Annual Energy Outlook 2012
Early Release Reference Case

AEO2012 Early Release Rollout Presentation
Paul H. Nitze School of Advanced International Studies
John Hopkins University
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Howard Gruenspecht, Acting Administrator
Key results from the AEO2012 Reference case, which assumes current laws remain unchanged

• Projected growth of energy use slows over the projection period reflecting an extended economic recovery and increasing energy efficiency in end-use applications
• Domestic crude oil production increases, reaching levels not experienced since 1994 by 2020
• With modest economic growth, increased efficiency, growing domestic production, and continued adoption of nonpetroleum liquids, net petroleum imports make up a smaller share of total liquids consumption
• Natural gas production increases throughout the projection period and exceeds consumption early in the next decade
• Renewables and natural gas fuel a growing share of electric power generation
• Total U.S. energy-related carbon dioxide emissions remain below their 2005 level through 2035
What is included (and excluded) in developing EIA’s “Reference case” projections?

• Generally assumes current laws and regulations
  – excludes potential future laws and regulations (e.g., proposed greenhouse gas legislation and proposed fuel economy standards are not included)
  – provisions generally sunset as specified in law (e.g., renewable tax credits expire)

• Some grey areas
  – adds a premium to the capital cost of CO₂-intensive technologies to reflect current market behavior regarding possible future policies to mitigate greenhouse gas emissions
  – assumes implementation of existing regulations that enable the building of new energy infrastructure and resource extraction

• Includes technologies that are commercial or reasonably expected to become commercial over next decade or so
  – includes projected technology cost and efficiency improvements, as well as cost reductions linked to cumulative deployment levels
  – does not assume revolutionary or breakthrough technologies
Overview of U.S. energy supply and demand
Current U.S. energy supply is 83% fossil fuels; demand is broadly distributed among the major sectors.

2010 total U.S. energy use = 98.0 quadrillion Btu

Primary energy demand by fuel:
- Natural gas: 25.2%
- Petroleum: 36.7%
- Nuclear: 8.6%
- Renewable: 8.2%
- Coal: 21.3%

Primary energy demand by sector:
- Transportation: 28.1%
- Industrial: 20.4%
- Residential and Commercial: 11.2%
- Electricity – Industrial: 10.4%
- Electricity – Commercial: 14.3%
- Electricity – Residential: 15.6%

Source: EIA, Annual Energy Outlook 2012 Early Release
Energy use grows slowly over the projection in response to a slow and extended economic recovery and improving energy efficiency.

U.S. primary energy consumption
quadrillion Btu per year

History

Shares of total U.S. energy

2010 Projections

Renewables (excluding liquid biofuels)

Natural gas

Liquid biofuels

Nuclear

Coal

Oil and other liquids

Source: EIA, Annual Energy Outlook 2012 Early Release

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Energy and CO₂ per dollar of GDP continue to decline; per-capita energy use also declines.

In the *AEO2012* Reference case, energy-related CO$_2$ emissions never get back to pre-recession levels by 2035.

**Source:** EIA, *Annual Energy Outlook 2012 Early Release*
Natural Gas
Technically recoverable natural gas resources reflect updated assessments

U.S. dry gas resources
trillion cubic feet

*Alaska resource estimates prior to AEO2009 reflect resources from the North Slope that were not included in previously published documentation.

Source: EIA, Annual Energy Outlook
Domestic natural gas production grows faster than consumption

U.S. dry gas
trillion cubic feet per year

Source: EIA, Annual Energy Outlook 2012 Early Release
Shale gas offsets declines in other U.S. natural gas production sources

U.S. dry gas production
tillion cubic feet per year

<table>
<thead>
<tr>
<th>Year</th>
<th>Shale gas</th>
<th>Tight gas</th>
<th>Non-associated offshore</th>
<th>Coalbed methane</th>
<th>Associated with oil</th>
<th>Non-associated onshore</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>2%</td>
<td>26%</td>
<td>21%</td>
<td>9%</td>
<td>10%</td>
<td>21%</td>
</tr>
<tr>
<td>1995</td>
<td>7%</td>
<td>21%</td>
<td>23%</td>
<td>9%</td>
<td>9%</td>
<td>7%</td>
</tr>
<tr>
<td>2000</td>
<td>9%</td>
<td>23%</td>
<td>21%</td>
<td>10%</td>
<td>8%</td>
<td>7%</td>
</tr>
<tr>
<td>2005</td>
<td>10%</td>
<td>22%</td>
<td>22%</td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
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<tr>
<td>2010</td>
<td>23%</td>
<td>23%</td>
<td>21%</td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>2015</td>
<td>24%</td>
<td>24%</td>
<td>21%</td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>2020</td>
<td>25%</td>
<td>25%</td>
<td>21%</td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
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<tr>
<td>2025</td>
<td>26%</td>
<td>25%</td>
<td>21%</td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>2030</td>
<td>27%</td>
<td>26%</td>
<td>21%</td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
</tr>
<tr>
<td>2035</td>
<td>28%</td>
<td>27%</td>
<td>21%</td>
<td>9%</td>
<td>7%</td>
<td>7%</td>
</tr>
</tbody>
</table>

Source: EIA, Annual Energy Outlook 2012 Early Release
Natural gas consumption is quite dispersed; electric power and industrial use drives much of the future demand growth.

U.S. dry gas consumption
trillion cubic feet per year

<table>
<thead>
<tr>
<th>Year</th>
<th>2005</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2035</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial*</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Electric power</td>
<td>31%</td>
<td>33%</td>
<td>31%</td>
<td>32%</td>
<td>34%</td>
</tr>
<tr>
<td>Commercial</td>
<td>21%</td>
<td>21%</td>
<td>21%</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>Transportation**</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>Residential</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
</tr>
</tbody>
</table>

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

Source: EIA, Annual Energy Outlook 2012 Early Release

Howard Gruenspecht
AEO2012, January 23, 2012
Natural gas price projections are lower than in *AEO2011*, consistent with recent market developments.

**natural gas spot price (Henry Hub)**

2010 dollars per million Btu

Petroleum and other liquid supply
Oil prices in the Reference case rise steadily; the full *AEO2012* will include a wide range of oil prices

Annual average price of light low sulfur (LLS) crude oil
real 2010 dollars per barrel

Source: EIA, *Annual Energy Outlook 2012 Early Release*
Global liquids supply increases 25% while market shares hold relatively stable

liquids supply (million barrels per day)

Source: EIA, Annual Energy Outlook 2012 Early Release
U.S. imports of liquid fuels continue to decline due to increased production of gas liquids and biofuels and greater fuel efficiency.

U.S. liquid fuels supply (million barrels per day)

Source: EIA, Annual Energy Outlook 2012 Early Release
U.S. dependence on imported petroleum continues to decline

U.S. liquid fuel supply
million barrels per day

Source: EIA, Annual Energy Outlook 2012 Early Release
Biofuels fall short of the RFS target in 2022, but exceed 36 billion gallons by the early 2030s

New light duty vehicle fuel economy reaches almost 38 mpg by 2035 in the Reference case, which does not include proposed standards for MY2017 to MY2025 vehicles.

Summary of standards:

- **2012-2016**: 34.1 mpg CAFE average (based on NHTSA vehicle footprint sales distribution)
- **2020**: 35 mpg by statute
- **2017-2025**: Reference case *does not* include proposed rulemaking from December 2011

Source: EIA, Annual Energy Outlook 2012 Early Release
Most transport fuel consumption is in light and heavy duty vehicles

U.S. transportation energy consumption
million barrels per day oil equivalent

Source: EIA, Annual Energy Outlook 2012 Early Release
Efficiency improvements mostly offset underlying drivers of growth in transportation services

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2035</th>
<th>Growth (2010-2035)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Light duty vehicles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>8.6</td>
<td>8.8</td>
<td>2%</td>
</tr>
<tr>
<td>(million barrels per day oil equivalent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of licensed drivers</td>
<td>209</td>
<td>265</td>
<td>27%</td>
</tr>
<tr>
<td>(millions)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miles per licensed driver</td>
<td>12,700</td>
<td>13,600</td>
<td>7%</td>
</tr>
<tr>
<td>Efficiency of vehicle stock</td>
<td>20.4</td>
<td>27.8</td>
<td>36%*</td>
</tr>
<tr>
<td>(mpg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Heavy duty vehicles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel consumption</td>
<td>2.4</td>
<td>2.8</td>
<td>18%</td>
</tr>
<tr>
<td>(million barrels per day oil equivalent)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manufacturing output</td>
<td>4,260</td>
<td>6,270</td>
<td>47%</td>
</tr>
<tr>
<td>(billion 2005 dollars)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of freight trucks</td>
<td>9.3</td>
<td>13.4</td>
<td>44%</td>
</tr>
<tr>
<td>(millions)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Miles per vehicle</td>
<td>25,300</td>
<td>25,700</td>
<td>1.3%</td>
</tr>
<tr>
<td>Efficiency of vehicle stock</td>
<td>6.7</td>
<td>8.2</td>
<td>23%**</td>
</tr>
<tr>
<td>(mpg)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Equal to a 27% reduction in fuel use per mile. ** Equal to an 19% reduction in fuel use per mile.

Source: EIA, Annual Energy Outlook 2012 Early Release
Electricity
While electricity consumption grows by 23% over the projection, the annual rate of growth slows.

### Percent Growth (3-year rolling average)

<table>
<thead>
<tr>
<th>Period</th>
<th>Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950s</td>
<td>9.8</td>
</tr>
<tr>
<td>1960s</td>
<td>7.3</td>
</tr>
<tr>
<td>1970s</td>
<td>4.7</td>
</tr>
<tr>
<td>1980s</td>
<td>2.9</td>
</tr>
<tr>
<td>1990s</td>
<td>2.4</td>
</tr>
<tr>
<td>2000-2010</td>
<td>1.0</td>
</tr>
<tr>
<td>2010-2035</td>
<td>0.8</td>
</tr>
</tbody>
</table>

*Source: EIA, Annual Energy Outlook 2012 Early Release*
In 2010, U.S. electricity generation was 70% fossil fuels, 20% nuclear, and 10% renewable.

2010 Total net generation: 4,120 billion kWh
- Natural gas: 23.8%
- Coal: 44.9%
- Nuclear: 19.6%
- Petroleum: 0.9%
- Other: 0.3%

2010 Non-hydro renewable net generation: 168 billion kWh
- Wind: 2.3%
- Solar thermal and PV: <0.1%
- Wood and wood-derived fuels: 0.9%
- Geothermal: 0.4%
- Other biomass: 0.5%
- Other renewable: 4.1%
- Conventional hydroelectric: 6.2%

Source: EIA, Annual Energy Review, October 2011
Electricity mix gradually shifts to lower-carbon options, led by growth in renewables and natural gas

electricity net generation
trillion kilowatthours per year

<table>
<thead>
<tr>
<th>Year</th>
<th>History</th>
<th>2010</th>
<th>Projections</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>1995</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>2000</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>2005</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>2010</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>2015</td>
<td>4%</td>
<td>24%</td>
<td>39%</td>
</tr>
<tr>
<td>2020</td>
<td>20%</td>
<td>45%</td>
<td>39%</td>
</tr>
<tr>
<td>2025</td>
<td>35%</td>
<td>10%</td>
<td>16%</td>
</tr>
<tr>
<td>2030</td>
<td>39%</td>
<td>10%</td>
<td>16%</td>
</tr>
<tr>
<td>2035</td>
<td>27%</td>
<td>45%</td>
<td>18%</td>
</tr>
</tbody>
</table>

Source: EIA, Annual Energy Outlook 2012 Early Release
Non-hydro renewable sources more than double between 2010 and 2035

non-hydropower renewable generation
billion kilowatthours per year

Source: EIA, Annual Energy Outlook 2012 Early Release
Expected changes in the *AEO2012* Reference case for the complete release

- Incorporation of Mercury and Air Toxics Standards (MATS) issued by EPA in December, 2011

- Updated historical data and equations in the transportation sector, based on revised data from the National Highway Traffic Safety Administration (NHTSA) and Federal Highway Administration

- Revised long-term macroeconomic projection based on an updated long term projection from IHS Global Insight, Inc.

- New model for cement production in the industrial sector

- Updated handling of biomass supply
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

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

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