World and U.S. Oil and Gas Production and Price Outlook: To Infinity (or at least 2050) and Beyond

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by
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Show of hands...who here uses EIA data?
EIA is all about energy data and energy analysis

• Data (Statistics)
  – Data collection (surveys)
  – Data synthesis, curating, presentation (e.g., Excel add-in)

• Analysis
  – Present and near history
    • Disruption analysis
    • Drilling productivity report
  – Near-term forecasts: STEO
  – Longer-term projections
    • Annual Energy Outlook (AEO)
    • International Energy Outlook (IEO)
The Annual Energy Outlook 2018 (AEO2018) represents a projection of the U.S. energy system to the year 2050

- Projection, not forecast

- Conceptually, represents peak (mode) of conditional probability distribution
  - No information about shape of distribution is given
  - Conditions include existing technologies (largely), current laws and regulations

- Infinitesimally small chance of being “right”
  - We’ve never been right in the past
  - No one has…
EIA has never correctly predicted the crude oil price

Average imported crude oil acquisition price
nominal dollars per barrel

Source: EIA, Annual Energy Outlooks through 2018
Global outlook
IEO2017 addresses the uncertainty inherent in energy projections by developing side cases focusing on overall energy consumption

• The effects of assumptions about economic growth on energy consumption are addressed in the High and Low Economic Growth cases. World gross domestic product increases by 3.3%/year from 2015 to 2040 in the High Economic Growth case and by 2.7%/year in the Low Economic Growth case, compared with 3.0%/year in the Reference case.

• The High and Low Oil Price cases address the uncertainty associated with the trajectory of world energy prices. In the Low Oil Price case, the price of North Sea Brent crude in 2016 dollars reaches $43/barrel by 2040, compared with $109/barrel in the Reference case and $226/barrel in the High Oil Price case.

• Although the graphics in this presentation focus on projections through 2040, this IEO is the first projection to include model results through 2050, which are available on the IEO page of the EIA website; EIA welcomes feedback on the assumptions and results over the period of 2040–50.
Future oil prices are another key source of uncertainty in the projections.

**World oil prices in three cases**
real 2016 dollars per barrel

- High Oil Price case
- Reference case
- Low Oil Price case

**World energy consumption in three cases**
quadrillion Btu

- 2015
- 2030
- 2040

Source: EIA, International Energy Outlook 2017
Economic growth—a major driver of energy demand—is greater on average in non-OECD countries

Average annual percent change in real GDP by region, 2015-40

OECD

- Australia/New Zealand: 2.6%
- Mexico/Chile: 2.3%
- United States: 2.1%
- South Korea: 2.0%
- Canada: 1.5%
- OECD Europe: 1.4%
- Japan: 0.2%
- Total OECD: 1.7%

Non-OECD

- India: 5.0%
- China: 4.3%
- Other Asia: 3.9%
- Africa: 3.9%
- Middle East: 3.0%
- Other Americas: 2.6%
- Other Europe/Eurasia: 2.4%
- Brazil: 1.6%
- Russia: 1.4%
- Total Non-OECD: 3.8%

Source: EIA and Oxford Economic Model (March 2017)
Energy consumption increases over the projection for all fuels other than coal in the Reference case with renewables being the fastest-growing energy source.

World energy consumption by energy source
quadrillion Btu

Past trend

Outlook

Petroleum and other liquids

Coal

Natural gas

Renewables

Nuclear

Source: EIA, International Energy Outlook 2017

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Although population and per capita output continue to rise, energy and carbon intensity are projected to continue to fall in the Reference case.

**Population**
- Million people
- Source: EIA, International Energy Outlook 2017

**Per capita gross domestic product**
- Thousand dollars

**Energy intensity**
- Thousand Btu per dollar

**Carbon intensity**
- Metric tons CO2 per billion Btu

Source: EIA, International Energy Outlook 2017
Liquid fuel supplies increase from 2015 to 2040 with most of the growth occurring in OPEC crude oil and lease condensate.

Source: EIA, International Energy Outlook 2017
World natural gas consumption increases by 43% from 2015 to 2040 in the Reference case largely due to demand growth.

Source: EIA, International Energy Outlook 2017
Middle East, the United States, and China account for more than 60% of the world increase in natural gas production.

Source: EIA, International Energy Outlook 2017
Shale gas and tight gas become increasingly important to gas supplies, not only for the United States, but also for China and Canada.

Source: EIA, International Energy Outlook 2017
Domestic Overview
Tight oil production remains the leading source of U.S. crude oil production from 2017 – 2050

Crude oil production
million barrels per day

2017

Reference case

History

2017 projections

Low Oil and Gas Resource and Technology

2017 projections

High Oil and Gas Resource and Technology

Tight oil production continues to increase from 2017 to 2050 in all cases.

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The Southwest region leads growth in tight oil production in the Reference case.

Lower 48 onshore crude oil production by region (Reference case)

million barrels per day
In the Reference case, the United States becomes a small net exporter of petroleum on a volume basis from 2029 to 2045.
Increased U.S. natural gas production is the result of continued development of shale gas and tight oil plays.

**Natural gas production by type**

- Trillion cubic feet
- Billion cubic feet per day

Increased U.S. natural gas production is the result of continued development of shale gas and tight oil plays.

**Graphs**

- **Reference**
- **High Oil and Gas Resource and Technology**

**Key**

- 2017 history
- 2017 projections
- Shale gas and tight oil plays
- Tight gas
- Other Lower 48 onshore
- Lower 48 offshore
- Other (Alaska and coalbed methane)
Plays in the East lead production of U.S. natural gas from shale resources in the Reference case.

Shale gas production by region

- Trillion cubic feet
- Billion cubic feet per day

- East
- Gulf Coast
- Rest of U.S.

History and projections from 2000 to 2050.
U.S. natural gas consumption and production increase in most cases with production growth outpacing natural gas consumption in all cases.

**Natural gas production**
- trillion cubic feet
- billion cubic feet per day

**Natural gas consumption**
- trillion cubic feet
- billion cubic feet per day

*History projections*:
- High Oil and Gas Resource and Technology
- High Oil Price
- High Economic Growth
- Reference
- Low Economic Growth
- Low Oil Price
- Low Oil and Gas Resource and Technology

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Natural gas prices across cases are dependent on resource and technology assumptions.

Dry natural gas production
trillion cubic feet

Natural gas spot price at Henry Hub
2016 dollars per million British thermal units

Reference, AEO 2017, and High Oil and Gas Resource and Technology scenarios are represented.

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The United States is a net natural gas exporter in the Reference case because of continued export growth and import decline.

**Natural gas trade**

<table>
<thead>
<tr>
<th>trillion cubic feet</th>
<th>billion cubic feet per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>-14</td>
</tr>
<tr>
<td>2010</td>
<td>-7</td>
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<tr>
<td>2017</td>
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</tr>
<tr>
<td>2040</td>
<td>21</td>
</tr>
<tr>
<td>2050</td>
<td>28</td>
</tr>
</tbody>
</table>

- liquefied natural gas (LNG) exports
  - pipeline exports to
    - Canada
    - Mexico
  - LNG imports
- pipeline imports from
  - Canada

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The U.S. has experienced a rapid increase in natural gas and oil production from shale and other tight resources

Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through February 2018 and represent EIA’s official tight oil & shale gas estimates, but are not survey data. State abbreviations indicate primary state(s). Note: Scales are presented at approximate barrel of oil equivalent.
EIA Products and information


Annual Energy Outlook | www.eia.gov/forecasts/aeo

Short-Term Energy Outlook | www.eia.gov/forecasts/steo

International Energy Outlook | www.eia.gov/forecasts/ieo

Today In Energy | www.eia.gov/todayinenergy

Monthly Energy Review | www.eia.gov/totalenergy/data/monthly

State Energy Portal | www.eia.gov/state