Key points

Economy

- Before possible implications of Russia’s war on Ukraine, the economic consensus expected global GDP growth could slow as stimulus efforts wear off
  - Consensus expectations call for GDP growth in 2022 and 2023 above its historical average level, but slowing each year and decelerating in two-thirds of the world by 2024
  - Uncertainties: geopolitics, price inflation, U.S. dollar exchange value, global debt

- Precursors for oil & natural supply growth have begun to appear, but it could take time for supply to catch up with demand that’s grown with the economy
  - Industry capital investment of $56 billion in Q4 2021, up by 32.5% from Q3 2021

Oil

- Global oil demand of nearly 100 million barrels per day (mb/d) in Q1 2022 and projected to grow to a record-high 104 mb/d at the end of 2023 per EIA

- Supply challenges could remain
  - EIA assumes 2022 Non-OPEC production growth nearly equal to global demand growth, yet OPEC (+2.6 mb/d) and Russia (+0.9 mb/d) add supplies that remain uncertain
  - EIA estimates that Q1 2022 U.S. rig productivity decreased as drilling increased

Natural gas

- As global natural gas prices remained at unprecedentedly high prices, nearly 9 bcf/d of potential US LNG export capacity awaits FERC/DOE approvals

- Appalachia and Permian production require additional pipelines to support growth

Fourth quarter 2021 by the numbers

Benchmark price averages

- Brent crude oil: $79.59 per barrel
- WTI crude oil: $77.45 per barrel
- NGL composite: $11.52 per mmBtu
- Natural gas (Henry Hub): $4.77 per mmBtu

U.S. petroleum demand
- 20.5 mb/d

U.S. drilling activity
- 614 rigs

U.S. refinery throughput
- 15.9 mb/d

U.S. oil & gas production
- 33.5 mb/oe

Revenues
- $806 B

Net income
- $75 B

Capital expenditures
- $56 B

Financial compilation based on API 200 companies with shares listed on U.S. stock exchanges. Sources: EIA; API Monthly Statistical Report; Bloomberg and company reports; Baker Hughes; API Team analysis.
Key implications – Q1 2022

For consumption
- Historically a combination of oil demand outpacing supply, lower inventories and higher imports has been a recipe for upward price pressure.
- Although a common question recently has been the fuel prices at which consumers could alter their consumption behavior, this must be considered in context with broader price inflation at its highest in 40 years.
- Prior to recent geopolitical events, elevated price inflation including but not limited to energy adversely impacted consumers and their measured sentiment, which historically has been a leading economic indicator.

For production
- Although U.S. and international drilling activity accelerated, it remained significantly below its 2019 levels. More drilling activity is likely to be needed given EIA’s estimated decrease in rig productivity and reduced inventories of drilled but uncompleted wells.
- Work force, supply chain, financial and policy uncertainties muted the historical drilling response to prices and raised industry cost escalation.
- Additional infrastructure is still needed to support production growth, especially for natural gas.

For economics and energy policies
- As stakes for economic and energy security of the U.S. and its allies have risen, explicitly pursue policies that support production, pipeline infrastructure, and trade.
In Q4 2021, industry capital expenditures rose by 32.5% q/q to $56 billion, but the backlog of U.S. projects under construction decreased.

- The industry invested $56.3 billion in Q4 2021, compared with $71.0 billion in the same quarter of 2019.
- Across the energy value chain, API is monitoring 114 oil & gas-related projects currently under construction worth $138 billion.

### Capital expenditures by industry segment

<table>
<thead>
<tr>
<th>Industry Segment</th>
<th>Capital Expenditures (Billion dollars)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downstream and Petrochemical</td>
<td>100</td>
</tr>
<tr>
<td>Equipment &amp; Services</td>
<td>90</td>
</tr>
<tr>
<td>Midstream</td>
<td>70</td>
</tr>
<tr>
<td>Global integrated</td>
<td>50</td>
</tr>
<tr>
<td>Upstream</td>
<td>40</td>
</tr>
</tbody>
</table>

### $138 billion in current U.S. energy infrastructure investments

- 5 LNG: $37 B
- 14 PetChem: $21 B
- 28 Refinery expansions: $26 B
- 57 Pipelines: $24 B
- 10 Facilities (Terminals, Storage): $144 M

Across the energy value chain, API is monitoring 114 oil & gas-related projects currently under construction worth $138 billion. Sources: S&P Market Intelligence; Oil & Gas Journal; American Chemistry Council; API Team calculations as of Mar. 2022.

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* All other oil & gas industry companies
Source: Bloomberg; publicly-available company reports; BLS
Global drilling activity has lagged its levels in 2019 and its historical responsiveness to prices

- In Feb. 2022, global oil & gas drilling activity was down by 38% compared with Feb. 2019. Changes vs. 2019 by segment:
  - U.S. oil drilling (-39%)
  - International oil drilling (-22.4%)
  - U.S. natural gas drilling (-34.5%)
  - International natural gas drilling (-13.5%)

Global oil drilling activity and Brent crude oil prices, monthly

sources: Baker Hughes; Bloomberg; CME Group
Global Economy
World Economic Outlook

- 2022 global economic growth is projected to remain **above its long-run average**, but has been **downgraded due to elevated price inflation** that could persist longer than expected in the Oct. 2021 WEO

- **Key assumption changes**: No Build Back Better package; earlier withdrawal of monetary stimulus; and continued supply chain shortages

- “**Risks to the global outlook are tilted to the downside**….supply chain disruptions, energy price volatility, and localized wage pressures mean uncertainty around inflation and policy paths is high.”

Effects of suppressed interest rates on corporate investment

- Unconventional monetary policy could have **diminished effects on corporate investment in an economy with many highly indebted companies**

- Corporate finance analysis based on Japan’s experience suggests that **healthy firms increase investment** in response to low long-term interest rates, but highly indebted companies generally respond to monetary easing with financial restructuring that takes advantage of low long-term interest rates **without increasing investment**

Oil Market Report, February 2022

- “Despite higher demand and the recurring failure of OPEC+ to meet its targets, the market is still set to shift to surplus in 2022.”

- “If the persistent gap between OPEC+ output and its target levels continues, supply tensions will rise, increasing the likelihood of more volatility and upward pressure on prices. But these risks, which have broad economic implications, could be reduced if producers in the Middle East with spare capacity were to compensate for those running out.”

### Total debt to capital (%)

<table>
<thead>
<tr>
<th>Category</th>
<th>Q3 2021</th>
<th>Q4 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>International diversified E&amp;Ps</td>
<td>57.9</td>
<td>57.1</td>
</tr>
<tr>
<td>N. Am. Independent E&amp;Ps</td>
<td>56.1</td>
<td>48.6</td>
</tr>
<tr>
<td>Appalachia nat. gas producers</td>
<td>57.7</td>
<td>41.2</td>
</tr>
<tr>
<td>U.S. natural gas producers</td>
<td>51.2</td>
<td>47.8</td>
</tr>
<tr>
<td>N. Am. Diversified oil &amp; gas prod</td>
<td>50.0</td>
<td>40.7</td>
</tr>
<tr>
<td>Canada natural gas producers</td>
<td>26.0</td>
<td>22.1</td>
</tr>
</tbody>
</table>

Source: Bloomberg (Feb. 2022)

International Monetary Fund, Jan. 2022

Oil Market Report, February 2022

International Energy Agency, Feb. 2022

Hong, Igan, and Lee, Bank for International Settlements, Jan. 2022

American Petroleum Institute
Consensus expectations are for above-average growth in 2022, but slower and relatively weaker U.S. growth through 2024

- As stimulus efforts wear off, the consensus expects economic slowing through 2024
- U.S. growth exceeded global growth in 2021, could be similar to it in 2022, but is expected to slow thereafter
- Historically, U.S. outperformance vs. global growth corresponded with a stronger U.S. dollar foreign exchange rate and lower crude oil prices. 2021 produced the opposite: a weaker dollar and higher oil prices

### Real GDP growth*

<table>
<thead>
<tr>
<th>Year</th>
<th>Global</th>
<th>U.S.</th>
<th>Average 2001-2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>5.2%</td>
<td>5.5%</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>4.0%</td>
<td>5.5%</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td>3.8%</td>
<td>4.5%</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td>3.2%</td>
<td>3.4%</td>
<td></td>
</tr>
</tbody>
</table>

* Market exchange rate basis aggregated for 204 countries, compiled Mar. 4, 2022

### Percent of countries globally with increased growth

<table>
<thead>
<tr>
<th>Year</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>91%</td>
<td>55%</td>
<td>45%</td>
<td>34%</td>
</tr>
</tbody>
</table>

### Relative U.S. economic performance

- **U.S. dollar exchange value** (y/y%, 2006-2021)
- **Brent crude oil prices** (y/y%, 2006-2021)

Sources: IMF; Bloomberg; Federal Reserve
Although price inflation has broadly been expected to ease, energy industry and commodity price escalation have remained protracted.

Compared with the same month in 2019, input prices for several U.S. energy industry segments – as well as energy prices facing U.S. households – continued to rise at multiples above the rate of consumer price inflation in Q1 2022.

### Global consumer price inflation

<table>
<thead>
<tr>
<th>Year</th>
<th>World</th>
<th>Advanced economies</th>
<th>U.S.</th>
<th>Emerging economies</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### U.S. producer price inflation

Percentage change, Jan. 2022 vs. Jan 2019

<table>
<thead>
<tr>
<th>Industry</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>NGL extraction</td>
<td>59</td>
</tr>
<tr>
<td>Petroleum refining</td>
<td>57</td>
</tr>
<tr>
<td>Oil &amp; gas extraction</td>
<td>40</td>
</tr>
<tr>
<td>Natural gas distribution</td>
<td>39</td>
</tr>
<tr>
<td>Chemical mfg.</td>
<td>16</td>
</tr>
</tbody>
</table>

### U.S. consumer energy price inflation

Percentage change, Jan. 2022 vs. Jan 2019

<table>
<thead>
<tr>
<th>Energy Type</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor fuels</td>
<td>44</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>30</td>
</tr>
<tr>
<td>Propane</td>
<td>29</td>
</tr>
<tr>
<td>Natural gas</td>
<td>25</td>
</tr>
<tr>
<td>Electricity</td>
<td>13</td>
</tr>
</tbody>
</table>

Americans have assumed more debt, and broad recent price increases have not (yet) corresponded with increased delinquencies.

- Energy has historically been a source of lower consumer expenditures that benefitted households across income levels.
- Increased healthcare, housing, and transportation expenditures have generally risen the most among low-income households.
- Consumer debt has risen over time (including by more than 10% in 2019-2020) but delinquencies on credit cards, auto loans, and mortgages have remained low, thanks to low interest rates and pandemic-related assistance.

### Expenditure changes by income bracket, % change 2010-2020

<table>
<thead>
<tr>
<th>Category</th>
<th>Lowest 20%</th>
<th>Middle 20%</th>
<th>Highest 20%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>(32)</td>
<td>(37)</td>
<td>(43)</td>
</tr>
<tr>
<td>Food</td>
<td>4</td>
<td>(5)</td>
<td>(3)</td>
</tr>
<tr>
<td>Healthcare</td>
<td>53</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>Housing</td>
<td>20</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Transport</td>
<td>28</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

### 2022 Household stress indicators

- Total debt held vs. share 90+ days delinquent
- Expenditure changes by income bracket, % change 2010-2020
- Trillion dollars

Sources:
- Bureau of Labor Statistics
- New York Fed Consumer Credit Panel/Equifax
Gasoline prices have historically reflected those of oil, which remained relatively low since 2015 but recently climbed to their highest levels since 2014.

Refiner acquisition cost of crude oil prices versus U.S. average gasoline prices, adjusted for price inflation.

Dollars per gallon (2022$)

Refiner acquisition cost of crude oil (EIA)
U.S. avg. gasoline price (AAA, regular gasoline)

Sources: Bloomberg; EIA; AAA; Bureau of Labor Statistics; API Team analysis.
Oil Markets
Global oil demand could achieve a record high in 2023 per EIA

EIA expects record-high global oil demand 102.6 mb/d in 2023, exiting the year at 104 mb/d in Dec. 2023

Global oil demand and GDP
Million barrels per day

*Market exchange rate basis
sources: EIA; Bloomberg; IMF; API Team calculations
EIA expects global oil production to sustain record high levels over 102 mb/d beginning in the second half of 2022, rising as high as 104 mb/d in late 2023.

- EIA projects 2022 Non-OPEC production growth nearly equal to global demand growth, and for OPEC (+2.6 mb/d) and Russia (+0.9 mb/d) to bring additional supplies, which remain uncertain.

Global oil production

- Million barrels per day

EIA global oil supply/demand annual changes

<table>
<thead>
<tr>
<th>Year</th>
<th>Global demand</th>
<th>Global production</th>
<th>Non-OPEC production</th>
<th>OPEC production</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>5.2</td>
<td>1.7</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>2022</td>
<td>3.5</td>
<td>5.9</td>
<td>3.3</td>
<td>2.6</td>
</tr>
<tr>
<td>2023</td>
<td>1.9</td>
<td>2.1</td>
<td>1.7</td>
<td>0.4</td>
</tr>
</tbody>
</table>

source: EIA STEO (Mar. 2022)
EIA expects the global oil supply/demand balance to support prices of $105 per barrel in 2022 and $89 per barrel in 2023.
U.S. liquid fuels consumption could grow to record levels in 2023 per EIA

- High-frequency indicators of transportation and industrial activity continued to improve in early 2022
- EIA projects U.S. annual oil consumption growth of 4.4% (0.9 mb/d) y/y to 20.7 mb/d in 2022 and another 1.4% y/y (0.3 mb/d) to 21.0 mb/d in 2023, which could set a new record high


- Total Flights +22%
- Plastics & Rubber +2%
- Manufacturing +3%
- Apple Mobility +34%
- DAT Spot Load Posts +18%

**U.S. liquid fuel consumption by fuel**

- Motor gasoline
- Distillates/diesel fuel
- Jet fuel
- Residual fuel oil
- Other (naphtha/gasoil; HGLs)

Sources: EIA; API MSR

Sources: FlightRadar24, FRB, Apple; DAT Trendlines

EIA estimates
U.S. oil production has sustained solid levels despite historically low drilling activity, and growth likely requires greater drilling activity.

- U.S. oil drilling in March 2022 remained nearly 40% lower than its level at the same point in 2019.
- With historically low drilling, the inventory of drilled but uncompleted wells has helped to sustain oil production.

U.S. oil drilling and production

- **Rigs Million barrels per day**
- **U.S. crude oil production**
- **U.S. oil rig count**

Sources: EIA; API; Baker Hughes
As U.S. oil well productivity fell in Q1 2022 per EIA, breakeven prices were mixed among regions by BTU Analytics’ estimates

- EIA estimated oil well productivity fell in the Permian (-22% y/y), Bakken (-24% y/y) and DJ Niobrara (-24% y/y) as of March 2022
- BTU Analytics’ estimated breakeven prices rose in four of the major oil basins but remained well below recent market prices

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Bakken</th>
<th>Permian</th>
<th>Eagle Ford</th>
<th>DJ Niobrara</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2017</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>2018</td>
<td>2.5</td>
<td>1.5</td>
<td>0.8</td>
<td>0.4</td>
</tr>
<tr>
<td>2019</td>
<td>2</td>
<td>1.5</td>
<td>0.5</td>
<td>0.3</td>
</tr>
<tr>
<td>2020</td>
<td>1.5</td>
<td>1.2</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>2021</td>
<td>1</td>
<td>1</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>2022</td>
<td>0.5</td>
<td>0.7</td>
<td>0.1</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Oil estimated breakeven prices*

- Bakken: Jan. 2022 - $70/Bbl, Jan. 2021 - $60/Bbl
- Eagle Ford - West: $60/Bbl
- Eagle Ford - East: $50/Bbl
- DJ Niobrara: $55/Bbl
- Permian - Delaware: $65/Bbl
- Permian - Midland: $70/Bbl

*Half cycle breakevens assuming 10% discount factor. Sources: BTU Analytics; CME Group

WTI month-ahead futures price $94.35/Bbl, Mar. 15, 2022
Drilled but uncompleted wells (DUCs) have contributed significantly to Permian and other oil production, but relatively fewer remain. By contrast, natural gas drilling has not relied as heavily on DUCs, so relatively more drilling is required to increase production. Nationwide, above one in five well completions in Feb. 2022 were from the inventory of DUCs, down from 31% in 2021 (EIA).
With Permian oil pipeline capacity expansions, the basin appears well positioned to support production growth

- Permian oil production rose to 5.3 mb/d in Dec. 2021 per EIA
- Despite some pipeline delays and cancellations in 2020-2021, Permian oil pipeline capacity rose about 40% in 2021

Permian oil pipeline infrastructure

Permian Basin pipeline capacity balance

Million barrels per day (mb/d)

<table>
<thead>
<tr>
<th>Year</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td></td>
</tr>
<tr>
<td>2023</td>
<td></td>
</tr>
<tr>
<td>2024</td>
<td></td>
</tr>
</tbody>
</table>

sources: EIA; PennWell; National Geographic ESR; Garmin; HERE; UNEP; USGS; WCMC; NASA; ESA

Permian oil pipeline infrastructure

Refining capacity
- Centurion
- WA Line and Line 0
- Centurion
- WA Line and Line 0
- Basin
- Amdel
- Longhorn
- Midland-ECHO 1
- Midland-ECHO 2
- Cactus
- Midland-ECHO 3
- Permian Express II
- Permian Express III
- Longview
- Permian Express IV
- Cactus II
- Wink-to-Webster
- Gray Oak
- Seahorse
- Jupiter
- Production (EIA)
- Borger Express
- Rail capacity

sources: HSB Solomon; Rystad; Bloomberg; EIA
Bakken oil production pipeline capacity has appeared to be ample for historical production, which has remained down since the 2020 COVID-19 recession.

- In 2021, Bakken oil production of 1.1 mb/d remained down by 21.1% compared with its 2019 average level per EIA.
- Bakken oil production, which has historically been diverse in source location and refinery markets served, has depended on crude-by-rail in addition to pipelines.

### Bakken oil production pipeline capacity has appeared to be ample for historical production, which has remained down since the 2020 COVID-19 recession.

- In 2021, Bakken oil production of 1.1 mb/d remained down by 21.1% compared with its 2019 average level per EIA.
- Bakken oil production, which has historically been diverse in source location and refinery markets served, has depended on crude-by-rail in addition to pipelines.

### Bakken oil pipeline infrastructure

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

### Bakken pipeline capacity balance

**Million barrels per day (mb/d)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Refinery capacity</th>
<th>Enbridge Line 26</th>
<th>Enbridge Line 83</th>
<th>MPC High Plains</th>
<th>ET DAPL</th>
<th>TC Upland</th>
<th>Production (EIA; Rystad)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.1 mb/d</td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.1 mb/d</td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.1 mb/d</td>
</tr>
<tr>
<td>2022</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td>1.1 mb/d</td>
</tr>
<tr>
<td>2023</td>
<td></td>
<td></td>
<td></td>
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<td>1.1 mb/d</td>
</tr>
<tr>
<td>2024</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.1 mb/d</td>
</tr>
</tbody>
</table>

**Sources:** HSB Solomon, Bloomberg, EIA

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**American Petroleum Institute**
Natural Gas
Historically strong global natural gas prices have spurred U.S. natural gas exports.

As natural gas prices in Europe and Asia rose to unprecedented levels, U.S. natural gas exports via liquefied natural gas (LNG) and pipelines have achieved record levels.

### Global Natural Gas Prices

- **Asian Benchmark (JKM)**
- **Henry Hub**
- **UK Benchmark (NBP)**
- **Dutch Benchmark (TTF)**

Historically strong global natural gas prices have spurred U.S. natural gas exports via liquefied natural gas (LNG) and pipelines have achieved record levels.

### U.S. Natural Gas Exports

- **U.S. Pipeline Natural Gas Exports**
- **U.S. LNG Exports**

EIA estimates
EIA expects LNG exports to drive U.S. natural gas production growth

- In 2022, EIA expects natural gas production growth of 3.1 bcf/d and 2.6 bcf/d higher net exports
- U.S. LNG export capacity could more than double by 2030 if permits and construction are able to proceed on a timely basis

### Natural gas consumption and production by sector

<table>
<thead>
<tr>
<th>Sector</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry natural gas production</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Net Exports</td>
<td>13.2</td>
<td>14.3</td>
<td></td>
</tr>
<tr>
<td>Electric Power</td>
<td>30.1</td>
<td>29.9</td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>28.7</td>
<td>29.0</td>
<td></td>
</tr>
<tr>
<td>Res / Comm</td>
<td>22.9</td>
<td>22.4</td>
<td></td>
</tr>
</tbody>
</table>

EIA estimates

### North American LNG projects

- Definite / Highly Likely
- Potential
- Approved, not yet under construction
- Await FERC/DOE permits
- Construction starts Apr. 2022

sources: API Team analysis; FERC; Bloomberg NEF; S&P Global Platts; O&G Journal
Ethane has been the largest growing component of natural gas liquids production, and prices for it approached $0.40 per gallon in Q1 2022 – roughly 22% over its value if left in the natural gas stream – providing incentive to extract it

As NGL prices have risen with crude oil since 2020, the relative value of propane and the economic incentive to extract ethane have both increased

Ethane, propane and Brent crude oil prices

2022$ per gallon

- Ethane
- Brent crude oil
- Propane
- Ethane value if kept in natural gas

sources: Bloomberg and API Team calculations
U.S. natural gas production could be challenged to grow unless drilling activity accelerates from its historic lows.

U.S. natural gas marketed production rose by 6.4% (6.3 bcf/d) y/y to 103.9 bcf/d in Q1 2022 and is expected by EIA to grow in 2022 and 2023 despite historically low drilling activity.

U.S. natural gas drilling and production

Sources: EIA; Baker Hughes
Natural gas drilling sustained historically low breakeven prices per BTU Analytics, and rig productivity remained relatively solid in Q1 2022 per EIA

- Estimated natural gas breakeven prices remained well below recent natural gas futures prices
- For dedicated dry gas drilling, rig productivity slipped by less than 10% y/y as drilling activity expanded

### Natural gas estimated breakeven prices

<table>
<thead>
<tr>
<th>Region</th>
<th>2022 Breakeven Price</th>
<th>2021 Breakeven Price</th>
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<tbody>
<tr>
<td>Appalachia - NE PA</td>
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<tr>
<td>Appalachia - SW PA</td>
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<tr>
<td>Appalachia - OH</td>
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</tbody>
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*Half cycle breakevens assuming 10% discount factor and play-specific costs

Source: BTU Analytics; CME Group

### Natural gas well productivity – production per rig

- Henry Hub futures price for delivery one month ahead: $4.48 per mmBtu (Mar. 15, 2022)

Source: EIA Drilling Productivity Report (Feb. 2022)
Greater Appalachian natural gas infrastructure could become essential by 2024

- Appalachia natural gas production grew by 2.8% in 2020, 5.2% in 2021 and at an estimated annualized pace of 2.8% in Q1 2022 per EIA.
- EIA and Rystad Energy project that Appalachian natural gas production could decrease in 2022.

Appalachian natural gas infrastructure

sources: EIA; PennWell; National Geographic ESR, Garmin; HERE; UNEP; USGS; WCMC; NASA; ESA

Appalachian Basin gas pipeline capacity utilization

- Billion cubic feet per day (bcf/d)
- NEP Xpress
- Dominion Hub
- ET Rover
- ANR GC
- Eqt System
- Adelphia
- Flows to Canada

sources: EIA; HSB Solomon; Rystad; API Team analysis

- TX Eastern TEAL
- KM Rex 2
- Leach Xpress
- Columbia Gas Trans
- National Fuel Gas
- PennEast
- Production (EIA)
Bakken natural gas pipeline capacity has historically matched well with production and appeared ample relative to recent changes.

Bakken natural gas pipeline infrastructure

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

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

sources: EIA; Rystad; EnSys; API Team analysis
Additional Permian natural gas pipeline egress could be needed to support production growth as expected by EIA and Rystad Energy

With an estimated 6.1 bcf/d of Permian gas pipeline capacity by end of 2021, lines stand to benefit post-COVID from increased demand, dry exports to Mexico, and LNG exports via the Gulf to emerging markets.

Permian natural gas pipeline infrastructure

Permian Basin gas pipeline capacity utilization

Billion cubic feet per day (bcf/d)

Permian Basin gas pipeline capacity utilization

2019 2020 2021 2022 2023 2024

Demand
EPNG
Impusora
Red Bluff
Oneok West Tex
Gemini
Transwestern
Permian-Katy

NNG
Corpus Christi
Roadrunner
ET Fuel/Enterprise
Gulf Coast Express
Permian Highway
Atmos
Production (EIA; Rystad)

NGPL
Coastal Bend
KM Texas
Enterprise/DCP
Flows to Mexico
Whistler
Oasis

Sources: HBS Solomon EIA; Rystad

Permian natural gas pipeline infrastructure

Sources: EIA, PennWell, National Geographic, ESRI, Garmin, HERE, UNEP, USGS, WCMC, NASA, ESA and API Team analysis
API economics resources available at www.api.org