Implications of low electricity demand growth

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Office of Electricity, Coal, Nuclear, & Renewables Analysis
U.S. Energy Information Administration
Growth in electricity use slows, but still increases by 29% from 2012 to 2040

percent growth (3-year compounded annual growth rate)

<table>
<thead>
<tr>
<th>Period</th>
<th>Annual Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Electricity use</td>
</tr>
<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>2000-2012</td>
<td>0.7</td>
</tr>
<tr>
<td>2013-2040</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Source: EIA, Annual Energy Outlook 2014 Reference Case
Year to year demand for electricity has decreased in 5 of the last 6 years; prior to 2008, demand declined only twice in 58 years.

Source: Energy Information Administration, Form EIA-923 and predecessor forms.
What might a low electricity demand growth future look like?

- Assumptions used to achieve low electricity demand growth:
  - Applied best available technology to buildings, and layered on greater industrial motor efficiency
  - Assumptions are technically achievable but not necessarily cost-effective at this time

- Shifts in demand are accompanied by changes in patterns of investment and prices
  - Consumers spend less for electricity, and utility bill savings nearly balance households’ increased costs for more efficient equipment, insulation, etc.
  - From 2012-2040, electric generating capacity additions decline by about 50% relative to the AEO2014 Reference case, while retirements of fossil fuel-fired capacity more than double relative to the AEO2014 Reference case
  - Lower marginal energy prices in competitive wholesale electricity markets, relative to the AEO2014 Reference case
  - Declines in residential electricity generation prices are partially offset by near-term increases in transmission and distribution prices
Historical and projected end-use electricity sales

billion kilowatthours (with percent change, 2012-2040)

Reference case
Low Growth case

Source: EIA, Monthly Energy Review and Annual Energy Outlook 2014

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Low Growth case compared to Reference case: industrial, commercial, and residential sectors each contribute to demand decrease

Difference between electricity sales, Reference case, and Low Growth case

billion kilowatthours

Source: EIA, Annual Energy Outlook 2014
Average annual electricity demand growth rates vary across regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Reference case</th>
<th>Low Growth case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total U.S.</td>
<td>0.80%</td>
<td>0.00%</td>
</tr>
<tr>
<td>New York City</td>
<td>0.10%</td>
<td>-0.70%</td>
</tr>
<tr>
<td>Long Island</td>
<td>0.10%</td>
<td>-0.70%</td>
</tr>
<tr>
<td>Upstate New York</td>
<td>0.20%</td>
<td>-0.60%</td>
</tr>
<tr>
<td>New England</td>
<td>0.30%</td>
<td>-0.60%</td>
</tr>
<tr>
<td>Eastern Wisconsin</td>
<td>0.50%</td>
<td>-0.40%</td>
</tr>
<tr>
<td>Mid Atlantic</td>
<td>0.50%</td>
<td>-0.30%</td>
</tr>
<tr>
<td>Lower Michigan</td>
<td>0.50%</td>
<td>-0.30%</td>
</tr>
<tr>
<td>Great Lakes</td>
<td>0.60%</td>
<td>-0.30%</td>
</tr>
<tr>
<td>Mississippi Basin</td>
<td>0.60%</td>
<td>-0.20%</td>
</tr>
<tr>
<td>Northern Plains</td>
<td>0.70%</td>
<td>-0.10%</td>
</tr>
<tr>
<td>Central Plains</td>
<td>0.70%</td>
<td>-0.10%</td>
</tr>
<tr>
<td>California</td>
<td>0.90%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Texas</td>
<td>1.00%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Florida</td>
<td>1.00%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Mississippi Delta</td>
<td>1.00%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Alabama/Georgia</td>
<td>1.00%</td>
<td>0.10%</td>
</tr>
<tr>
<td>Tennessee Valley</td>
<td>1.00%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Virginia Carolina</td>
<td>1.00%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Southern Plains</td>
<td>1.00%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Northwest</td>
<td>1.00%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Arizona/New Mexico</td>
<td>1.30%</td>
<td>0.40%</td>
</tr>
<tr>
<td>Rocky Mountain</td>
<td>1.30%</td>
<td>0.50%</td>
</tr>
</tbody>
</table>

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Projected end-use electricity prices are lower in the Low Growth case.

Average end-use electricity price, all sectors
2012 cents per kilowatthour

Source: EIA, Annual Energy Outlook 2014
Declines in residential electricity generation prices are partially offset by near-term increases in transmission and distribution prices.
Utility bill savings nearly balance households’ increased costs for more efficient equipment, insulation

Change in per-household expenditures and electric bills relative to Reference case

2012$ per year

Table: Annual per household expenditures on electricity (2012$)

<table>
<thead>
<tr>
<th>Year</th>
<th>Reference</th>
<th>Low Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>$1,434</td>
<td>$1,228</td>
</tr>
<tr>
<td>2040</td>
<td>$1,535</td>
<td>$1,076</td>
</tr>
</tbody>
</table>

About 2/3 of the reduced electric bills are attributable to lower consumption; lower per-kWh prices explain the remaining 1/3

Source: EIA, Annual Energy Outlook 2014

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Capacity additions decline dramatically in the Low Growth case.

U.S. electricity generation capacity additions (gigawatts)

**Reference case**

History 2012 Projections

- Other Renewables
- Solar
- Wind
- Natural gas/oil
- Nuclear
- Hydro / Other
- Coal

**Low Growth case**

History 2012 Projections

- Capacity under construction is still assumed completed

Projected renewable builds primarily occur in the buildings sector, power sector builds are much lower and are primarily natural gas-fired.

Source: EIA, Annual Energy Outlook 2014
More fossil capacity is retired in the Low Growth case

U.S. electric power sector capacity retirements
gigawatts (cumulative)

Source: EIA, Annual Energy Outlook 2014
Coal-fired capacity is substantially reduced under lower demand, particularly in Eastern Interconnection regions.

Installed capacity electric power sector

gigawatts

2012
2040 Reference case
2040 Low Growth case

Eastern Interconnection

Source: EIA, Annual Energy Outlook 2014
Natural gas/oil capacity is substantially reduced under lower demand across all regions

Installed capacity electric power sector

gigawatts

Source: EIA, Annual Energy Outlook 2014
Gas generation grows much more slowly in the Low Growth case

U.S. electricity net generation

trillion kilowatthours

Source: EIA, Annual Energy Outlook 2014
In the long term, lower demand growth leads to lower energy prices in competitive wholesale electricity markets

Average marginal energy prices 2012$ per megawatt hour

Source: EIA, Annual Energy Outlook 2014, electricity model regions averaged to approximate existing ISOs/RTOs

1 The “Midwest” region combines the electricity model regions used to approximate the Midcontinent ISO (MISO) and the Southwest Power Pool (SPP).
Delivered coal and natural gas prices are reduced in the Low Growth case.

Average delivered fuel prices to electric power plants
2012$ per million Btu

Source: EIA, Annual Energy Outlook 2014
In the Low Growth case, total carbon dioxide emissions from the electric power sector in 2040 are 22% below the Reference case.

Source: EIA, Annual Energy Outlook 2014
For more information

U.S. Energy Information Administration home page | [www.eia.gov](http://www.eia.gov)

Short-Term Energy Outlook | [www.eia.gov/steo](http://www.eia.gov/steo)

Annual Energy Outlook | [www.eia.gov/aeo](http://www.eia.gov/aeo)

International Energy Outlook | [www.eia.gov/ieo](http://www.eia.gov/ieo)

Monthly Energy Review | [www.eia.gov/mer](http://www.eia.gov/mer)

Today in Energy | [www.eia.gov/todayinenergy](http://www.eia.gov/todayinenergy)