U.S. Tight Oil in Context

Overview of U.S. Tight Oil Production and Trends

For
Region 5 and Region 7 Regional Response Teams Meeting
April 22, 2015 | St. Charles, Missouri via video/teleconference

By
Grant Nülle, Upstream Oil & Gas Economist, Exploration and Production Analysis Team
EIA mission: independent statistics and analysis

• EIA was created by the U.S. Congress in 1977

• EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment

• EIA is the Nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the U.S. Government

• EIA does not propose or advocate any policy positions
EIA produces data series, analyses, and energy projections

• Weekly, monthly, and annual data
  – Displays U.S. and regional production, stocks, blender inputs, imports, and exports

• Real-time analyses
  – Digests important developments in *Today in Energy*, *This Week in Petroleum*, Issues & Trends, Country Analysis Briefs, *Drilling Productivity Report*

• Short-Term Energy Outlook (STEO)
  – Forecasts U.S. supplies, demands, imports, stocks, and prices of energy with a horizon of 12 to 24 months

• Annual Energy Outlook (AEO)
  – Presents 25- to 30-year projection and analysis of U.S. energy supply, demand, and prices

• International Energy Outlook (IEO)
  – Assesses international energy production and consumption
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 March 2015 and represent EIA’s official tight oil & shale gas estimates, but are not survey data. State abbreviations indicate primary state(s).
Estimated U.S. tight oil production was 4.6 MMbbl/d in April 2015 about 49% of total U.S. oil production (9.3 MMbbl/d)

Tight oil production
million barrels of oil per day

Sources: EIA derived from state administrative data collected by DrillingInfo Inc. Data are through March 2015 and represent EIA’s official tight oil estimates, but are not survey data. State abbreviations indicate primary state(s).
Tight oil characteristics vary considerably

• Prior to the “shale development breakthrough”
  – Drillers targeted either oil or natural gas formations
  – Production was relatively stable over a long period from each well
  – Simple rig count was sufficient to monitor and forecast production

• Drilling in tight formations
  – New applications of technology: Horizontal drilling and hydraulic fracturing
  – Pad drilling: Multiple wells per rig from one surface location
  – High initial production rates driven by better technology
  – Steep production declines
  – Formations yielding both oil and natural gas
  – Regional differences contrast rig and well productivity
  – Higher costs to drill and complete a well
Tight oil and shale gas trends: production by geography – the Drilling Productivity Report (DPR)

http://www.eia.gov/petroleum/drilling/
Recent analysis has focused on production in the counties shown here

EIA Drilling Productivity Report regions

EIA Drilling Productivity Report: http://www.eia.gov/petroleum/drilling/
## Drilling Productivity Report

**Release Date:** March 9, 2015  |  **Next Release:** April 13, 2015  |  **full report**

### New-well production per rig by region

<table>
<thead>
<tr>
<th>Region</th>
<th>March 2015</th>
<th>April 2015</th>
<th>change</th>
<th>March 2015</th>
<th>April 2015</th>
<th>change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bakken</td>
<td>1,328</td>
<td>1,320</td>
<td>(8)</td>
<td>1,557</td>
<td>1,549</td>
<td>(8)</td>
</tr>
<tr>
<td>Eagle Ford</td>
<td>1,733</td>
<td>1,723</td>
<td>(10)</td>
<td>7,518</td>
<td>7,532</td>
<td>14</td>
</tr>
<tr>
<td>Haynesville</td>
<td>57</td>
<td>57</td>
<td>-</td>
<td>7,055</td>
<td>7,135</td>
<td>80</td>
</tr>
<tr>
<td>Marcellus</td>
<td>57</td>
<td>57</td>
<td>-</td>
<td>16,712</td>
<td>16,787</td>
<td>75</td>
</tr>
<tr>
<td>Niobrara</td>
<td>418</td>
<td>413</td>
<td>(5)</td>
<td>4,787</td>
<td>4,752</td>
<td>(15)</td>
</tr>
<tr>
<td>Permian</td>
<td>1,961</td>
<td>1,982</td>
<td>21</td>
<td>6,403</td>
<td>6,428</td>
<td>25</td>
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<tr>
<td>Utica</td>
<td>59</td>
<td>62</td>
<td>3</td>
<td>1,920</td>
<td>1,970</td>
<td>50</td>
</tr>
</tbody>
</table>

### Contents

- Bakken
- Eagle Ford
- Haynesville
- Marcellus
- Niobrara
- Permian
- Utica

- Year-over-year summary
- Explanatory notes and sources
- Full report

- Report data (aggregated by region)

Documentation
Drilling Productivity Report Captures Key Elements of Tight Oil

Contributing Factors to U.S. Tight Oil Production

- Technical Expertise and Experience
- Extensive Transportation Capacity
- Price Responsiveness of producers
- Regulatory Stability & Government Support
Prices & Production
Energy & Financial Markets

WHAT DRIVES CRUDE OIL PRICES?
An analysis of 7 factors that influence oil markets, with chart data updated monthly and quarterly

Overview - What Drives Crude Oil Prices?

Who's Who in Global Markets

Factors that Influence Prices
Oil prices rise from mid-2015 through mid-2016 in EIA’s forecast – however, the market-implied confidence band is very wide.

### WTI Price

<table>
<thead>
<tr>
<th></th>
<th>2015</th>
<th>2016</th>
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</thead>
<tbody>
<tr>
<td>WTI</td>
<td>$52</td>
<td>$70</td>
</tr>
<tr>
<td>Brent</td>
<td>$60</td>
<td>$75</td>
</tr>
</tbody>
</table>

Source: EIA, Short-Term Energy Outlook, April 2015
Various events could lead to changes in global supply or demand that could push future crude oil prices higher or lower than the STEO forecast

<table>
<thead>
<tr>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>ISIL disrupts Iraqi exports</td>
</tr>
<tr>
<td>Iranian sanctions are tightened</td>
</tr>
<tr>
<td>Social unrest in oil-dependent countries leads to supply disruptions</td>
</tr>
<tr>
<td>OPEC cuts output more than projected</td>
</tr>
<tr>
<td>World economic growth is lower than projected (e.g., China)</td>
</tr>
<tr>
<td>OPEC keeps production at 2015 levels in 2016</td>
</tr>
<tr>
<td>Reduction in unplanned production outages</td>
</tr>
<tr>
<td>Iranian sanctions are lifted</td>
</tr>
</tbody>
</table>
North American oil production growth slows with lower oil prices but remains the main driver of global production growth

Source: EIA, Short-Term Energy Outlook, March 2015
U.S. crude oil production is expected to increase 700,000 bbl/d in 2015 and 140,000 in 2016; if prices do not recover to the mid-$70s by mid-2016 as forecast by EIA, production would be lower.

Source: EIA, Short-Term Energy Outlook, March 2015
January 2015 STEO had Lower 48 y/y growth in 2015 of 580,000 bbl/d and in 2016 130,000 bbl/d.

U.S. monthly crude oil production
million barrels per day

April 2015 STEO shows Lower 48 y/y growth in 2015 of 454,000 bbl/d and in 2016 a mere 10,000 bbl/d.

U.S. monthly crude oil production
million barrels per day

Source: EIA, Short-Term Energy Outlook (STEO) April 2015
Rigs drilling will decrease, but a backlog of oil wells awaiting completion & productivity increases will add to oil production

U.S. monthly crude oil production
million barrels per day

Total U.S. onshore rig count

Annual Energy Outlook 2015: Petroleum and other liquid supply

http://www.eia.gov/forecasts/aeo/
U.S. crude oil production rises above previous historical highs before 2020 in all AEO2015 cases, with a range of longer-term outcomes

Source: EIA, Annual Energy Outlook 2015
Crude by Rail
EIA crude-by-rail project overview

- EIA published monthly crude-by-rail (CBR) data at the end of March 2015 along with its monthly petroleum supply balances.
- EIA’s new data series provides historical monthly data starting in January 2010.
- The data include inter-regional, intra-regional, and cross border CBR traffic between the U.S. and Canada.
- Developed using data from the Surface Transportation Board (STB) and Canada’s National Energy Board (NEB).
- EIA’s most recent monthly data are estimated.
Petroleum Administration for Defense Districts (PADDs) with major shale oil producing areas that indicate CBR originations
Unaccounted-for crude oil is minimized on a regional basis with the inclusion of rail data.
EIA’s new webpage dedicated to crude-by-rail movements

U.S. Movements of Crude Oil By Rail

With Data through January 2016 | Release Date: March 30, 2015 | Next Release Date: April 29, 2015

http://www.eia.gov/petroleum/transportation
Summary table of CBR data include inter-PADD, intra-PADD, and U.S.-Canada movements

![Movement of Crude Oil by Rail](http://www.eia.gov/dnav/pet/PET_MOVE_RAILNA_A_EPC0_RAIL_MBBL_M.htm)
Inter-PADD rail movements are comparable to pipeline and waterborne movements of crude oil

![Table showing movements of crude oil by rail between PAD districts](http://www.eia.gov/dnav/pet/PET_MOVE_RAIL_A_EPC0_RAIL_MBBLM.htm)
Crude oil movements by mode data table now includes rail

http://www.eia.gov/dnav/pet/PET_MOVE_PTB_A_EPC0_TNR_MBBL_M.htm
Canada
Canadian liquids production is projected to reach 5 million bbl/d by 2020, of which bitumen is 3 million bbl/d

Canadian liquid fuels production, Reference case
million barrels per day

Canadian tight oil production surpassed 0.4 million barrels per day in 2014 mainly from Saskatchewan and Alberta.

Canadian tight oil production
million barrels per day

Producing well count

Source: Canada NEB 2014
For more 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

Drilling Productivity Report | www.eia.gov/petroleum/drilling
Supplemental Slides
New AEO table browser

- Signature product redeveloped for EIA’s state-of-the-art table browser experience
- Compares up to 6 cases from AEO
Annual Energy Outlook 2015:
Petroleum and other liquid supply

http://www.eia.gov/forecasts/aeo/
Crude oil price projection is lower in the AEO2015 Reference case than in AEO2014, particularly in the near term.

AEO2015 explores scenarios that encompass a wide range of future crude oil price paths

Brent crude oil spot price
2013 dollars per barrel

Source: EIA, Annual Energy Outlook 2015
Growth of onshore crude oil production varies across supply regions, affecting pipeline and midstream infrastructure needs

change between 2013 and 2040 in U.S. lower 48 onshore crude oil production by region

Source: EIA, Annual Energy Outlook 2015
Combination of increased tight oil production and higher fuel efficiency drive projected decline in oil imports

U.S. liquid fuels supply
million barrels per day

History

2013

Projections

Note: “Other” includes refinery gain, biofuels production, all stock withdrawals, and other domestic sources of liquid fuels

Source: EIA, Annual Energy Outlook 2015 Reference case
Net imports provide a declining share of U.S. liquid fuels supply in most AEO2015 cases; in two cases the nation becomes a net exporter.
In the transportation sector, motor gasoline use declines; diesel fuel, jet fuel, and natural gas use all grow

Transportation energy consumption by fuel (quadrillion Btu)

Source: EIA, Annual Energy Outlook 2015 Reference case

*Includes aviation gasoline, propane, residual fuel oil, lubricants, electricity, and liquid hydrogen
U.S. net exports of petroleum products vary with the level of domestic oil production given current limits on U.S. crude oil exports.
Tight Oil Abroad
Oil and natural gas resource categories reflect varying degrees of certainty

Source: U.S. Energy Information Administration
Note: Resource categories are not drawn to scale relative to the actual size of each resource category. The graphic shown above is applicable only to oil and natural gas resources.

http://www.eia.gov/todayinenergy/detail.cfm?id=17151
Map of 106 basins assessed for shale oil and shale gas resources in 46 countries

Source: EIA/ARI Supplement 2015 Preliminary Release
Top ten countries with technically recoverable shale resources

<table>
<thead>
<tr>
<th>Shale gas</th>
<th>Rank</th>
<th>Country</th>
<th>Trillion cubic feet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>China</td>
<td>1,115</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Argentina</td>
<td>802</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Algeria</td>
<td>707</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Canada</td>
<td>573</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>United States</td>
<td>555</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Mexico</td>
<td>545</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Australia</td>
<td>429</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>South Africa</td>
<td>390</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Russia</td>
<td>287</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Brazil</td>
<td>245</td>
</tr>
<tr>
<td></td>
<td>Total for 46 countries</td>
<td>7,509</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Shale oil</th>
<th>Rank</th>
<th>Country</th>
<th>Billion barrels</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Russia</td>
<td>75.8</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>United States</td>
<td>60.2</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>China</td>
<td>32.2</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Argentina</td>
<td>27.0</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Libya</td>
<td>26.1</td>
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<tr>
<td></td>
<td>6</td>
<td>UAE</td>
<td>22.6</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>Chad</td>
<td>16.2</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Australia</td>
<td>15.6</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>Venezuela</td>
<td>13.4</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Mexico</td>
<td>13.1</td>
</tr>
<tr>
<td></td>
<td>Total for 46 countries</td>
<td>400.8</td>
<td></td>
</tr>
</tbody>
</table>

Source: EIA, USGS and ARI 2015 Preliminary Results
Countries producing shale gas and tight oil in 2014

- **United States**
  - 51% of total (47% in 2013)
  - Shale gas
  - Other gas

- **Canada**
  - 20% of total (18% in 2013)
  - Shale gas
  - Other gas

- **Argentina**
  - 3% of total (1% in 2013)
  - Shale gas
  - Other gas

- **United States**
  - 10% of total (9% in 2013)
  - Tight oil
  - Other oil

Source: US EIA, Canada National Energy Board, Fact Global Energy, Chevron, Yacimientos Petrolíferos Fiscales
Canadian liquid fuels production, Reference case
million barrels per day


Nüelle | Region 5 and Region 7
Regional Response Teams April 22, 2015