Key points

**Economy.** The IMF and Bloomberg consensus expects sustained global economic growth near its long-term average rate, despite slowing in the U.S. and Europe
- U.S. interest rate hikes intended to slow price inflation and demand are in contrast with continued supply-side constraints
- U.S. dollar appreciation to record-highest presents global financial risks and opportunities
- Amid myriad uncertainties, even weak global growth has historically required more energy over time

**Oil.** Recurrent themes from previous quarters have remained germane
- Global oil demand expected to reach a record-high 101.5 mb/d in 2023 per EIA
- Global oil & gas drilling activity was down by 21.5% in August 2022 compared with August 2019 per Baker Hughes
- Work force, supply chain, financial, and policy headwinds continued to hamper investment, drilling, production, and inventories
- Global investment and spare capacity could struggle to meet demand in 2023 per IEA, the KSA, and OPEC
- U.S. rig productivity slipped, and there was lower production from leveraging the inventories of previously drilled but uncompleted wells (DUCs)
- Inventories historically low in the U.S. and OECD

**Natural gas.** Global natural gas prices set new record highs, and U.S. spot prices at Henry Hub rose to their highest since 2008
- U.S. LNG exports could reach new record levels in 2023 per EIA

With the lowest SPR crude oil inventories since 1984 – and global inventories below their 5-year range – U.S. economic and energy security requires policies to support production, pipeline infrastructure, and trade

**Second Quarter 2022 by the numbers**

**Benchmark price averages**
- Brent crude oil: $112.85 per barrel
- WTI crude oil: $108.77 per barrel
- NGL composite: $11.95 per mmBtu
- Nat. gas (Henry Hub): $7.47 per mmBtu

**U.S. petroleum demand**
- 20.1 mb/d

**U.S. refinery throughput**
- 16.5 mb/d

**U.S. drilling activity**
- 713 rigs

**U.S. oil & gas production**
- 33.7 mb/doe

**Revenues**
- $1,078 B

**Net income**
- $140 B

**Capital expenditures**
- $53 B

Sources: EIA; API Monthly Statistical Report; Bloomberg and company reports; Baker Hughes; API Team analysis
Global energy needs have grown with economic activity in Q3 2022

In Q3 2022, the world will have consumed approximately 154,800,000,000,000 British thermal units of primary energy, nearly 85% of which was oil, natural gas and coal per EIA, including:

- 2,089,104,080 tons of coal
- 8,995,500,000 barrels of oil
- 36,730,668,068 thousand cubic feet of natural gas

Nearly 5X Russia’s natural gas production in 2021 per IEA

The U.S. Strategic Petroleum Reserve held the equivalents of 4.3 days of global oil consumption and 22 days of U.S. oil consumption as of Sep. 9 per EIA

Sources: EIA; IEA; IMF; Bloomberg; API Team calculations

* Market exchange rate basis
In Q2 2022, the natural gas and oil industry invested $51.6 billion, and the backlog of U.S. projects under construction increased.

- The industry invested $51.6 billion in Q2 2022, compared with $44.6 billion in Q2 2021.
- Across the energy value chain, API is monitoring 130 oil & gas-related projects currently under construction worth $158 billion.

### Capital expenditures by industry segment

**Billion dollars (2022$)**

- **Downstream and Petrochemical**
- **Midstream**
- **Equipment & Services**
- **Global integrated**

### $158 billion in current U.S. energy infrastructure investments

- **6 LNG**
  - **$80 B**
- **14**
  - **PetChem**
  - **$21 B**
- **23**
  - **Refinery expansions**
  - **$20 B**
- **80**
  - **Pipelines**
  - **$37 B**
- **7 Facilities**
  - **(Terminals, Storage)**
  - **$104 M**

**sources:** S&P Market Intelligence; Oil & Gas Journal; American Chemistry Council; API Team calculations as of Aug. 2022

*All other oil & gas industry companies sources: Bloomberg, publicly-available company reports, BLS
Global drilling activity has continued to lag its 2019 levels and historical response to prices

- In August 2022, global oil & gas drilling activity was down by 21.5% compared with Aug. 2019. Changes vs. 2019 by segment:
  - U.S. oil drilling (-21.0%)
  - International oil drilling (-19.2%)
  - U.S. natural gas drilling (-3.6%)
  - International natural gas drilling (-40.4%)

Global oil drilling activity and Brent crude oil prices, monthly

Real Brent crude oil futures prices (12-months ahead, 3-mo. avg.) right axis

Sources: Baker Hughes; Bloomberg; CME Group
Global Economy
What we’re watching now: Could above-average global growth be recessionary? Oil and natural gas demand have grown

Key themes this quarter are: 1) ongoing macroeconomic risks despite historically strong growth; 2) natural gas in high demand, requiring policy clarity for investment; and 3) upgrades to estimated global oil demand, amid low inventories

World Economic Outlook

• Global growth could slow to 3.2% y/y in 2022 and 2.9% y/y in 2023 – above its historical average rate despite prevalent downside risks
• China growth in 2022 3.3% y/y, 2023 4.6% y/y
• “Rising food and energy prices cause widespread hardship, famine, and unrest”
• “Tighter financial conditions could trigger debt distress in emerging and developing economies”
• “Global trade growth in 2022 and 2023 will likely slow” due to weakened demand, supply chain problems, and a strong U.S. dollar foreign exchange rate

Global Voice of Gas

• Austria, France, Germany and Italy indicated they will boost coal-fired power generation to mitigate risks of winter energy shortages. High gas prices are having similar effects in Asia
• Diesel generators account for more than 40% of total electricity consumed in West Africa.... businesses in countries like Nigeria are struggling to stay afloat. The rising cost of natural gas also makes utility-scale electricity generation much more expensive in markets like Ghana, Cote d’Ivoire, and Nigeria
• “EU policymakers need to avoid making contradictory and unreasonable [low] forecasts on the future role of natural gas...This mixed messaging risks deterring investment in needed natural gas supply and infrastructure”

Oil Market Report, August 2022

• Upgraded 2022 world oil demand growth to 2.1 mb/d from 1.7 mb/d to an average of 99.7 mb/d, plus another 2.1 mb/d in 2023 to 101.8 mb/d
• “Soaring oil use for power generation and gas-to-oil switching are boosting demand”
• Revised up their forecast for Russian oil output but lowered that for North America
• Global observed inventories fell by 5 mb in June, with a drawdown in both OECD and non-OECD stocks, partially offset by an increase in oil on water
The economic consensus expects sustained global economic growth near its long-term average rate, despite notable slowing in the U.S. and Europe.

- Global industrial production continued to improve through June 2022.
- Global GDP growth expectations to 2024 have remained over long-run historical averages and could be driven predominantly by China/developing Asia Pacific, N. America, and the European Union per the IMF and Bloomberg economic consensus.

**Global industrial production vs. GDP growth**

- Global industrial production (left) vs. Global GDP growth (right).

**Real GDP growth**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>2022</td>
<td>0 y/y%</td>
<td>2 y/y%</td>
<td>3 y/y%</td>
<td>0 y/y%</td>
<td>-4 y/y%</td>
</tr>
<tr>
<td>2023</td>
<td>0 y/y%</td>
<td>2 y/y%</td>
<td>3 y/y%</td>
<td>0 y/y%</td>
<td>-2 y/y%</td>
</tr>
<tr>
<td>2024</td>
<td>0 y/y%</td>
<td>2 y/y%</td>
<td>3 y/y%</td>
<td>0 y/y%</td>
<td>0 y/y%</td>
</tr>
</tbody>
</table>

**Bloomberg consensus’ contributions to GDP growth, 2022 to 2024**


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

Sources: IMF; Bloomberg; API Team calculations.

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Sources: Bloomberg Economics; CPB Netherlands Bureau for Econ. Policy Analysis.
Leading economic indicators showed relative U.S. weakness but China rebounded.

- U.S. consumer sentiment recently fell to historic lows, which indicated potential weakness in consumer spending, per the Univ. of Michigan’s survey.
- China’s GDP growth historically been driven by industrial production (and exports), and an indicator of production – the composite purchasing managers’ index – recently improved.

Key leading indicators, GDP drivers, and real growth in the U.S. and China

**United States: Consumer sentiment vs. spending**

- Index (1966 Q1=100)
- Univ. of Mich. consumer sentiment index (left)
- U.S. consumer spending (right)

**China: Purchasing Managers’ Index vs. industrial production**

- Diffusion index (values ≥50 show expansion)

Sources: BEA; OECD; Univ. of Michigan; China Federation of Logistics and Purchasing; Bloomberg
U.S. consumer health: diminished savings have not resulted in marked debt problems so far in 2022

- The personal savings rate has fallen to its lowest since 2010 from its extraordinary levels through the pandemic, but has remained above its minimum of the 2008-2009 Great Financial Crisis despite high recent price inflation.
- Loan delinquencies have remained historically low.

### Personal saving as a percent of personal income

![Chart showing personal savings rate from 2010 to 2022]

**Median, 2010-2021**

**Minimum of the Great Financial Crisis, 2008-2009**

**Source:** BEA

### Loan delinquencies of 90+ days, by type

![Chart showing loan delinquencies from 2010 to 2022]

**Percent of outstanding loans**

- Mortgages
- Auto loans
- Credit cards

**Sources:** New York Fed Consumer Credit Panel/Equifax
Strong U.S. dollar appreciation has fueled a record trade imbalance

- U.S. dollar appreciation makes U.S. goods and services imports less expensive and exports less competitive, which have historically corresponded with higher net imports.

- U.S. trade was at a record imbalance—an annual rate of over $1.5 trillion of net imports—in Q1 2022.

- With global uncertainties and Fed Funds rate increases since March 2022, the U.S. dollar appreciated to record-high levels despite the U.S. having been a petroleum net exporter through the first seven months of 2022.

**U.S. broad dollar exchange rate vs. net imports, Jan. 2006–Jul. 2022**

Sources: Federal Reserve Board; Bureau of Economic Analysis
Historically U.S. crude oil production growth has reduced imports and increased exports of crude oil and refined products.

- As U.S. crude oil production has grown, net imports of total petroleum (crude oil and refined products) have historically fallen.
- The U.S. became a petroleum net exporter in 2020 for the first time since 1958 – and with Russia’s war in Ukraine has seen record-high exports occur so far in 2022.
- U.S. crude oil production returned to over 12.0 mb/d in Q3 2022, but has remained below its highest level of 13.0 mb/d in Nov. 2019.
Global oil demand could achieve a record high in 2023 per EIA

- EIA expects record-high global oil demand 101.5 mb/d in 2023, exiting the year at 102.9 mb/d in Dec. 2023

**Global oil demand and GDP**

Million barrels per day

- 110

Real GDP (Trillion 2010$)

- 100
- 90
- 80
- 70
- 60
- 50
- 40

*Market exchange rate basis

sources: EIA; Bloomberg; IMF; API Team calculations
U.S. oil consumption has historically been an indicator of global oil consumption.

- Although U.S. oil consumption has generally been about one-fifth of global consumption, intertwined economic and trade relationships are such that U.S. oil consumption has historically correlated with that of the world.

- Excluding the 2020 COVID-19 pandemic, a 1.0% change in U.S. oil consumption last month has historically correlated with a 0.93% change in oil consumption by the rest of the world in the following month since 2010.
U.S. liquid fuels consumption could reach record levels in 2023 per EIA

- High-frequency indicators of transportation and industrial activity have remained solid.
- EIA projects U.S. annual oil consumption growth 2.6% (0.5 mb/d) y/y in 2022 and 1.7% y/y (0.4 mb/d) in 2023.

U.S. demand indicators, y/y%

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Aug. 2022 vs. Aug. 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Flights</td>
<td>+14%</td>
</tr>
<tr>
<td>Plastics &amp; rubber</td>
<td>+5.8%</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>+3.7%</td>
</tr>
<tr>
<td>Traffic volume</td>
<td>+2.8%</td>
</tr>
<tr>
<td>DAT spot Truck posts</td>
<td>+20.4%</td>
</tr>
</tbody>
</table>

U.S. liquid fuel consumption by fuel

- Million barrels per day
- EIA estimates

Sources: FlightRadar24; FRB; FHA; DAT Trendlines

Sources: EIA; API
EIA projects that the U.S. and OPEC could need to raise production further this year and in 2023 to meet global demand growth.

<table>
<thead>
<tr>
<th></th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEC</td>
<td>+4.4</td>
<td>+1.2</td>
</tr>
<tr>
<td>Russia</td>
<td>+2.3</td>
<td>+0.5</td>
</tr>
<tr>
<td>United States</td>
<td>+1.4</td>
<td>+1.2</td>
</tr>
<tr>
<td>Other Non-OPEC</td>
<td>+0.8</td>
<td>+0.9</td>
</tr>
</tbody>
</table>

Global oil production

- Million barrels per day
- EIA estimates (Aug. 2022)

Source: EIA
Oil and natural gas rig productivity has decreased by EIA estimates

- EIA estimated oil well productivity fell in the Permian (-15% y/y), Bakken (-27% y/y) and DJ Niobrara (-25% y/y) as of August 2022.
- For dedicated dry gas drilling, rig productivity slipped 13.3% y/y in August 2022 as drilling activity expanded per EIA.

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Permian</th>
<th>Bakken</th>
<th>Eagle Ford</th>
<th>DJ Niobrara</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>2018</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
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<tr>
<td>2019</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
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<tr>
<td>2020</td>
<td>2</td>
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<tr>
<td>2021</td>
<td>1</td>
<td>1</td>
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<td>1</td>
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<tr>
<td>2022</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Natural gas well productivity – production per rig

<table>
<thead>
<tr>
<th>Year</th>
<th>Haynesville</th>
<th>Appalachia</th>
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</thead>
<tbody>
<tr>
<td>2017</td>
<td>50</td>
<td>40</td>
</tr>
<tr>
<td>2018</td>
<td>45</td>
<td>35</td>
</tr>
<tr>
<td>2019</td>
<td>40</td>
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<td>2020</td>
<td>35</td>
<td>25</td>
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<tr>
<td>2021</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>2022</td>
<td>25</td>
<td>15</td>
</tr>
</tbody>
</table>
The inventory of drilled but uncompleted wells (DUCs) contributed to 2% U.S. well completions in August 2022, compared with over 19% in August 2021.

- Annually in 2021, 30% of U.S. well completions were from wells that were previously drilled but uncompleted (EIA).
- By contrast, only 2% of U.S. well completions relied on DUCs in August 2022 per EIA.

U.S. oil and natural gas well completions from DUCs, by basin in August 2022

Drilled by uncompleted wells, by basin

- **Oil basins**
  - Wells: 6,000
  - Bakken: 1%
  - Eagle Ford: 10%
  - Permian: 8%
  - DJ Niobrara: 0%
  - Anadarko: 5%
  - Haynesville: 0%

- **Natural gas basins**
  - Wells: 1,500
  - Appalachia: 0%
  - Haynesville: 0%

Source: EIA
Historically low oil inventories have persisted since 2021

- OECD and U.S. petroleum inventories – that is, combined crude oil and refined products, commercial and government-controlled – have remained below their respective five-year historical averages.
- Building of commercial inventories was more than offset by drawdowns of government-controlled inventories.

**OECD petroleum oil inventories, combined crude and products, commercial and government-controlled**

<table>
<thead>
<tr>
<th>Billion barrels</th>
<th>5-year range</th>
<th>2022</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>4.4</td>
<td>3.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Q2</td>
<td>4.2</td>
<td>3.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Q3</td>
<td>4.0</td>
<td>3.8</td>
<td>3.6</td>
</tr>
<tr>
<td>Q4</td>
<td>3.8</td>
<td>3.8</td>
<td>3.6</td>
</tr>
</tbody>
</table>

**U.S. petroleum inventories, combined crude and products, commercial and government-controlled**

<table>
<thead>
<tr>
<th>Billion barrels</th>
<th>5-year range</th>
<th>2022</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>2.4</td>
<td>1.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Q2</td>
<td>2.2</td>
<td>1.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Q3</td>
<td>2.0</td>
<td>1.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Q4</td>
<td>1.8</td>
<td>1.8</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Sources: Bloomberg; OPEC Argus; EIA; Eurolist; IEA; METI
Gasoline prices have historically reflected those of oil, which accounted for the majority of changes in gasoline and diesel fuel prices through the first seven months of 2022.

Crude oil has continued to represent upwards of 60% of the retail price at the gasoline pump in 2022 per EIA, but contributed 77% of the year-on-year increase in gasoline prices at the pump between January and July.

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

Dollars per gallon (2022$)

sources: Bloomberg; EIA; AAA; Bureau of Labor Statistics; API Team analysis
Motor gasoline fundamentals have similarly tightened so far in 2022

- In the first eight months of 2022, U.S. refinery motor gasoline production remained strong within its five-year range, and motor gasoline demand remained within the historical range.
- Motor gasoline exports rose markedly since January, and inventories fell to the bottom of their five-year range.
Distillates/diesel fuel fundamentals have generally tightened so far in 2022

- In the first eight months of 2022, U.S. refinery distillates’ production and consumption were solid within their five-year ranges.
- Distillate exports more than doubled between January and August, and inventories remained below their five-year range.

**Distillates production**
- Million barrels per day
- 5-year range, 2022, 2021

**Distillates demand**
- Million barrels per day
- 5-year range, 2022, 2021

**Distillates exports**
- Million barrels per day
- 5-year range, 2022, 2021

**Distillates inventories**
- Million barrels
- 5-year range, 2022, 2021

Sources: EIA; API MSR™
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, including nearly $100 per million Btu for Netherlands TTF as of Aug. 26, U.S. natural gas exports via liquefied natural gas (LNG) and pipeline have achieved record levels.
Global natural gas shortages, furthered by Russia’s war in Ukraine, have affected fertilizer production and food security.

“The short-term impact of reduced fertilizer consumption is the threat of a significant reduction in crop yields in the next harvest, prompting lower food production and ultimately increasing the number of people at risk of hunger and starvation.”

International Fertilizer Association, July 2022

Global population and fertilizer use

source: United Nations

IEA global natural gas consumption for non-energy use

source: IEA

2022 Unrealized imports of nitrogen-based fertilizers for the 2021-2022 crop year ended June 30, 2022

source: United Nations

-584 kt -1,500 kt

source: American Petroleum Institute
EIA expects natural gas production annual growth of 3.7 bcf/d in 2022 and 2023 could support more than 31% of U.S. electricity net generation and higher exports.

- EIA expects natural gas to represent more than 31% of U.S. net electricity generation despite increases by other sources.
- With committed capacity expansions, EIA expects U.S. LNG exports to grow by 2.4 bcf/d in 2023.

### Natural gas consumption and production, by sector

**Billion cubic feet per day**

<table>
<thead>
<tr>
<th>Sector</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Exports</td>
<td>11.8</td>
<td>14.4</td>
<td></td>
</tr>
<tr>
<td>Electric Power</td>
<td>32.1</td>
<td>31.0</td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>28.1</td>
<td>27.4</td>
<td></td>
</tr>
<tr>
<td>Res / Comm</td>
<td>23.3</td>
<td>23.3</td>
<td></td>
</tr>
</tbody>
</table>

**EIA estimates**

**Dry natural gas production**

Source: EIA (August 2022)

### North American LNG projects

**Billion cubic feet per day (bcf/d)**

Sources: API Team analysis; FERC; Bloomberg NEF; S&P Global Platts; O&G Journal

- Potential
- Definite/Highly Likely
Historically low natural gas inventories have spurred higher prices that EIA expect could persist through the 2022-2023 winter

- Natural gas net injections into underground storage were 3.8% above those last year as of early September per EIA, yet storage sits at the bottom of its five-year range and recent price increases.
- Natural gas prices through the value chain have risen so far through 2022, and EIA expects these changes to persist in 2023.

### U.S. Working Gas in Underground Storage

<table>
<thead>
<tr>
<th>Billion cubic feet</th>
<th>5-year range</th>
<th>2022</th>
<th>2021</th>
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<tbody>
<tr>
<td>3,500</td>
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<tr>
<td>2,500</td>
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<td>1,500</td>
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<tr>
<td>500</td>
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</tbody>
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### EIA Natural Gas Prices by End-Use Sector

- Henry Hub spot price
- Industrial
- Commercial
- Residential

Dollars per thousand cubic feet (2022$)

sources: EIA; EIA STEO (August 2022)
Global naphtha, crude oil and petrochemical prices have historically moved together, while those of ethane and propane have depended on both global petrochemical prices and regional market conditions.

In Q3 to date, lower ethylene prices and historically high ethane costs together resulted in negative margins per Bloomberg.

U.S. energy revolution challenge: ethylene spot margins turned negative for the first time since 2018 despite record-high ethane production in 2022 per Bloomberg.
API economics resources available at www.api.org