THE FUTURE OF NUCLEAR POWER IN THE UNITED STATES

Richard A. Meserve
Carnegie Institution
1530 P St., NW
Washington, DC 20004
202-387-6404
Outline

• Factors affecting domestic interest in nuclear power
• Challenges that must be overcome
Factors Driving Interest in New Nuclear Construction

• Growing need for baseload power
• Current performance of nuclear power plants
• The inevitability of carbon controls
• Energy security
Total Electricity Generation

Source: EIA, Annual Energy Outlook 2009
Nuclear Capacity with and without License Renewal
(2005-2050)

Source: Platts POWERdat
Effect of Operating Life Extensions on Current U.S. Nuclear Generating Capacity. Open symbols represent the electric generating capacity available from currently operating nuclear power plants with extensions to 60 year operating lives. The dark gray symbols represent the electricity available from the current fleet of plants assuming all 104 plants receive lifetime extensions to 80 years. SOURCE: USNRC, 2008.
Past and future CO₂ atmospheric concentrations

Scenarios
- A1B
- A1T
- A1FI
- A2
- B1
- B2
- ISIS92a

Projections

Ice core data

Direct measurements

ppm

SYR - FIGURE 9-1a
Electricity Generation by Fuel Source (2007)

Source: Global Energy Decisions/EIA
Life-cycle CO$_2$ emissions per kilowatt-hour of generated electricity

(g CO$_2$-eq/kWh)
Energy Security

• Uncertain availability of coal given environmental concerns
• Natural gas – subject to price volatility and possible supply interruption
## Expected New Nuclear Power Plant Applications

### Updated February 4, 2009

<table>
<thead>
<tr>
<th>Company*</th>
<th>Date of Application</th>
<th>Design</th>
<th>Date Accepted</th>
<th>Site Under Consideration</th>
<th>State</th>
<th>Existing Operating Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>NRG Energy (52-012/013)***</td>
<td>09/20/2007</td>
<td>ABWR</td>
<td>11/29/2007</td>
<td>South Texas Project (2 units)</td>
<td>TX</td>
<td>Y</td>
</tr>
<tr>
<td>NuStart Energy (52-014/015)***</td>
<td>10/30/2007</td>
<td>AP1000</td>
<td>01/18/2008</td>
<td>Bellefonte (2 units)</td>
<td>AL</td>
<td>N</td>
</tr>
<tr>
<td>UNISTAR (52-016)***</td>
<td>07/13/2007 (Envir.)</td>
<td>EPR</td>
<td>01/25/2008</td>
<td>Calvert Cliffs (1 unit)</td>
<td>MD</td>
<td>Y</td>
</tr>
<tr>
<td>03/13/2008 (Safety)</td>
<td></td>
<td></td>
<td>06/03/2008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dominion (52-017)***</td>
<td>11/27/2007</td>
<td>ESBWR</td>
<td>01/28/2008</td>
<td>North Anna (1 unit)</td>
<td>VA</td>
<td>Y</td>
</tr>
<tr>
<td>Duke (52-018/019)***</td>
<td>12/13/2007</td>
<td>AP1000</td>
<td>02/25/2008</td>
<td>William Lee Nuclear Station (2 units)</td>
<td>SC</td>
<td>N</td>
</tr>
</tbody>
</table>

### 2007 TOTAL NUMBER OF APPLICATIONS = 5
TOTAL NUMBER OF UNITS = 8

### Calendar Year (CY) 2008 Applications

<table>
<thead>
<tr>
<th>Company*</th>
<th>Date of Application</th>
<th>Design</th>
<th>Date Accepted</th>
<th>Site Under Consideration</th>
<th>State</th>
<th>Existing Operating Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Progress Energy (52-022/023)***</td>
<td>02/19/2008</td>
<td>AP1000</td>
<td>04/17/2008</td>
<td>Harris (2 units)</td>
<td>NC</td>
<td>Y</td>
</tr>
<tr>
<td>NuStart Energy (52-024)***</td>
<td>02/27/2008</td>
<td>ESBWR</td>
<td>04/17/2008</td>
<td>Grand Gulf (1 units)</td>
<td>MS</td>
<td>Y</td>
</tr>
<tr>
<td>Southern Nuclear Operating Co. (52-025/026)***</td>
<td>03/31/2008</td>
<td>AP1000</td>
<td>05/30/2008</td>
<td>Vogtle (2 units)</td>
<td>GA</td>
<td>Y</td>
</tr>
<tr>
<td>South Carolina Electric &amp; Gas (52-027/028)***</td>
<td>03/31/2008</td>
<td>AP1000</td>
<td>07/31/2008</td>
<td>Summer (2 units)</td>
<td>SC</td>
<td>Y</td>
</tr>
<tr>
<td>Progress Energy (52-029/030)***</td>
<td>07/30/2008</td>
<td>AP1000</td>
<td>10/06/2008</td>
<td>Levy County (2 units)</td>
<td>FL</td>
<td>N</td>
</tr>
<tr>
<td>Exelon (52-031/032)***</td>
<td>09/03/2008</td>
<td>ESBWR</td>
<td>10/30/2008</td>
<td>Victoria County (2 units)</td>
<td>TX</td>
<td>N</td>
</tr>
<tr>
<td>Detroit Edison (52-033)***</td>
<td>09/18/2008</td>
<td>ESBWR</td>
<td>11/25/2008</td>
<td>Fermi (1 unit)</td>
<td>MI</td>
<td>Y</td>
</tr>
<tr>
<td>Luminant Power (52-034/035)***</td>
<td>09/19/2008</td>
<td>USAFWR</td>
<td>12/2/2008</td>
<td>Comanche Peak (2 units)</td>
<td>TX</td>
<td>Y</td>
</tr>
<tr>
<td>Entergy (52-036)***</td>
<td>09/25/2008</td>
<td>ESBWR</td>
<td>12/4/2008</td>
<td>River Bend (1 unit)</td>
<td>LA</td>
<td>Y</td>
</tr>
<tr>
<td>Ameren/E (52-037)***</td>
<td>07/2/2008</td>
<td>EPR</td>
<td>12/12/2008</td>
<td>Callaway (1 unit)</td>
<td>MO</td>
<td>Y</td>
</tr>
<tr>
<td>UNISTAR (52-038)***</td>
<td>09/26/2008</td>
<td>EPR</td>
<td>12/12/2008</td>
<td>Nine Mile Point (1 unit)</td>
<td>NY</td>
<td>Y</td>
</tr>
<tr>
<td>PPL Generation (52-039)***</td>
<td>10/10/2008</td>
<td>EPR</td>
<td>12/19/2008</td>
<td>Bell Bend (1 unit)</td>
<td>PA</td>
<td>Y</td>
</tr>
</tbody>
</table>

### 2008 TOTAL NUMBER OF APPLICATIONS = 12
TOTAL NUMBER OF UNITS = 18

### Calendar Year (CY) 2009 Applications

<table>
<thead>
<tr>
<th>Company*</th>
<th>Date of Application</th>
<th>Design</th>
<th>Date Accepted</th>
<th>Site Under Consideration</th>
<th>State</th>
<th>Existing Operating Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida Power and Light (763)</td>
<td></td>
<td>AP1000</td>
<td>Turkey Point (2 units)</td>
<td>FL</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Amarillo Power (752)</td>
<td></td>
<td>EPR</td>
<td>Vicinity of Amarillo (2 units)</td>
<td>TX</td>
<td>UNK</td>
<td></td>
</tr>
<tr>
<td>Alternate Energy Holdings (765)</td>
<td></td>
<td>EPR</td>
<td>Hammnett (1 unit)</td>
<td>ID</td>
<td>N</td>
<td></td>
</tr>
</tbody>
</table>

### 2009 TOTAL NUMBER OF APPLICATIONS = 3
TOTAL NUMBER OF UNITS = 5

### Calendar Year (CY) 2010 Applications

<table>
<thead>
<tr>
<th>Company*</th>
<th>Design</th>
<th>State</th>
<th>Existing Operating Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blue Castle Project</td>
<td>TBD</td>
<td>UT</td>
<td>N</td>
</tr>
<tr>
<td>Unannounced</td>
<td>TBD</td>
<td>TBD</td>
<td>UNK</td>
</tr>
</tbody>
</table>

### 2010 TOTAL NUMBER OF APPLICATIONS = 2
TOTAL NUMBER OF UNITS = 2

### Calendar Year (CY) 2011 Applications

No Letters of intent have been received from applicants expressing their plans to submit new COL applications in CY 2011.

### 2007 – 2011 Total Number of Applications = 22
Total Number of Units = 33

*Project Numbers/Docket Numbers  **Yellow – Acceptance Review Ongoing  ***Blue – Accepted/Docketed
Essential Preconditions

- Adequate protection of public health and safety.
- Continued focus on and assurance of security.
Financial Barriers

- Special risk with the first few plants.
Legal Barriers

- Need to reduce legal risk before significant funds have been expended.
- Part 52 serves to reduce financial risk, but is new.
Infrastructure

• Need to rebuild network of suppliers.
• Challenge in meeting human-resource needs.
Spent Fuel

- Yucca Mountain is derailed.
- Some states bar new construction until there is a disposal site.
- From a policy perspective, absence of a disposal site should not be a barrier to new construction.
Conclusion

• There is the prospect of substantial new construction in the US.
• The barriers to new construction can be overcome, but much work remains.