Tracking New Coal-Fired Power Plants

National Energy Technology Laboratory

Office of Systems Analyses and Planning
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This report is intended to provide an overview of proposed new coal-fired power plants that are under development. This report may not represent all possible plants under consideration but is intended to illustrate the potential that exists for installation of new coal-fired power plants.

Recent experience has shown that public announcements of new coal-fired power plant development do not provide an accurate representation of actual new operating power plants. Actual plant capacity commissioned has historically been significantly less than new capacity announced.

The report focuses on those power plant projects that have achieved significant progress toward completion, to provide a more accurate assessment of the ability of this segment of the power generation industry to support demand for new electricity capacity in various regions of the United States.

The Department of Energy does not warrant the accuracy or suitability of this information.
Tracking New Coal-Fired Power Plants

- This report provides a perspective of coal-fired power plants that are currently under development, with a focus on those having made significant progress toward achieving commercial operation.
- The status of projects in development varies from project announcements to those under construction.
- Announced projects that are canceled before or during the permitting phase are not unusual; announced projects are not necessarily strong indicators of capacity additions.
- Plants that are permitted or under construction reflect a developer’s significant financial commitment to completion and offer a better perspective of the new generation capacity that may be forthcoming.
- Long-term forecasts reflecting declining natural gas production for North America also highlight the increased importance of coal-fired power generation to the Nation’s energy security and to a growing economy.
Historically, actual capacity has been seen to be significantly less than proposed capacity. For example, the 2002 report listed 36,161 MW of proposed capacity by the year 2007 when actually only 4,478 MW (12%) were constructed.

2002 – 2005 data – Previous NETL Tracking New Coal-Fired Power Plants Reports
Historic Capacity Additions by Years

Refer to Figure 1

- Actual plant capacity, commissioned since 2000, has been far less than new capacity announced; the year 2002 report of announcements reflected a schedule of over 36,000 MW to be installed by 2007, whereas ≈ 4,500 MW (12%) were achieved.

- The trend over several years has reflected the bulk of power plant developments shifting out in time due to project delays.

- Delays and cancelations have been attributed to regulatory uncertainty (regarding climate change) or strained project economics due to escalating costs in the industry.

- New announcements combined with delayed projects have tended to increase the backlog of plants in the queue.

- Cancellations become more prevalent as prospects of fulfilling all projects in the queue become impractical.
Current Coal-Fired Capacity Projects *(quarterly change)*

**Table 1**

<table>
<thead>
<tr>
<th>General Status</th>
<th>Number of Plants</th>
<th>Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Construction</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>Near Construction</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Permitted</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

**SUB TOTAL** 45 47 +2 23,240 23,166 -74 (-0.3%)

<table>
<thead>
<tr>
<th>Announced (early stages of development)</th>
<th>76</th>
<th>67</th>
<th>-9</th>
<th>48,440</th>
<th>42,394</th>
<th>-6,046 (-12.5%)</th>
</tr>
</thead>
</table>

**TOTAL** 121 114 -7 71,680 65,560 -6,120 (-8.5%)

<table>
<thead>
<tr>
<th>Status Listing</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under Construction</td>
<td>Project is under construction.</td>
</tr>
<tr>
<td>Near Construction</td>
<td>Project has been approved: majority or all permits are obtained. Sponsor is contracting vendors and Engineering, Procurement and Construction (EPC) contractors. Site preparation has begun.</td>
</tr>
<tr>
<td>Permitted</td>
<td>In the permitting phase. Two or more permits approved or fuel or power contracts have been negotiated.</td>
</tr>
<tr>
<td>Announced</td>
<td>Early stages of development to filing for permits. May include a feasibility study.</td>
</tr>
</tbody>
</table>
Current Capacity Additions by Years

Refer to Table 1

- Table 1 reflects the current status of coal-fired plant development activity with quarterly changes.
- “Progressing” plants are projects with status indicating permitted, near construction, or under construction.
- Progressing plants have attained a higher likelihood of advancing toward commercial operation; however, regulatory uncertainty and industry cost increases are impacting development decisions for all projects.
- Two net plants have been added to Progressing projects in the last quarter; there has been a modest net loss of 74 MW (0.3%) of Progressing projects during the quarter.
Current Capacity Additions by Years

Figure 2

Current Capacity Additions by Years

Refer to Figures 2 & 3

- Current coal-fired projects in development reflect the potential for a surge in growth but questions exists as whether this is achievable.
- The ≈ 2,400 MW of new added capacity installed in the last three years (800 MW per year) is only 18% of the 13,400 MW of progressing plants that are proposed to be operational in the next three years.
- Coal-fired plants commissioned, from 1990 through 2007, have averaged 976 MW per year in the U.S.; this lack of domestic demand has significantly reduced the level of skilled human resources available to perform current projects (Figure 3).
- Scarcity of skilled labor for power plant engineering, procurement, project management and construction activities, increases major equipment and EPC costs and calls into question the viability of the annual commissioning levels reflected in current schedules.
Our Workforce and Skills Challenge

**Figure 3**

![Graph showing MW Capacity Additions from 1950 to 2030 for Coal (COAL) and Nuclear (NUCLEAR). The graph highlights a two-decade gap for coal and a three-decade gap for nuclear.]

Lost opportunity to transfer a generation of valuable experience.

Source: EIA AEO'07 reference case and Annual Energy Review 2006
Past Quarter Comparison (all Projects)

Figure 4

Continued Delays with a Quarterly Decline in Mostly “Announced” Projects

Source: 2007 data Global Energy Decisions – Velocity Suite
October Report data collected (9/20/2007); Current Report data collected (12/31/2007)
Net Capacity Changes (Removed or Added Opportunities)

**Figure 5**

91% of MWs removed represent “Announced” projects

Total Net Reductions 6,120 MW (-8.5%) for 4th Quarter 2007
<table>
<thead>
<tr>
<th>NERC Region</th>
<th>Under Construction</th>
<th>Near Construction</th>
<th>Permitted</th>
<th>Sub Total</th>
<th>Announced</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASCC</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Plants</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>ERCOT</td>
<td>Capacity (MW)</td>
<td>3,265</td>
<td>0</td>
<td>900</td>
<td>4,165</td>
<td>5,330</td>
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<td>Plants</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>5</td>
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<td>FRCC</td>
<td>Capacity (MW)</td>
<td>0</td>
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<td>Plants</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>MRO US</td>
<td>Capacity (MW)</td>
<td>1,649</td>
<td>55</td>
<td>0</td>
<td>1,704</td>
<td>2,880</td>
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<tr>
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<td>1</td>
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<td>6</td>
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<tr>
<td>NPCC</td>
<td>Capacity (MW)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1,420</td>
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<td>Plants</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>RFC</td>
<td>Capacity (MW)</td>
<td>2,505</td>
<td>562</td>
<td>985</td>
<td>4,052</td>
<td>9,558</td>
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<tr>
<td></td>
<td>Plants</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>13</td>
</tr>
<tr>
<td>SERC</td>
<td>Capacity (MW)</td>
<td>4,150</td>
<td>500</td>
<td>2,557</td>
<td>7,207</td>
<td>7,391</td>
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<tr>
<td></td>
<td>Plants</td>
<td>7</td>
<td>1</td>
<td>3</td>
<td>11</td>
<td>15</td>
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<tr>
<td>SPP</td>
<td>Capacity (MW)</td>
<td>1,832</td>
<td>0</td>
<td>1,350</td>
<td>3,182</td>
<td>800</td>
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<td></td>
<td>Plants</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>1</td>
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<tr>
<td>WECC</td>
<td>Capacity (MW)</td>
<td>1,484</td>
<td>742</td>
<td>630</td>
<td>2,856</td>
<td>13,365</td>
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<tr>
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<td>Plants</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>N/A</td>
<td>Capacity (MW)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>600</td>
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<td></td>
<td>Plants</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Total Sum Capacity (MW)</td>
<td>14,885</td>
<td>1,859</td>
<td>6,422</td>
<td>23,167</td>
<td>42,394</td>
<td>65,560</td>
</tr>
<tr>
<td>Total Count of Plants</td>
<td>28</td>
<td>6</td>
<td>13</td>
<td>47</td>
<td>67</td>
<td>114</td>
</tr>
</tbody>
</table>

**Proposed Technologies of New Plants (quarterly change)**

**Figure 7**

<table>
<thead>
<tr>
<th>Technology Listings</th>
<th>Operational (Since 2000)</th>
<th>Progressing (Permitted, Near-, and Under Construction)</th>
<th>Announced</th>
<th>Total Proposed</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>October</td>
<td>Current (Change)</td>
<td>October</td>
</tr>
<tr>
<td><strong>PC Subcritical</strong></td>
<td>10</td>
<td>25</td>
<td><strong>22</strong> (-3)*</td>
<td>26</td>
</tr>
<tr>
<td><strong>CFB</strong></td>
<td>8</td>
<td>12</td>
<td><strong>14</strong> (+2)</td>
<td>12</td>
</tr>
<tr>
<td><strong>PC Supercritical</strong></td>
<td>1</td>
<td>4</td>
<td><strong>8</strong> (+4)</td>
<td>9</td>
</tr>
<tr>
<td><strong>IGCC</strong></td>
<td>1</td>
<td>4</td>
<td><strong>3</strong> (-1)**</td>
<td>29</td>
</tr>
</tbody>
</table>

*Progressing PC subcritical: -3 plants due to revised status reported reverting from Progressing to Announced

**Progressing IGCC: 2 removed +1 added = -1 plant net

Source: Global Energy Decisions – Velocity Suite
October Report data collected (9/20/2007); Current Report data collected (12/31/2007)
Proposed Technologies of New Plants
Refer to Figure 7 and Table 3

- Opportunities involving conventional technologies, such as subcritical PC and CFB, are more plentiful and tend to be more advanced due to earlier start in development (Figure 7 & Table 3)

- Advanced technologies proposed, such as supercritical PC and IGCC, reflect more recent trends in development activity, so fewer have achieved permitted status

- Regulatory uncertainty for GHG legislation is a key issue impacting technology selection and project economics

- Returns on investment for conventional plants, including supercritical, can be severely compromised by the need to subsequently address CO$_2$ mitigation

- Higher capital costs incurred for IGCC may make such new plants less competitive unless their advantage in CO$_2$ mitigation is secured
NERC Generation Capacity Margins Perspective

Figure 8

135 GW Increase in Summer Peak Capacity Required by 2016

Source: 2007 Long-Term Reliability Assessment – NERC, October 2007
Consideration of EIA and NERC Capacity Forecasts  
Refer to Figures 8 and 9

- NERC foresees inadequate peak summer capacity margins in several regions of the U.S., as early as next year, requiring 135 GW of added capacity by 2016 (Figure 8)

- In contrast, AEO’08er (2008 early release) forecasts a net increase of only 4 GW in total capacity by 2016, substantially lower than NERC’s estimate (Figure 9)

- Differences are partly attributable to declining assumptions for annual electricity generation growth rates, with NERC’s report reflecting prior year data compared to EIA

- The forecasts represent a wide variation in the perceived need and value for near-term added generation of all types

Note: EIA, AEO 2008 Early Release, December 2007 data is referenced in this report; EIA is expected to reissue this report in March 2008 incorporating the Energy Independence and Security Act of 2007 (“EISA”)
Capacity Growth Forecasts Vary Substantially, Partly Due to Assumptions for Annual Electricity Generation Growth Rates

Declining Total Electricity Generation Growth Rate Assumptions

Figure 10

Declining Growth in Long-term Electricity Demand; NERC Estimates Tied to Higher Growth Rate

Declining Electricity Generation Growth Rate
Refer to Figures 10 and 11

- Electricity generation growth rate assumptions have declined substantially over the last 4 Annual Energy Outlook reports, dropping from 1.9% in AEO’05 to 1.2% in AEO’08 (Figure 10).

- The resulting decline in forecasted average annual increase in kWh demand for the U.S. amounts to ≈ 27 BkWh per year; this equates to the generation of approximately 3,700 MW of new capacity (each year) operating at an 85% capacity factor.

- There has been a long term trend in declining generation growth rates in the U.S. (Figure 11).

- The current AEO’08er forecast of 1.2% electricity generation growth has moved below the last six year average growth of 1.7%.

- If the forecasted growth rate is too low this will underestimate the new capacity needed to maintain adequate capacity margins with implications for periods of insufficient electricity supply.
Total Electricity Generation Growth

Figure 11

Forecast for Electricity Generation Growth Well Below Recent Averages

Development Activity vs. EIA AEO’08er

Figure 12

Actual Installation Trend and EIA AEO’08er Reference Forecast Correspond; A Significant Surplus of Developments Exists Above EIA’s Forecast Demand

Coal and Natural Gas-fired Development Issues
Refer to Figures 12 and 13

- Coal-fired power plant development activity significantly exceeds the current estimate of need by EIA (Figure 12)

- Evidence provided by recent installations and the low forecast for new capacity in 2008 suggest that the capability to install and commission plants is constrained by limited skilled resources

- Low forecasts of demand growth add an element of “demand uncertainty” to the problems of regulatory uncertainty and rapidly escalating costs for coal-fired power plant development

- Should electricity demand growth prove higher than anticipated, the alternative of increasing natural-gas fired generation will create fuel resource adequacy issues, due to diminished natural gas supply expectations (Figure 13)

- Virtually all incremental demand for consumption of natural gas can be seen to require increases in imports of LNG
Total Natural Gas Supply to U.S. (Including LNG)

Figure 13

Increased Use of Natural Gas in Electricity Will Require LNG;
N. American Natural Gas Supply for U.S. Trending Down

Summary

- Coal-fired power plant development activity has experienced a significant number of cancellations (8.5% of MW) during the quarter, mostly involving “Announced” projects.

- “Progressing” projects have increased by two plants with little change in the total MW involved, during the 4th quarter 2007.

- Recent forecasts of EIA and NERC represent disparate views on the need for near-to-mid-term increase in U.S. capacity.

- Should NERC’s views for required new electricity capacity prevail, significant added coal-fired plant capacity will be required to maintain reliability in several U.S. regions and to keep electricity prices from rising due to shortages.

- Forecasts for natural gas supply to the U.S. indicate that turning to additional natural gas-fired generation will create fuel resource adequacy issues and increase LNG imports.