BP Midstream Partners Holdings LLC	$1,826.9	14.5x	9.3x
6/1/2021	Stagecoach Gas Services LLC	Kinder Morgan, Inc. (NYSE:KMI)	$1,225.0	-	10.0x
2/17/2021	Enable Midstream Partners, LP (NYSE:ENBL)	Energy Transfer LP (NYSE:ET)	$7,329.7	3.1x	9.5x
2/10/2021	Inter Pipeline Ltd. (TSX:IPL)	Brookfield Infrastructure Partners L.P. (NYSE:BIP)	$13,857.6	6.5x	17.2x
8/24/2020	Cheniere Energy Partners, LP (AMEX:CQP)	Brookfield Infrastructure Partners LP (NYSE:BIP) and Blackstone Infrastructure Partners, LP	$17,027.5	5.1x	11.3x
7/27/2020	CNX Midstream Partners LP (NYSE:CNXM)	CNX Resources Corporation (NYSE:CNX)	$764.2	5.1x	6.6x
2/27/2020	EQM Midstream Partners, LP	Equitrans Midstream Corporation (NYSE:ETRN)	$4,395.8	7.6x	8.1x
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
10/22/2018	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

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

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

PIPELINES

EQUITY COMPARABLES (1)

Oil and Gas Pipelines (United States & Canada)

Company	LTM(2) Revenues	LTM(2) EBITDA	LTM(2) Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value(3)	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt(4)/ EBITDA
Antero Midstream Corporation	$1,061	$788	74.3%	$10.49	90.4%	$5,021	$8,382	7.9x	10.6x	4.2x
ATCO Ltd.	3,752	1,469	39.2	32.02	89.4	3,663	13,370	3.6x	9.1x	5.0x
Crestwood Equity Partners LP	5,680	743	13.1	24.93	75.6	2,626	7,061	1.2x	9.5x	4.5x
Enbridge Inc.	37,167	9,644	25.9	38.09	86.3	77,121	144,091	3.9x	14.9x	6.1x
Energy Transfer LP	88,380	12,236	13.8	12.47	91.2	38,590	101,616	1.1x	8.3x	3.9x
Enterprise Products Partners L.P.	57,622	8,825	15.3	25.90	90.4	56,224	85,946	1.5x	9.7x	3.3x
Equitrans Midstream Corporation	1,392	1,096	78.7	5.78	58.4	2,503	10,619	7.6x	9.7x	6.3x
Genesis Energy, L.P.	2,948	572	19.4	11.26	84.4	1,380	6,170	2.1x	10.8x	6.1x
Gibson Energy Inc.	7,918	361	4.6	15.96	77.8	2,277	3,486	0.4x	9.7x	3.3x
Kinder Morgan, Inc.	17,145	6,412	37.4	17.51	86.7	39,363	72,469	4.2x	11.3x	4.9x
ONEOK, Inc.	21,463	4,180	19.5	63.54	84.6	28,416	41,920	2.0x	10.0x	3.0x
Plains All American Pipeline, L.P.	55,989	2,535	4.5	12.47	92.4	8,709	22,807	0.4x	9.0x	3.0x
Summit Midstream Partners, LP	387	166	42.9	15.35	71.4	159	1,855	4.8x	11.2x	8.8x
Targa Resources Corp.	20,491	3,487	17.0	72.95	89.5	16,507	30,184	1.5x	8.7x	3.4x
The Williams Companies, Inc.	11,209	5,762	51.4	29.86	78.6	36,394	61,914	5.5x	10.7x	4.2x
TC Energy Corporation	11,779	7,039	59.8	38.85	70.6	39,736	84,234	7.2x	12.0x	6.1x
Western Midstream Partners, LP	3,227	1,879	58.2	26.37	89.4	10,150	16,830	5.2x	9.0x	3.5x
Median			**25.9%**		**86.3%**			**3.6x**	**9.7x**	**4.2x**
Mean			**33.8%**		**82.8%**			**3.5x**	**10.2x**	**4.7x**

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

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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
5/14/2023	Magellan Midstream Partners, L.P. (NYSE:MMP)	ONEOK, Inc. (NYSE:OKE)	$18,938.4	5.6x	12.3x
8/17/2022	DCP Midstream, LP (NYSE:DCP)	Phillips 66 (NYSE:PSX)	$13,227.8	0.7x	7.3x
7/28/2022	PBF Logistics LP (NYSE:PBFX)	PBF Logistics LP (NYSE:PBFX)	$1,661.0	4.8x	7.8x
2/11/2022	Shell Midstream Partners, L.P. (NYSE:SHLX)	Shell Pipeline Company L.P.	$6,370.5	11.5x	10.0x
8/5/2021	BP Midstream Partners LP (NYSE:BPMP)	BP Midstream Partners Holdings LLC	$1,826.9	14.5x	9.3x
6/1/2021	Stagecoach Gas Services LLC	Kinder Morgan, Inc. (NYSE:KMI)	$1,225.0	-	10.0x
2/17/2021	Enable Midstream Partners, LP (NYSE:ENBL)	Energy Transfer LP (NYSE:ET)	$7,329.7	3.1x	9.5x
2/10/2021	Inter Pipeline Ltd. (TSX:IPL)	Brookfield Infrastructure Partners L.P. (NYSE:BIP)	$13,857.6	6.5x	17.2x
10/5/2020	TC PipeLines, LP (NYSE:TCP)	TC Energy Corporation (TSX:TRP)	$2,213.6	7.4x	9.0x
7/27/2020	CNX Midstream Partners LP (NYSE:CNXM)	CNX Resources Corporation (NYSE:CNX)	$764.2	5.1x	6.6x
2/27/2020	EQM Midstream Partners, LP	Equitrans Midstream Corporation (NYSE:ETRN)	$4,395.8	7.6x	8.1x
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

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

PUBLIC AND TRANSACTION COMPARABLES BY SEGMENT

TRUCKERS

EQUITY COMPARABLES (1)

Truckers (United States & Canada)

Company	LTM[2] Revenues	LTM[2] EBITDA	LTM[2] Margin	Stock Price 03/31/23	% of 52-Week High	Market Cap	Total Enterprise Value[3]	TEV / LTM Revenues	TEV / LTM EBITDA	Net Debt[4]/ EBITDA
Adams Resources & Energy, Inc.	$3,243	$20	0.6%	$38.42	62.1%	$97	$125	0.0x	6.2x	0.6x
ArcBest Corporation	4,944	371	7.5	92.42	88.1	2,242	2,355	0.5x	6.3x	0.2x
Covenant Logistics Group, Inc.	1,149	107	9.3	35.42	87.7	469	580	0.5x	5.4x	1.1x
Daseke, Inc.	1,752	182	10.4	7.73	74.2	349	1,103	0.6x	6.1x	3.4x
Heartland Express, Inc.	1,148	248	21.6	15.92	87.6	1,257	1,642	1.4x	6.6x	1.3x
Hess Corporation	10,682	5,137	48.1	132.34	82.4	40,346	47,651	4.5x	9.3x	1.4x
J.B. Hunt Transport Services, Inc.	13,850	1,886	13.6	175.46	86.8	18,208	19,727	1.4x	10.5x	0.8x
Knight-Swift Transportation Holdings Inc.	6,830	1,297	19.0	56.58	87.9	9,106	11,008	1.6x	8.5x	1.4x
Landstar System, Inc.	6,306	504	8.0	179.26	95.1	6,457	6,262	1.0x	12.4x	(0.4)x
Marten Transport, Ltd.	1,231	235	19.1	20.95	89.4	1,700	1,620	1.3x	6.9x	(0.4)x
Old Dominion Freight Line, Inc.	5,951	1,993	33.5	340.84	89.3	37,501	37,464	6.3x	18.8x	(0.1)x
P.A.M. Transportation Services, Inc.	919	141	15.3	28.63	76.5	634	783	0.9x	5.6x	0.8x
Patriot Transportation Holding, Inc.	93	8	8.4	8.00	91.6	28	24	0.3x	3.1x	(0.4)x
Parkland Corporation	26,616	1,062	4.0	23.95	82.1	4,203	8,873	0.3x	8.4x	4.4x
Ryder System, Inc.	11,959	2,615	21.9	89.24	87.2	4,147	10,964	0.9x	4.2x	2.6x
Saia, Inc.	2,740	608	22.2	272.08	88.8	7,199	7,166	2.6x	11.8x	(0.0)x
Schneider National, Inc.	6,413	910	14.2	26.75	86.5	4,762	4,615	0.7x	5.1x	(0.3)x
TFI International Inc.	8,471	1,197	14.1	119.19	92.7	10,333	11,915	1.4x	10.0x	1.3x
Titanium Transportation Group Inc.	345	39	11.3	1.94	91.9	88	158	0.5x	4.1x	1.8x
Universal Logistics Holdings, Inc.	1,814	263	14.5	29.15	64.8	766	1,193	0.7x	4.5x	1.6x
Werner Enterprises, Inc.	3,358	500	14.9	45.49	90.4	2,877	3,545	1.1x	7.1x	1.2x
Yellow Corporation	5,143	277	5.4	2.03	23.9	105	1,556	0.3x	5.6x	5.3x
Median			**14.2%**		**87.7%**			**0.9x**	**6.5x**	**1.2x**
Mean			**15.3%**		**82.1%**			**1.3x**	**7.6x**	**1.3x**

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

TRUCKERS

SELECTED TRANSACTIONS (1)

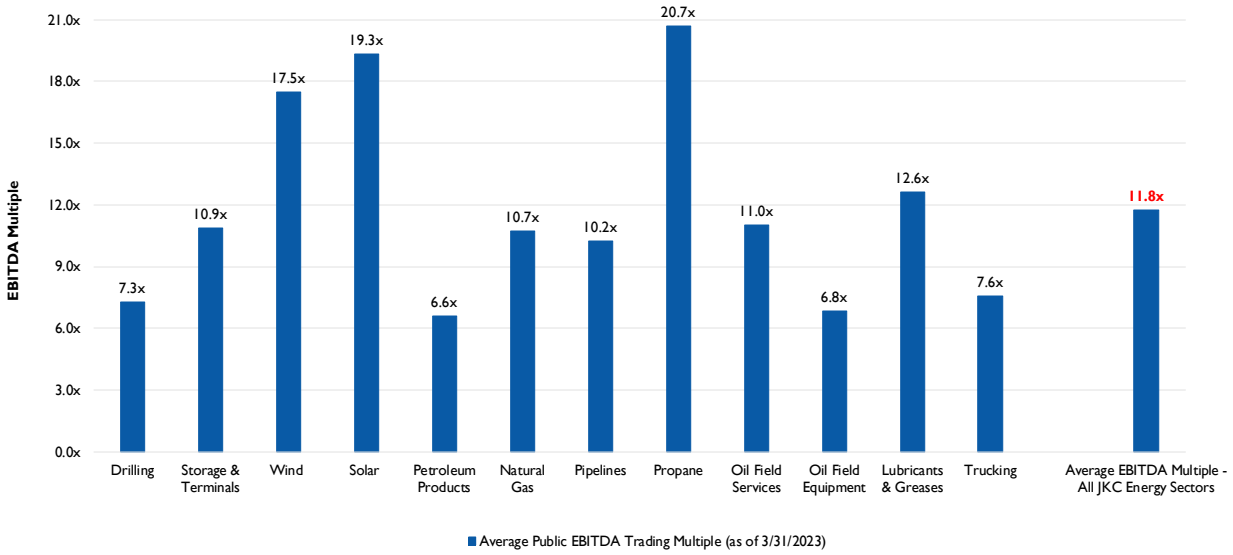
Announced / Closed Date	Target(s)	Acquirer	Total Enterprise Value (TEV)	TEV / Revenues	TEV / EBITDA
6//24/22	USA Truck, Inc.	Schenker, Inc.	$461.3	0.6x	4.7x
2/9/2022	Pilot Freight Services, Inc.	A.P. Møller - Mærsk A/S (CPSE:MAERSK B)	$168.0	-	-
2/9/2022	AAT Carriers, Inc.	Covenant Logistics Group, Inc. (NasdaqGS:CVLG)	$55.0	2.2x	-
1/4/2022	Midwest Logistics Systems Ltd.	Schneider National, Inc. (NYSE:SNDR)	$262.6	1.3x	-
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
10/1/2014	Barr-Nunn Transportation, Inc.	Knight Transportation, Inc. (NYSE:KNX)	$115.9	-	4.5x
7/24/2014	Contrans Group Inc.	TFI International Inc. (TSX:TFII)	$528.2	-	6.8x

(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 3/31/2023)



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FACTOIDS: LITTLE-KNOWN FACTS AND STATS

Petroleum Products (1)

- In southeastern New Mexico, horizontal wells in Lea and Eddy counties drove much of the recent growth in Permian Basin crude oil output.
- Output from horizontal wells in the two counties accounted for 29% of all crude oil production in the Permian Basin in the first quarter of 2023, averaging 1.7 million barrels per day.
- The Permian Basin is the largest oil-producing basin in the United States, spanning 66 counties in southeastern New Mexico and western Texas.

Natural Gas (2)

- In 2022, global trade in liquefied natural gas (LNG) set a record high, averaging 51.7 billion cubic feet per day, a 5% increase compared with 2021.
- Liquefaction capacity additions, primarily in the United States, drove growth in global LNG trade. At the same time, increased LNG demand in Europe also contributed to trade growth as LNG continued to displace pipeline natural gas imports from Russia.
- U.S. LNG exports in 2022 increased by 16% compared with 2021, the largest increase of all LNG-exporting countries.

Propane and Heating/Fuel Oil (3)

- The main factors affecting wholesale propane price are crude oil and natural gas prices, proximity of supply, production, volumes being exported, weather, and cyclical demand periods.
- Most of the country's propane is priced based on the distance from the largest storage hubs in Conway/Bushton, Kansas, and Mt. Belvieu, Texas.
- The U.S. also exports propane, which can reduce the available inventory in the United States at the beginning of the heating season.
- Because propane is a byproduct, the volume of propane made available from crude oil refining and natural gas processing cannot be adjusted when demand or price changes.

(1) U.S Energy Information Administration.
(2) U.S Energy Information Administration.
(3) Smith Gas Liquids Company.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

Lubricants and Greases (1)

- North America's lubricating grease production jumped up 16% in 2022, signaling a further rebounding from the impacts of the COVID-19 pandemic, according to the National Lubricating Grease Institute.
- Worldwide production rose about 2%.
- North American lubricant demand in 2021 almost recovered to pre-pandemic levels, driven by strong growth in the United States' market. Despite inflation, rising raw material costs and supply chain disruptions, North America's total lubricant demand reached 97% of the 2019 total.

Solar (2)

- Over $263 billion in domestic utility-scale clean energy investments have been announced since August 2022. 180,80 MW of new clean power capacity has been announced since the passage of federal clean energy incentives in August 2022.
- The investment announced during this time period is equivalent to seven years' worth of American clean energy investment, surpassing total investment into U.S. clean power projects commissioned between 2016 – 2022.
- Forty-seven new or expanded solar manufacturing facilities will support more than 63 GW of new panel or module manufacturing capacity, more than 15,000 jobs, and over $8 billion of new investment.

Wind (3)

- Wind power capacity totals 146 GW, making it the fourth-largest source of electricity generation capacity in the country. This is enough wind power to serve the equivalent of 46 million American homes.
- Wind energy provides a quarter of the electricity produced in eight states.
- The U.S. wind industry supports nearly 126,000 jobs across all 50 states.

(1) Lubes'N'Greases.
(2) American Clean Power.
(3) American Clean Power.

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FACTOIDS: LITTLE-KNOWN FACTS AND STATS

Oil and Gas Field Services (1)

- Oil and gas field services revenue has declined an annualized 5.2% to $94.2 billion over the past five years, including a 2.9% decrease in 2023, when profit margins will reach 8.6%.
- Market size -- $94 billion.
- Number of businesses -- 27,518.
- Industry employment -- 342,713.

Equipment and Physical Technology (2)

- Students from the Massachusetts Institute of Technology have discovered an innovative material consisting of carbon nanotubes that can produce electricity by absorbing energy from its surroundings.
- Tiny carbon particles that can generate a current just by reacting with the liquid around them can be used to produce power.
- According to the researchers, the liquid, an organic solvent, pulls electrons from the particles and creates a current that may be used to operate micro- or nanoscale robotics or chemical reactions.

Storage and Terminals (3)

- Five largest crude oil storage fields in the United States:
  - Cushing, Oklahoma -- 82 million barrels.
  - Louisiana Offshore Oil Port -- 67 million barrels, the single largest point of entry for waterborne crude oil coming into the U.S.
  - Houston, Texas -- 36 million barrels.
  - Beaumont-Nederland, Texas -- 30 million barrels.
  - St. James, Louisiana -- 30 million barrels.

(1) IBISWorld.
(2) KnowHow.com.
(3) NOLA.com.

FACTOIDS: LITTLE-KNOWN FACTS AND STATS

PIPELINES (1)

- A single major pipeline construction project is estimated to employ 7,000 construction workers and provide them and their families more than $400 million in salary and benefits.
- More than 500 workers are needed to construct each 100-mile section of pipeline.
- Pipelines need pumping stations constructed every 50 miles.
- Heavy equipment operators, laborers, welders, Teamsters, foremen, engineers and quality control personnel are all needed to construct a pipeline.

TRUCKERS (2)

- Suttons Tankers is testing hydrotreated vegetable oil (HVO) as an alternative fuel in a recently launched eight-week trial.
- HVO is a sustainable fuel source with a lower carbon footprint than diesel, reducing CO2 emissions by at least 85%, according to proponents.
- The fuel is compatible with existing diesel engines without any need for modifications and the trial phase aims to reduce CO2 emissions by 91,000 kgs on just five routes.
- Full implementation of HVO throughout the Suttons fleet is aimed at reducing 42,990 tons of CO2.

(1) Liquid Energy Pipeline Association.
(2) Bulk Transporter.

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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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ABOUT THE ENERGY EQUIPMENT & INFRASTRUCTURE ALLIANCE

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

ENERGY EQUIPMENT & INFRASTRUCTURE ALLIANCE

The Voice of the Energy Supply Chain

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