U.S. Energy Outlook Bright in 2018

Mine Yücel
Senior Vice President and Research Advisor
Federal Reserve Bank of Dallas

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Energy Market Overview

• Global oil market
  • Oil prices between $45 - $55 in 2017. Moved up in 2018
  • US oil production on track to a record high in 2018
  • OPEC and friends keeping a lid on production
  • Robust global growth should boost oil demand

• Natural Gas
  • Natural gas market increasingly global
  • US natural gas production a record every year since 2007
Global Oil Balance

SOURCE: Energy Information Administration.
# OPEC and Non-OPEC Cuts

<table>
<thead>
<tr>
<th>Country/group</th>
<th>Agreed cut (mb/d)</th>
<th>January actual cut (mb/d)</th>
<th>January percent compliance (est.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Saudi Arabia</td>
<td>-0.49</td>
<td>-0.56</td>
<td>116</td>
</tr>
<tr>
<td>Other OPEC</td>
<td>-0.69</td>
<td>-1.05</td>
<td>152</td>
</tr>
<tr>
<td>Russia</td>
<td>-0.30</td>
<td>-0.27</td>
<td>88</td>
</tr>
<tr>
<td>Other non-OPEC</td>
<td>-0.25</td>
<td>-0.21</td>
<td>85</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>-1.72</strong></td>
<td><strong>-2.09</strong></td>
<td><strong>121</strong></td>
</tr>
</tbody>
</table>

**NOTE:** Estimates come from the International Energy Agency’s Feb 2018 Oil Market Report.
mb/d: million barrels per day
Crude oil inventories remain high

NOTE: Square marks use latest weekly data as of 2/7/2018.

SOURCE: Energy Information Administration.
U.S. production up strongly

U.S. crude oil production

U.S. oil rig count

Million barrels per day

10.03 mb/d (Nov)

791 (Feb)

Sources: Baker Hughes; Energy Information Administration.
Natural gas prices low

Nominal price, weekly

Natural gas production a record every year

SOURCE: Energy Information Administration.
## Global Oil and Gas Production

<table>
<thead>
<tr>
<th>Crude Oil (mb/d)</th>
<th>Natural Gas (bcf/d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>World</strong></td>
<td><strong>World</strong></td>
</tr>
<tr>
<td>80.48</td>
<td>386.18</td>
</tr>
<tr>
<td><strong>Russia</strong></td>
<td><strong>U.S.</strong></td>
</tr>
<tr>
<td>10.95</td>
<td>83.16</td>
</tr>
<tr>
<td><strong>U.S.</strong></td>
<td><strong>Russia</strong></td>
</tr>
<tr>
<td>10.03</td>
<td>73.38</td>
</tr>
<tr>
<td><strong>Saudi Arabia</strong></td>
<td><strong>Qatar</strong></td>
</tr>
<tr>
<td>9.98</td>
<td>22.33</td>
</tr>
<tr>
<td><strong>Iraq</strong></td>
<td><strong>Texas</strong></td>
</tr>
<tr>
<td>4.49</td>
<td>19.58</td>
</tr>
<tr>
<td><strong>Texas</strong>*</td>
<td><strong>Canada</strong></td>
</tr>
<tr>
<td>3.97</td>
<td>18.29</td>
</tr>
<tr>
<td><strong>Iran</strong></td>
<td><strong>Pennsylvania</strong></td>
</tr>
<tr>
<td>3.81</td>
<td>15.65</td>
</tr>
<tr>
<td><strong>China</strong></td>
<td><strong>China</strong></td>
</tr>
<tr>
<td>3.71</td>
<td>15.62</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td><strong>Iran</strong></td>
</tr>
<tr>
<td>3.06</td>
<td>15.50</td>
</tr>
<tr>
<td><strong>U.A.E.</strong></td>
<td><strong>Norway</strong></td>
</tr>
<tr>
<td>2.85</td>
<td>12.83</td>
</tr>
<tr>
<td><strong>Kuwait</strong></td>
<td><strong>Saudi Arabia</strong></td>
</tr>
<tr>
<td>2.70</td>
<td>8.33</td>
</tr>
</tbody>
</table>


*Estimate based on January weekly data.

SOURCES: Energy Information Administration; International Energy Agency; Oil and Gas Journal.
Impact on the Economy
Impact on U.S. economy

• The U.S. benefits from lower oil prices
• Low prices boost consumer disposable income
• Reduces the cost of energy to firms
• Reduces profitability of producing oil
  • Layoffs, capex declines and bankruptcies in oil patch
• Timing of impact on economy may be asymmetric
Why didn’t low oil prices have a larger positive effect on the economy?

• Oil price changes have asymmetric effects on the economy

• Increases in oil prices impact the economy more than oil price declines
  • Oil price increase: $\Sigma$ (negative reallocation effects + negative price effects)
  • Oil price decline: $\Sigma$ (negative reallocation effects + positive price effects)
Oil investment bounces back

Billions of chained 2009 dollars

U.S. rig count

Investment in mining/exploration

OPEC decision

Sources: Baker Hughes; Bureau of Economic Analysis.
Low oil prices benefit most states
(Effect of a 50% decline in oil prices on employment)

Current State of Oil & Gas Industry
Drilling concentrates on focus areas

NOTE: Change in active rig count from May 27, 2016, to January 26, 2018.
SOURCE: Baker Hughes.
Permian most prolific shale basin

Total oil production, million barrels per day

Permian
Eagle Ford
Bakken

SOURCE: Energy Information Administration.
Texas oil production continues to rise

Million barrels per day

Texas total rig count
3.97 mb/d (Jan)

Texas crude oil production
479 (Feb. 9)

Sources: Baker Hughes; Energy Information Administration; Oil and Gas Journal.
Well completions rise in the Permian

Completed wells per day

- Permian
- Eagle Ford
- Bakken

SOURCE: Energy Information Administration.
Breakeven prices for new wells

NOTES: Line shows the mean, and bars show the range of responses; 62 E&P firms answered this question from March 15-23, 2017.
SOURCE: Federal Reserve Bank of Dallas.
Oil and Natural Gas Exports
U.S. crude exports surge after lifting of export ban

SOURCE: Energy Information Administration.
U.S. Crude Imports and Exports

Million barrels per day, 3MMA

Crude oil imports

Crude oil exports

SOURCE: Energy Information Administration.
Imported by API Gravity

SOURCE: Energy Information Administration.

Percent, 3MMA

25 degrees and lower
30.1 degrees and higher

SOURCE: Energy Information Administration.
U.S. Total Product Imports and Exports

Million barrels per day, 3MMA

- Petroleum products exports
- Petroleum products imports

SOURCE: Energy Information Administration.
Bulk of U.S. natural gas exports go to Canada and Mexico

NOTES: Exports to Mexico comprises pipeline and LNG exports; exports to Canada comprises pipeline, LNG and CNG exports.
SOURCE: Energy Information Administration.
U.S. natural gas imports mostly by pipeline

Billion cubic feet per day, 3MMA

SOURCE: Energy Information Administration.
North American LNG Import/Export Terminals
Approved

Import Terminals

U.S.
APPROVED - UNDER CONSTRUCTION - FERC
1. Corpus Christi, TX: 0.4 Bcf/d (Cheniere – Corpus Christi LNG) (CP12-507)

APPROVED - NOT UNDER CONSTRUCTION - FERC
2. Salinas, PR: 0.6 Bcf/d (Aguirre Offshore GasPort, LLC) (CP13-193)

APPROVED - NOT UNDER CONSTRUCTION - MARAD/Coast Guard
3. Gulf of Mexico: 1.0 Bcf/d (Main Pass McMoRan Exp.)
4. Gulf of Mexico: 1.4 Bcf/d (TORP Technology-Bienville LNG)

Export Terminals

U.S.
APPROVED - UNDER CONSTRUCTION - FERC
5. Hackberry, LA: 2.1 Bcf/d (Sempra-Cameron LNG) (CP13-25)
6. Freeport, TX: 2.14 Bcf/d (Freeport LNG Dev/Freeport LNG Exp/FLNG Liquification) (CP12-509) (CP15-516)
7. Cove Point, MD: 0.82 Bcf/d (Dominion–Cove Point LNG) (CP13-113)
8. Corpus Christi, TX: 2.14 Bcf/d (Cheniere – Corpus Christi LNG) (CP12-507)
10. Elba Island, GA: 0.36 Bcf/d (Southern LNG Company) (CP14-103)

APPROVED - NOT UNDER CONSTRUCTION - FERC
11. Lake Charles, LA: 2.2 Bcf/d (Southern Union – Lake Charles LNG) (CP14-120)
12. Lake Charles, LA: 1.08 Bcf/d (Magnolia LNG) (CP14-347)
13. Hackberry, LA: 1.41 Bcf/d (Sempra – Cameron LNG) (CP15-560)
14. Sabine Pass, TX: 2.1 Bcf/d (ExxonMobil – Golden Pass) (CP14-517)

Canada
APPROVED – NOT UNDER CONSTRUCTION
15. Port Hawkesbury, NS: 0.8 Bcf/d (Bear Head LNG)
16. Kitimat, BC: 3.23 Bcf/d (LNG Canada)
17. Squamish, BC: 0.29 Bcf/d (Woodfibre LNG Ltd)
18. Prince Rupert Island, BC: 2.74 Bcf/d (Pacific Northwest LNG)

* Trains 5 & 6 with Train 5 under construction
U.S. LNG exports rising

Billion cubic feet per day, 3MMA

- Total Exports
- Pipeline exports
- LNG exports

SOURCE: Energy Information Administration.
Outlook
Business activity picks up in Q4 2017
Dallas Fed Energy Survey

SOURCE: Federal Reserve Bank of Dallas.
Outlook

• Uncertainty abounds

• Market and contacts expect oil prices in the $50 – $60 range in 2018.
  • Downside risks: higher shale growth, break-up of OPEC agreement, output growth in Libya, Brazil
  • Upside risks: global growth, Iran sanctions, Middle East geopolitics, faster decline in Venezuela

• U.S. exports of crude oil, oil products and natural gas rising.

• U.S. a major player in both oil and gas markets.
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