Energy Trade Dual Plenary Session
U.S. Association for Energy Economics

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1. The U.S. energy revolution has brought structural improvements in productivity that advanced economic and environmental progress

- **Strong production and productivity have underpinned abundant U.S. oil & gas supplies**
  - Refinery expansions have enabled the U.S. to become a global supplier of finished products
  - Record U.S. LNG exports have helped reduce global CO₂ emissions and contribute to lower global natural gas prices

2. An imminent milestone for U.S. energy net exports, but multiple uncertainties with USMCA, oil & gas exports (infrastructure, markets), Sec. 232 & 301 tariffs

- U.S. appeared to become an energy net exporter in September 2019 (per API Monthly Statistical Report estimates)
- Global planned refinery capacity additions
- U.S. gross crude oil exports
- U.S. existing and proposed LNG export projects
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 – Sept. 2019***

- **Eagle Ford - West**: Sept. 2019
- **Bakken**: Sept. 2018
- **Eagle Ford - East**: Sept. 2019
- **Permian - Delaware**: Sept. 2019
- **Permian - Midland**: Sept. 2019

| Area          | Breakeven ($/Bbl.) | WTI Spot Price
<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Eagle Ford - West</td>
<td>20</td>
<td>Sept. 2019</td>
</tr>
<tr>
<td>Bakken</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Eagle Ford - East</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Permian - Delaware</td>
<td>20</td>
<td>Sept. 2019</td>
</tr>
<tr>
<td>Permian - Midland</td>
<td>20</td>
<td></td>
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</tbody>
</table>

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

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

- **Eagle Ford**: 3,000 barrels per day oil-equivalent
- **Bakken**: 2,500 barrels per day oil-equivalent
- **Permian**: 2,000 barrels per day oil-equivalent

*Source: EIA Drilling Productivity Report*
As refineries have expanded, the U.S. has increasingly become a supplier of finished products to the world.

- Since 2010, U.S. refining capacity has increased 6.8% while throughput rose 11.7%, yielding world-leading capacity utilization rates.
- This growth has leveraged domestic crude oil – driving imports to 24-year lows and enabling petroleum exports to reach new records.

### U.S. petroleum refining

**Million barrels per day**
- **Gross inputs**
- **Operable capacity**

### U.S. petroleum imports

**Million barrels per day**
- **Crude oil**
- **Refined products**

### U.S. petroleum exports

**Million barrels per day**

**Sources:** EIA, API.
U.S. LNG exports have helped reduce global CO₂ emissions while bolstering global gas market depth and liquidity.

- Between 2014 and 2018, about 50% of U.S. LNG exports went to Asia and another 20% to Mexico.
- In 2019 so far, U.S. LNG exports have served 35 countries with roughly 40% going to Europe and another 35% to Asia despite China trade frictions.

**35 U.S. LNG export destinations in 2019**

(May year-to-date)

sources: EIA, API Team graphics
EIA expects the U.S. to become an energy net exporter this year

- The U.S. is already a net exporter of coal, natural gas and natural gas liquids, and EIA projects the U.S. will become a net exporter in 2019 of total energy (including oil)
- The turning point could be a decline in petroleum net imports, which averaged 1.2 mb/d through the first seven months of 2019 (API)

**Gross energy trade**

<table>
<thead>
<tr>
<th>Quadrillion Btu</th>
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<tbody>
<tr>
<td>35</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>25</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>15</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>0</td>
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</table>

**Energy net exports and imports**

<table>
<thead>
<tr>
<th>Quadrillion Btu</th>
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<tbody>
<tr>
<td>10</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>-5</td>
</tr>
<tr>
<td>-10</td>
</tr>
</tbody>
</table>

**Source:** EIA
Global refiners have expanded to meet demand growth

- Refining capacity has expanded in Asia, the Middle East and North America – and is expected to grow more than 7.0 mb/d by 2025

**Global refinery capacity**

<table>
<thead>
<tr>
<th>Year</th>
<th>Europe</th>
<th>Rest of World</th>
<th>North America</th>
<th>Middle East</th>
<th>Asia Pacific</th>
</tr>
</thead>
<tbody>
<tr>
<td>1970</td>
<td>25</td>
<td>45</td>
<td>5</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>1980</td>
<td>30</td>
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<td>2000</td>
<td>50</td>
<td>65</td>
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<td>90</td>
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<tr>
<td>2010</td>
<td>60</td>
<td>70</td>
<td>25</td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>

**Global planned refinery capacity additions**

<table>
<thead>
<tr>
<th>Year</th>
<th>Europe</th>
<th>Rest of World</th>
<th>North America</th>
<th>Middle East</th>
<th>Asia Pacific</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019</td>
<td>0.1</td>
<td>0.5</td>
<td>0.3</td>
<td>0.2</td>
<td>1.0</td>
</tr>
<tr>
<td>2021</td>
<td>0.2</td>
<td>0.6</td>
<td>0.4</td>
<td>0.3</td>
<td>1.2</td>
</tr>
<tr>
<td>2023</td>
<td>0.3</td>
<td>0.7</td>
<td>0.5</td>
<td>0.4</td>
<td>1.5</td>
</tr>
<tr>
<td>2025</td>
<td>0.4</td>
<td>0.8</td>
<td>0.6</td>
<td>0.5</td>
<td>1.8</td>
</tr>
</tbody>
</table>

Sources:
- Bloomberg, BP Statistical Review
- McKinsey (2019)
U.S. crude oil export capacity has been sufficient, 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 3.1 mb/d in September and could grow in line with EIA’s projections to approach the lower end of the export capacity range in 2020.

### U.S. gross crude oil exports

<table>
<thead>
<tr>
<th>Million barrels per day (mb/d)</th>
<th>Uncertain range (4.0 mb/d to 5.0 mb/d) of U.S. crude oil export terminal capacity</th>
</tr>
</thead>
</table>

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 will be key to execute the next wave of projects which are critical to advance the U.S. energy revolution.

### U.S. existing and proposed LNG export projects

- **5.4 Bcf/d** Existing
- **8.3 Bcf/d** Under Construction
- **13.1 Bcf/d** Approved

### 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

Sources: Bloomberg, EIA, API Team graphics
API'S ECONOMIC INDUSTRY OUTLOOK

The API Industry Outlook, developed by API’s Chief Economist, Dr. R. Dean Foreman, is a quarterly report that provides an overview of the natural gas and oil industry as it relates to the U.S. and global economy.

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