U.S. Energy Outlook

for

IEA Bilateral Meetings
March 14, 2013 | Paris, France

by
Adam Sieminski, Administrator
Annual Energy Outlook 2013 projections to 2040

- Growth in energy production outstrips consumption growth
- Crude oil production rises sharply over the next decade
- Motor gasoline consumption reflects more stringent fuel economy standards
- The U.S. becomes a net exporter of natural gas in the early 2020s
- U.S. energy-related carbon dioxide emissions remain below their 2005 level through 2040
U.S. energy use grows slowly over the projection reflecting improving energy efficiency and slow, extended economic recovery.

U.S. primary energy consumption
quadrillion Btu

History Projections

shares of total U.S. energy

Source: EIA, Annual Energy Outlook 2013 Early Release
U.S. Shale Gas
An average well in shale gas and other continuous resource plays can also have steep decline curves, which require continued drilling to grow production.

Source: EIA, Annual Energy Outlook 2012
For example: Oil production by monthly vintage of wells in the Williston Basin

Source: DrillingInfo history through August 2012, EIA Short-Term Energy Outlook, February 2013 forecast
Domestic production of shale gas has grown dramatically over the past few years

shale gas production (dry)
billion cubic feet per day

Sources: LCI Energy Insight gross withdrawal estimates as of January 2013 and converted to dry production estimates with EIA-calculated average gross-to-dry shrinkage factors by state and/or shale play.
Shale gas leads growth in total gas production through 2040

U.S. dry natural gas production
tillion cubic feet

Source: EIA, Annual Energy Outlook 2013 Early Release

Adam Sieminski, IEA Bilateral Meetings, March 14, 2013
Natural gas consumption is quite dispersed with electric power, industrial, and transportation use driving future demand growth.

U.S. dry gas consumption
trillion cubic feet

<table>
<thead>
<tr>
<th>Year</th>
<th>Electric Power</th>
<th>Industrial*</th>
<th>Gas to Liquids</th>
<th>Commercial</th>
<th>Residential</th>
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</thead>
<tbody>
<tr>
<td>2005</td>
<td>31%</td>
<td>33%</td>
<td>3%</td>
<td>13%</td>
<td>19%</td>
</tr>
<tr>
<td>2011</td>
<td>32%</td>
<td>33%</td>
<td>3%</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>2020</td>
<td>33%</td>
<td>33%</td>
<td>3%</td>
<td>12%</td>
<td>14%</td>
</tr>
<tr>
<td>2025</td>
<td>33%</td>
<td>33%</td>
<td>3%</td>
<td>12%</td>
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<td>2030</td>
<td>33%</td>
<td>33%</td>
<td>3%</td>
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<td>2035</td>
<td>33%</td>
<td>33%</td>
<td>3%</td>
<td>12%</td>
<td>14%</td>
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<tr>
<td>2040</td>
<td>33%</td>
<td>33%</td>
<td>3%</td>
<td>12%</td>
<td>14%</td>
</tr>
</tbody>
</table>

*Includes combined heat-and-power and lease and plant fuel.
**Includes pipeline fuel.

Source: EIA, Annual Energy Outlook 2013 Early Release
Growth of natural gas in transportation led by heavy duty trucks (LNG) and gas to liquids (diesel)… marine and rail to come?

U.S. natural gas consumption (quadrillion Btu)

Note: Gas to liquids includes heat, power, and losses.

Source: EIA, Annual Energy Outlook 2013 Early Release
Total natural gas exports nearly quadruple by 2040 in the AEO2013 Reference case

U.S. natural gas exports
tillion cubic feet

Source: EIA, Annual Energy Outlook 2013 Early Release

Adam Sieminski, IEA Bilateral Meetings, March 14, 2013
Domestic natural gas production grows faster than consumption and the U.S. becomes a net exporter of natural gas around 2020.

U.S. dry gas
trillion cubic feet

History | 2011 | Projections

Consumption

Domestic supply

Net imports

Source: EIA, Annual Energy Outlook 2013 Early Release
U.S. Tight Oil
Domestic production of tight oil has grown dramatically over the past few years.

Tight oil production for select plays (millions of barrels per day)

- Eagle Ford
- Bakken
- Granite Wash
- Bonespring
- Monterey
- Woodford
- Niobrara-Codell
- Spraberry
- Austin Chalk

Source: Drilling Info (formerly HPDI), Texas RRC, North Dakota department of mineral resources, and EIA, through October 2012.

Adam Sieminski, IEA Bilateral Meetings, March 14, 2013
U.S. tight oil production leads a growth in domestic production of 2.6 million barrels per day between 2008 and 2019

U.S. crude oil production
million barrels per day

Source: EIA, Annual Energy Outlook 2013 Early Release and Short-Term Energy Outlook, February 2013

Adam Sieminski, IEA Bilateral Meetings, March 14, 2013
U.S. petroleum product exports exceeded imports in 2011 for first time in over six decades

annual U.S. net exports of total petroleum products, 1949 – 2011
million barrels per day

Source: EIA, Petroleum Supply Monthly
U.S. dependence on imported liquids depends on both supply and demand.

U.S. liquid fuel supply
million barrels per day

Source: EIA, Annual Energy Outlook 2013 Early Release

Adam Sieminski, IEA Bilateral Meetings, March 14, 2013
Light-duty vehicle liquids consumption is lower primarily due to more stringent CAFE standards

Source: EIA, Annual Energy Outlook 2013 Early Release

Adam Sieminski, IEA Bilateral Meetings, March 14, 2013
Global tight oil production comparisons


U.S. Coal and Electricity
Over time the electricity mix shifts toward natural gas and renewables, but coal remains the largest fuel source.

U.S. electricity net generation
trillion kilowatthours

<table>
<thead>
<tr>
<th>Year</th>
<th>History</th>
<th>2011</th>
<th>Projections</th>
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<tbody>
<tr>
<td>1990</td>
<td>13%</td>
<td>25%</td>
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<tr>
<td>1995</td>
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<td>2010</td>
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<td>2040</td>
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Source: EIA, Annual Energy Outlook 2013 Early Release

Adam Sieminski, IEA Bilateral Meetings, March 14, 2013
Changing electricity generation mix in AEO2012 reference case and carbon fee allowance side cases

U.S. electricity net generation
trillion kilowatthours

2012 Reference Case

$15 Carbon Fee

$25 Carbon Fee

Source: EIA, Annual Energy Outlook 2012

Adam Sieminski, IEA Bilateral Meetings,
March 14, 2013
Coal regains some competitive advantage relative to natural gas over time on a national average basis.
U. S. electricity use and economic growth, 1950-2040

Source: EIA, Annual Energy Outlook 2013 Early Release
U.S. Renewables and Biofuels
Non-hydro renewable generation more than doubles between 2011 and 2040

non-hydropower renewable generation
billion kilowatthours per year

Source: EIA, Annual Energy Outlook 2013 Early Release
Despite recent growth, ethanol and biodiesel provide a modest share of U.S. motor fuels.
Biofuels grow at a slow rate due to lower near-term crude oil prices and slow growth in sales of high-percentage ethanol blends such as E85.

renewable fuel standard credits
billions ethanol-equivalent gallons

Sources: EIA, Annual Energy Outlook 2013 Early Release and EIA, Annual Energy Outlook 2012
In the *AEO2013* Reference case, energy-related CO₂ emissions never get back to their 2005 level.

**Carbon dioxide emissions (billion metric tons)**

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<th>Projections</th>
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<td>5.75</td>
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<td>4.88</td>
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<td>2015</td>
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*(billion metric tons)*

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*(percent change from 2005)*

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<thead>
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<th>Year</th>
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<tbody>
<tr>
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<td>2040</td>
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*Source: EIA, Annual Energy Outlook 2013 Early Release*
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

Annual Energy Review | www.eia.gov/totalenergy/data/annual