Record U.S. progress in 2019 provides a strong point of departure in the face of global challenges

2019 U.S. oil & natural gas production set records despite weaker economic growth, as signaled by the API D-E-I© since December 2018

Solid oil & gas productivity combined with increased pipeline capacity in the Permian basin is having a global market impact – the U.S. now an energy net exporter

U.S. energy trade has grown so far despite trade frictions, but sustaining progress and future growth could depend on how these issues are resolved

As global natural gas demand has risen, the U.S. appears poised to help meet that growth as infrastructure and market challenges are surmounted

 NAFTA / USMCA

2019 energy trade flows (August year-to-date*)

U.S. and Canada

Crude oil 3.6 mb/d

Refined products 0.5 mb/d

Natural gas 7.4 bcfd

U.S. and Mexico (August year-to-date*)

Crude oil 17 kb/d

Refined products 1.2 mb/d

Natural gas 5.0 bcfd

1989 Energy Trade Flows: U.S. and Canada

1989 Energy Trade Flows: U.S. and Mexico

2018 Refinery Receipts of crude oil

(Billion barrels per day)

Global natural gas production versus GDP

North American LNG projects

U.S. existing and proposed LNG export projects

www.api.org
API industry health dashboard – Q3 2019

Quarterly highlights

- **Record oil & gas production as well as demand** rose to the top of the 5-year range, and U.S refinery throughput increased to its highest so far in 2019
- **Industry revenues neared 5-year highs** despite moderate prices, due to strong production and demand
- **Net income fell** towards 5-year lows with divergent segment performance, including large write-downs in Upstream and Equipment, Services and EPC
- Weaker income and free cash flow plus moderate prices resulted in a **fourth consecutive quarter of lower drilling activity**

Key metrics for U.S. supply/demand and U.S. industry members*

- **U.S. petroleum demand** 20.8 mb/d
- **Revenues** $672.6 B
- **U.S. refinery throughput** 17.4 mb/d
- **Capital expenditures** $65.4 B
- **U.S. drilling activity** 920 rigs
- **Net income** $13.3 B
- **Q3 2019 averages**
  - Brent $61.90 / bbl.
  - WTI $56.35 / bbl.
  - NGL composite $4.71 / mmbtu
  - Henry Hub $2.47 / mmbtu

* Financial compilation based on API 200 companies with shares listed on U.S. stock exchanges sources: EIA, API MSR, Bloomberg, Baker Hughes, API Team Analysis
Led by Global Integrated companies, the industry invested $65.4 billion in Q3 2019 and $278 billion over the past four quarters

- Capital expenditures decreased by 6.2% ($4.3 billion) in the third quarter of 2019, compared with one year ago
- As Downstream investments accelerated, Midstream and Global Integrated company investments held steady

**Capital expenditures by industry segment**

- **Global Integrated**: $65.4 billion in Q3 2019, Q3 2019 change (%y/y) -0.6%
- **Upstream**: $40.4 billion in Q3 2019, Q3 2019 change (%y/y) -19.2%
- **Midstream**: $20.4 billion in Q3 2019, Q3 2019 change (%y/y) -0.8%
- **Downstream**: $10.4 billion in Q3 2019, Q3 2019 change (%y/y) -8.7%
- **Specialty Petrochemical, Equipment, Services and EPC**: $0.4 billion in Q3 2019, Q3 2019 change (%y/y) -27.6%

Total: -6.2%

* All other oil & gas industry companies

Sources: Bloomberg, publicly-available company reports
Global economy & oil markets
Despite economic uncertainties, the global economy has needed more energy – and U.S. supply has stepped up.

Global Economy on Course for Weakest Growth Since Crisis
The Wall Street Journal

The slowing economy is no longer a surprise
Top news and what to watch in the markets on Thursday, December 5, 2019.
Read More »
Yahoo! finance

Slowing Chinese growth delivers blow to global economy
Financial Times

American Petroleum Institute
The D-E-I© (Distillate Economic Indicator) - Nov. 2019

- The D-E-I© value of -0.1 for November and three-month average of -0.15 suggests a continued slowing of industrial production.

Industrial production
Percentage change year-over-year (3-month average)

- Recession (left axis)
- Industrial production (left axis)
- DEI (right axis)

DEI
Percentage change year-over-year (3-month average)

sources: API Monthly Statistical Report, EIA, CME Group, Moody’s, Federal Reserve Board
The consensus expects a divergence between U.S. and global economic growth, which historically has had implications

- Bloomberg consensus expects U.S. and world GDP growth to diverge, and a relative weakness of U.S. economic growth historically has corresponded with a weaker U.S. dollar foreign exchange rate and higher crude oil prices.

### Real GDP growth*

<table>
<thead>
<tr>
<th>Year</th>
<th>World</th>
<th>U.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>3.0%</td>
<td>1.8%</td>
</tr>
<tr>
<td>2019</td>
<td>2.5%</td>
<td>1.6%</td>
</tr>
<tr>
<td>2020</td>
<td>2.3%</td>
<td>1.5%</td>
</tr>
<tr>
<td>2021</td>
<td>2.2%</td>
<td>1.4%</td>
</tr>
</tbody>
</table>

* Market exchange rate basis aggregated for 205 countries

### Relative U.S. economic performance


- Consensus expects the U.S. cannot keep pace with global growth.

**U.S. dollar exchange value (y/y%, 2006-2018)**

**Brent crude oil prices (y/y%, 2006-2018)**

Sources: IMF, Bloomberg, Federal Reserve

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www.api.org
Global economic growth has consistently required liquid fuels

- Global oil demand has grown consistently with the economy, increasing by an average of 1.3 mb/d since 2010 or roughly half the rate of global GDP growth – 2019 has been no exception*

**Global oil demand versus GDP**

Million barrels per day

![Graph showing the relationship between real GDP (Trillion 2010$) and global oil demand (Million barrels per day). The graph highlights the rise in oil demand from 1970 to 2019, with a notable peak during the Great Financial Crisis (2008-2009).](chart)

*Market exchange rate basis

sources: EIA, Bloomberg, IMF, API Team calculations
Potential demand responses to IMO 2020 – market precedents where residual fuel oil decreased, distillates increased

IMO 2020 has been in the works for more than a decade, and there are past precedents where residual fuel oil demand decreased by more than 3.0 mb/d and distillate demand rose by more than 2.0 mb/d.

Global oil demand by selected product

Million barrels per day (mb/d)

Gas/diesel oil demand increased by more than 2.7 mb/d in 2002-2006 and 2009-2013

Fuel oil demand decreased 3.9 mb/d, 1979-1983

Despite geopolitical events, EIA expects a balanced global oil market and oil prices below $60 per barrel until Q4 2020.
Strong productivity and cost effectiveness have continued to position the U.S. for oil and natural gas production growth

- BTU Analytics’ estimated breakeven prices continued to fall among most major crude oil production areas, while EIA’s productivity estimates have continued to rise.

### Estimated breakeven prices – Nov. 2019*

<table>
<thead>
<tr>
<th>Area</th>
<th>Nov. 2019</th>
<th>Nov. 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eagle Ford - West</td>
<td></td>
<td></td>
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<tr>
<td>Bakken</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eagle Ford - East</td>
<td></td>
<td></td>
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<tr>
<td>Permian - Delaware</td>
<td></td>
<td></td>
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<tr>
<td>Permian - Midland</td>
<td></td>
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</tr>
</tbody>
</table>

*Half cycle breakevens assuming 10% discount factor and play-specific costs

Source: BTU Analytics

### U.S. oil productivity – monthly new well production per rig

<table>
<thead>
<tr>
<th>Year</th>
<th>Eagle Ford</th>
<th>Bakken</th>
<th>Permian</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td></td>
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<td>2016</td>
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<td>2018</td>
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<tr>
<td>2019</td>
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</tbody>
</table>

Strong supply growth concentrated in top producing states

- Permian basin (Texas and New Mexico) and Bakken formation (North Dakota) production set records in 2019
- Ohio and West Virginia grew strongly from a small base, while Alaska and California downshifted

2019 oil production share by state (Jan.- Aug. 2019, %)

- Texas: 40.0%
- North Dakota: 11.2%
- New Mexico: 8.8%
- Oklahoma: 5.9%
- Colorado: 4.0%
- Alaska: 3.7%
- California: 3.6%
- Other & Offshore: 20.3%

2019 oil production change by state (Jan.- Aug. 2019, y/y%)

- Michigan: -5.0%
- Louisiana: -11.4%
- Mississippi: 1.3%
- West Virginia: 50.2%
- Alabama: -17.4%
- Michigan: 3.0%
- Pennsylvania: 4.4%
- Ohio: 27.9%
- Mississippi: -17.4%
- West Virginia: 50.2%
- Louisiana: 11.4%
- Texas: 17.2%
- New Mexico: 38.4%
- Oklahoma: 7.9%
- Colorado: 8.5%
- Wyoming: 19.5%
- North Dakota: 14.2%
- Montana: 9.8%
- Idaho: -3.3%
- California: -3.0%

source: EIA
Rail has remained critical to Bakken formation egress

By API estimates, North Dakota production reached a record 1.5 million barrels per day (+5.8% y/y) in October 2019, enabled by the ability to ship incremental production via rail and trucking.

Bakken Formation pipeline infrastructure

Bakken pipeline capacity balance

Million barrels per day (mb/d)

sources: EIA, PennWell, National Geographic, ESRI, Garmin, HERE, UNEP, USGS, WCMC, NASA, ESA and API Team analysis

sources: EnSys, Bloomberg, EIA, API Monthly Statistical Report
The Permian Basin added 1.1 mb/d of new pipeline capacity in 2019 (Q4 19 vs. Q4 18)

The expansions, including the Grey Oak, Cactus II, Seminole Red, EPIC, Jupiter and Wink-to-Webster pipelines, should accommodate expected production growth.

New Permian Basin new pipeline egress

Permian Basin pipeline capacity balance

Million barrels per day (mb/d)

1Q18  3Q18  1Q19  3Q19  2020  2022

- Refining capacity
- WA Line and Line 0
- Basin
- Midland-Sealy
- Permian Express IV
- Gray Oak
- Wink-to-Webster
- Permian production
- Centurion
- Amdel
- Longhorn
- Cactus
- Longview2
- Cactus II
- Jupiter
- West Texas Gulf
- Wink
- BridgeTex
- Permian Express II
- Seminole Red
- EPIC
- Rail capacity

Trucking need

New in Q4 19
Grey Oak Pipeline

source: EnSys, Gray Oak Pipeline

sources: EnSys, EIA, Rystad Energy, Bloomberg
For the first time in nearly 60 years, the U.S. has become a net exporter of energy in total

- The U.S. already was a net exporter of coal, natural gas and natural gas liquids, and EIA projected the U.S. to become a net exporter of total energy (including oil) in 2019
- EIA’s Short-Term Energy Outlook in November confirmed the finding per API’s estimates in the September Monthly Statistical Report

### Gross energy trade

<table>
<thead>
<tr>
<th>Quadrillion Btu</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Net imports</td>
</tr>
</tbody>
</table>

### Energy net exports and imports

<table>
<thead>
<tr>
<th>Quadrillion Btu</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Net exports</td>
</tr>
</tbody>
</table>

Source: EIA
With the U.S. energy revolution, U.S. oil & gas net imports have fallen despite less buying by China

U.S liquids production and net imports

- Crude oil and NGL production
- Petroleum net imports

Million barrels per day

- 2007
- 2009
- 2011
- 2013
- 2015
- 2017
- 2019

U.S natural gas production and net imports

- Dry natural gas production
- Natural gas net imports (exports)

Trillion cubic feet

Percentages of U.S. oil and LNG exports going to China

- Crude oil and refined products
- 2017: 5.2
- 2018: 4.1
- 2019 (Q3 2019 YTD): 2.7

- Liquefied natural gas (LNG)
- 2017: 12.2
- 2018: 7.9
- 2019 (Q3 2019 YTD): 1.1

Sources: EIA, API Monthly Statistical Report

www.api.org
Section 301 tariffs and China retaliation have impacted China’s imports of U.S. crude oil, natural gas and refined products

U.S. petroleum exports to China and U.S. Section 301 tariff & China retaliation timeline

Aug. 23: U.S. tariffs on $16B, China retaliation: 25% on U.S. petroleum products

Sep. 1: 15% U.S. tariffs on $300B (subset), China retaliation 5% on crude oil and raised to LNG and refined products +5%

Sep. 24: 10% U.S. tariffs on $200B, China retaliation on LNG 10%

Jun. 1: China retaliation on LNG raised to 25%

Jun. 15: 25% U.S. tariffs on $200B

Jul. 6: U.S. tariffs on $34B, China retaliation on U.S. exports

Dec. 15: pending 15% U.S. tariffs on $300B (subset), pending China retaliatory tariffs

U.S. crude oil export capacity has been sufficient to date, but capacity estimates suggest some urgency to plan forward

- Estimates of U.S. crude oil export capacity vary between 4.0 mb/d and 5.0 mb/d and depend on local conditions, including weather, ship availability and congestion.
- By API estimates, U.S. crude oil exports exceeded 3.2 mb/d in October and could bump up against the lower end of the export capacity range in 2020 given EIA's projections for oil production growth.

U.S. gross crude oil exports

![U.S. onshore ports: Houston, Texas, Corpus Christi, Texas](source: U.S. Energy Information Administration, Saudi Arabia, Louisiana Offshore Oil Port)

![Deepwater jetty: Yantou, Saudi Arabia](source: U.S. Energy Information Administration, Saudi Arabia, Louisiana Offshore Oil Port)

Four flavors of trade-related issues could affect U.S. energy trade and production growth

- **Section 232**: Steel and aluminum import restriction – tariffs and quotas

- **Section 301**: Tariffs on imported goods from China already levied on more than 100 products that hurt the natural gas and oil industry, including bearings, drill collars, electronic circuits, fluids, lithium batteries, meters, motors, pumps, pump parts, rotors/stators, steel, turbines, and valves

**NAFTA / USMCA**

**2019 energy trade flows (August year-to-date*)**

**U.S. and Canada**

- Crude oil: 3.8 mb/d
- Refined products: 0.6 mb/d
- Natural gas: 7.4 bcf/d
- Electricity: 139 GWh/d

**U.S. and Mexico (August year-to-date*)**

- Crude oil: 17 kb/d
- Refined products: 1.2 mb/d
- Natural gas: 5.0 bcf/d
- Electricity: 41 GWh/d

* source: EIA. Aug. 2019 ytd for crude oil, refined products and natural gas; electricity based on 2017 data

**Economic sanctions** and the projection of U.S. power globally
Heavy oil can be advantageous in serving diverse product markets, and Canada has been a main source. Deep conversion refining of heavy oil generally yields relatively large shares of distillates and products, such as asphalt, petroleum coke and petrochemical inputs, that have important market niches not served by light oil.

Representative refining yields from coking medium/heavy sour crude oil

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Output Mix (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refinery fuel gas (propane, butane)</td>
<td>7</td>
</tr>
<tr>
<td>Gasoline</td>
<td>58</td>
</tr>
<tr>
<td>Distillates (jet fuel, diesel, heating oil)</td>
<td>28</td>
</tr>
<tr>
<td>Heavy fuel oil (and other products)</td>
<td>15</td>
</tr>
</tbody>
</table>

Total yield with volumetric refinery gain: 108

Source: IHRDC, API Team graphics

2018 Refinery Receipts of crude oil (thousand barrels per day)

- Western Canada
- U.S. (excluding Alaska)
- Alaska
- Atlantic Canada
- Other imports

Source: CAPP (citing EIA, NEB, Statistics Canada and CA Energy Commission)
Pipeline infrastructure keys the United States’ ability to utilize Canadian crude oil

- The vast majority of U.S.-Canada oil trade goes by pipeline, which can influence pricing and availability as comparable quality crude oil from Venezuela has declined.

Canada crude oil exports to U.S. by mode

- Exports to U.S. by pipeline
- Exports to U.S. by rail and road

Canadian pipeline projects that could enable greater U.S. utilization of Canadian oil

source: CAPP

sources: EIA, API Monthly Statistical Report, Statistics Canada
U.S. petroleum demand remained near record highs in 2019 due to solid economic growth

- Jet fuel and other oils – naphtha, gasoil in refining and petrochemicals – led 2019 petroleum demand growth
- Motor gasoline and diesel demand have neared their highs but with diminished growth

U.S. oil demand by product

sources: EIA, API Monthly Statistical Report
2019 U.S. gasoline and diesel fuel consumption remained near record levels, but regional changes were divergent

Through the first three quarters of 2019, U.S. demand for gasoline (9.3 mb/d, -0.3% y/y) and diesel (4.1 mb/d, -1.3% y/y) varied by region, shown by Petroleum Administration Defense District (PADD)

2019 Gasoline demand by PADD (y/y%)*

2019 Diesel demand by PADD (y/y%)*

As refineries have expanded, the U.S. has run relatively strong throughput and capacity utilization rates

Since 2010, U.S. refining capacity has increased 6.8% while throughput rose 11.7%, yielding relatively strong capacity utilization rates.

Per API’s Monthly Statistical Report (MSR), refinery capacity utilization slipped in the second half of 2019 y/y due to a mix of planned turnarounds and unplanned outages (Bloomberg).

**U.S. petroleum refining**

Million barrels per day

- **Gross inputs**
- **Operable capacity**

**Distillation unit inputs**

Million barrels per day

**Refinery capacity utilization**

Percent operated

- 5-year range
- 2019
- 2018

Seasonal turnaround with outages coming back online

Capacity utilization reverts into the 5-year range

Sources: EIA, API
U.S. refineries have put their plans into action for IMO 2020

- U.S. refining system is well-positioned for IMO 2020 due to our:
  - Relatively complex refineries;
  - Access to attractive crude oils;
  - Abundant and inexpensive natural gas; and,
  - The best workers in the global industry

This combination makes the U.S. refining system flexible and resilient in competing to place its products globally

**Economic variables** that are likely to affect IMO 2020 outcomes

1. Regional crack spreads
2. Heavy crude price differential, especially the WTI-WCS spread for U.S. refiners
3. Coker economics

**Refinery capabilities/capacities** that influence refiner optionality

1. Residual fuel oil upgrading capability
2. Capacities for sulfur treating and hydrotreating
With solid distillate stocks and low market price expectations, EIA expects the U.S. industry is prepared for IMO 2020

- Since 2000, U.S. distillate stocks have remained above 100 million barrels with an increasingly interconnected supply chain and pipeline network
- With the energy revolution, U.S. refining including Ultra Low Sulfur Diesel (ULSD) increased and lowered prices. EIA and futures market expectations have remained low

### U.S. distillate inventories

**Million barrels**

- 2000: 100
- 2005: 120
- 2010: 150
- 2015: 120

**Sources:** EIA, API Monthly Statistical Report

### Ultra-low sulfur diesel (ULSD) prices

**2019$ per gallon**

- 2000: 1
- 2005: 2
- 2010: 3
- 2015: 2

**Sources:** EIA, CME Group, Bloomberg, BLS
Motor gasoline and diesel fuel prices have generally moved with crude oil, and EIA expects limited impact from IMO 2020

Crude oil, retail gasoline and diesel fuel prices, adjusted for consumer price inflation

sources: EIA, AAA, Bloomberg, BLS

EIA estimates
Natural gas
Global LNG prices have remained below historical levels as U.S. and Australian supply came on stream.

Global natural gas landed prices ($ per million Btu) – October 2019

- Mexico $5.26
- Canada $6.36
- Lake Charles $2.31
- Spain $5.17
- UK $5.16
- Belgium $5.99
- India $5.93
- Argentina $5.81
- Korea $6.11
- Japan $5.40
- China $6.11

Sources: U.S. FERC (Dec. 2019) and METI data for Oct.
Global natural gas supply has grown in tandem with GDP

Led by the U.S., Middle East and Russia, global natural gas supply grew on average at the same rate as global GDP between 2010 and 2018*

Global natural gas production versus GDP

Global natural gas production by country/region

*Market exchange rate basis. sources: EIA, BP Statistical Review, Bloomberg, IMF, API Team calculations
Solid domestic natural gas demand growth

- Although growth occurred in all regions in 2018, the Midwest and Gulf Coast regions led gas demand growth.
- Through the first three quarters of 2019, natural gas in power generation (+5.6% y/y) was the top end-use sector, followed closely by natural gas use by industry (+1.9% y/y).

2018 natural gas demand by PADD (y/y%)

- PADD 5: 4.1%
- PADD 4: 8.0%
- PADD 3: 12.5%
- PADD 2: 15.4%
- PADD 1: 9.8%

2019 U.S. natural gas demand by sector (bcf/d)

- Electric Power: 31.5
- Industrial: 30.0
- Residential: 12.5
- Commercial: 9.0
- Vehicles: 0.1

Source: EIA
As winter has approached, U.S. propane stocks have risen

- The U.S. has appeared well supplied for winter, with propane inventories up since 2018 and near the top of the 5-year range in all but PADD 5, but local infrastructure limited supply in some locations.
- Inventories grew through August in most regions with exception of the West Coast (PADD 5).

### 2019 U.S. propane inventories share by PADD (Jan.-Aug. 2019, %)

- PADD 3: 65.4%
- PADD 1: 7.1%
- PADD 2: 24.3%
- PADD 4: 1.8%
- PADD 5: 1.4%

### 2019 Propane inventories by PADD (Jan.-Aug. 2019, y/y%)

- PADD 5: -12.7%
- PADD 4: 8.2%
- PADD 2: 9.5%
- PADD 1: 25.5%
- PADD 3: 51.7%

Source: EIA
Solid productivity and cost-effective production support continued U.S. natural gas production growth

- BTU Analytics estimates breakeven prices among major natural gas-producing regions range from $1.34 per million Btu (mmBtu) to $3.02 per mmBtu

Breakeven prices for selected gas plays – Nov. 2019*

<table>
<thead>
<tr>
<th>Region</th>
<th>Nov. 2019</th>
<th>Nov. 2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haynesville</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appalachia - Northeast PA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appalachia - Southwest PA</td>
<td></td>
<td></td>
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<tr>
<td>Appalachia - Ohio</td>
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</tr>
</tbody>
</table>

*Half cycle breakevens assuming 10% discount factor and play-specific costs

source: BTU Analytics

U.S. natural gas productivity – new production per rig

U.S. natural gas production has become increasingly concentrated among top producing states

The top eight gas-producing states showed strong growth through the first three quarters of 2019

2019 U.S. natural gas production, share by state (%)

- Pennsylvania: 19.4%
- Texas: 24.6%
- Louisiana: 8.7%
- Ohio: 7.2%
- West Virginia: 5.8%
- Colorado: 4.1%
- New Mexico: 2.6%
- Other & Offshore: 7.0%
- Arkansas: 1.5%
- Wyoming: 2.4%

2019 natural gas production, change by state (y/y%)

- Pennsylvania: 19.4%
- Texas: 24.6%
- West Virginia: 20.1%
- Louisiana: 13.2%
- Ohio: 11.5%
- West Virginia: 20.1%
- Montana: 4.4%
- North Dakota: 23.1%
- Wyoming: +11.4%
- Utah: -7.4%
- Colorado: 8.7%
- Kansas: -7.3%
- New Mexico: 21.9%
- Oklahoma: 9.7%
- Alaska: 9.8%
- Texas: 14.1%
- Louisiana: 13.2%
- Alaska: -2.7%
Bakken 0.3 bcf/d of pipeline capacity expansions are expected by the end of 2019 (Q4 19 vs. Q4 18)

- About half of Northern Border Pipeline’s 2.4 bcf/d of capacity serves the Bakken, while the remainder and most Alliance Pipeline capacity transports Canadian gas, resulting in a relatively tight natural gas supply/demand balance for the Bakken region.

- Gas processing capacity has expanded, helping to move supply to market in different forms.

Bakken – natural gas pipelines

Bakken gas pipeline utilization
Billion cubic feet per day (bcf/d)

- North Bakken Expansion
- Demicks Lake to Northern Border Pipeline
- Current Bakken egress on Northern Border and Alliance pipelines
- Demand
- Production

Sources: RBN Energy, EIA, Bloomberg
Permian Basin 5.0 bcf/d of new pipeline capacity additions are expected by the end of 2019 (Q4 19 vs. Q4 18)

The project slate suggests relief for bottlenecks by late 2019, but not all projects shown are likely to be constructed.

Permian Basin – natural gas pipeline expansions

Permian Basin gas pipeline utilization

Permian gas pipeline utilization

source: Permian Texans for Natural Gas
Bloomberg anticipates about 25 bcf/d of new North American export capacity by 2030

North American LNG projects

<table>
<thead>
<tr>
<th>Plant name</th>
<th>Bloomberg view of likelihood</th>
<th>Final Investment Decision (FID) Status</th>
<th>2030 capacity (Bcf/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corpus Christi Mod. 1-7</td>
<td>Unlikely</td>
<td>Under regulatory review</td>
<td>3.0</td>
</tr>
<tr>
<td>Plaquemines Mod. 1-20</td>
<td>Unlikely</td>
<td>Planning FID</td>
<td>2.6</td>
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<tr>
<td>Freeport LNG Train 4</td>
<td>Unlikely</td>
<td>Planning FID</td>
<td>0.7</td>
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<tr>
<td>Alaska LNG</td>
<td>Unlikely</td>
<td>Planning FID</td>
<td>2.6</td>
</tr>
<tr>
<td>Lake Charles</td>
<td>Unlikely</td>
<td>Planning FID</td>
<td>2.0</td>
</tr>
<tr>
<td>Delfin FLNG</td>
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<td>Planning FID</td>
<td>1.7</td>
</tr>
<tr>
<td>Kitimat LNG</td>
<td>Unlikely</td>
<td>Planning FID</td>
<td>1.3</td>
</tr>
<tr>
<td>Goldboro LNG</td>
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<td>1.3</td>
</tr>
<tr>
<td>Rio Grande LNG Tr. 3-6</td>
<td>Unlikely</td>
<td>Under regulatory review</td>
<td>2.4</td>
</tr>
<tr>
<td>Monkey Island (SCT&amp;E)</td>
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<td>Under regulatory review</td>
<td>1.6</td>
</tr>
<tr>
<td>Port Arthur LNG</td>
<td>Likely</td>
<td>Planning FID</td>
<td>1.8</td>
</tr>
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<td>LNG Canada Tr. 3-4</td>
<td>Likely</td>
<td>Planning FID</td>
<td>1.6</td>
</tr>
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<td>Magnolia LNG</td>
<td>Likely</td>
<td>Planning FID</td>
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<td>Rio Grande LNG Tr. 1-2</td>
<td>Likely</td>
<td>Planning FID</td>
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</tr>
<tr>
<td>Driftwood</td>
<td>Likely</td>
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<tr>
<td>Texas LNG</td>
<td>Likely</td>
<td>Planning FID</td>
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<tr>
<td>Calcasieu Pass</td>
<td>Highly Likely</td>
<td>FID taken</td>
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<td>LNG Canada Tr. 1-2</td>
<td>Likely</td>
<td>FID taken</td>
<td>1.6</td>
</tr>
<tr>
<td>Woodfibre LNG</td>
<td>Likely</td>
<td>FID taken</td>
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<tr>
<td>Sabine Pass Tr. 6</td>
<td>Likely</td>
<td>Under construction</td>
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</tr>
<tr>
<td>Golden Pass</td>
<td>Likely</td>
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<tr>
<td>Corpus Christi Tr. 1-3</td>
<td>In operation/definite</td>
<td>Operational (T1); Under construction (T2-3)</td>
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<td>Elba Island</td>
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<td>Freeport LNG Tr. 1-3</td>
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<td>Operational (T1-2); Under construction (T3)</td>
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<td>Operational (T1); Under construction (T2-3)</td>
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<td>Cove Point</td>
<td>In operation/definite</td>
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<td>Sabine Pass Tr. 1-5</td>
<td>In operation/definite</td>
<td>Operational</td>
<td>3.6</td>
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</table>

source: Bloomberg New Energy Finance (Dec. 2019), amended for Sabine Pass T6 FID; Golden Pass construction; Port Arthur regulatory approval and commercial HOA with Saudi Aramco; and, Cameron and Freeport T1 completions
Furthering the U.S. energy revolution will require industry leadership to achieve unprecedented mega-project execution

- Outside of steel tariffs, cost escalation has been modest with the first wave of mega-projects
- With a mounting project queue, active cost containment measures historically have been key to project execution and could be critical to advance the U.S. energy revolution

U.S. existing and proposed LNG export projects

Cost containment measures

- Advance workforce planning/training
- Contracting strategy to promote competition, including
  - Well-defined work packages
  - Global project management
  - Diverse sourcing/procurement
  - Yard selection/supervision
  - Construction management
  - Flexible contract types (reimbursable, lump-sum, or hybrid)
- Consideration of alternate delivery models, including modularization, mid-scale LNG, Floating LNG
Resources: Chief Economist's section at www.api.org