Remarks Before The House Republican Policy Committee
Hearing Regarding Wind Energy and Alternative Energy Portfolio Standards

Douglas L. Biden, President

June 11, 2010
Electric Power Generation Association

- EPGA members:
  - AES Beaver Valley
  - Allegheny Energy
  - Cogentrix Energy, Inc.
  - Dynegy Inc.
  - Edison Mission Group
  - Exelon Generation
  - FirstEnergy Corporation
  - LS Power
  - PPL Generation Group
  - RRI Energy, Inc.
  - Sunbury Generation LP
  - Tenaska, Inc., and
  - UGI Development Company

- Members operate 140,000 MW of electric generating capacity in the U.S., half in PA and surrounding states. They have approximately 19,000 employees in PA.
- Comments today are my own and do not necessarily represent views of any particular EPGA member.
Summary of Main Points

- Wind now 55% of planned generating capacity in PJM.
- Existing mandates will require 200 billion KWH in PJM by 2025. Are higher mandates necessary?
- Higher levels of wind integration present a number of challenges: transmission, reliability, operations, costs.
- AEPS Mandates = significant additional costs over time, many not known to policymakers.
- Need energy storage and flexible non-variable resources to provide back-up to wind.
- Consider relying on the market rather than mandates for future renewables development.
### PJM Supply Mix - 2009

<table>
<thead>
<tr>
<th></th>
<th>Installed Capacity</th>
<th>Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>40.7%</td>
<td>50.5%</td>
</tr>
<tr>
<td>Nuclear</td>
<td>18.4%</td>
<td>36.0%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>29.2%</td>
<td>9.5%</td>
</tr>
<tr>
<td>Hydro</td>
<td>4.7%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Wind</td>
<td>0.2%</td>
<td>0.8%</td>
</tr>
<tr>
<td>Oil</td>
<td>6.4%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Waste, Solar, Other</td>
<td>0.4%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

- These statistics are very similar for Pennsylvania.
- In PJM 1,200+ power plants with capacity >167,000 MW compete for market share on basis of costs.
- These are the results of a **least-cost** dispatch market.
- PA is #2 in electricity production in the US, #1 in export.
New Capacity

- At end of 3/2009, there were 76,785 MW in PJM active or under construction queues.
- Breakdown:
  - Wind 41,877 MW (55%)
  - Gas CC or CT 19,871 MW (26%)
  - Nuclear or Steam 12,968 MW (16%)
  - Hydro 485 MW (1%)
  - Solar, Battery & Other 1,584 MW (2%)
- 14% of queued capacity in PA. 6% of wind capacity in PA.
- PA has no comparative economic advantage in wind.
- Takeaway: Generation a policy-driven industry planning to build what is being mandated by states in a slow growth, credit-constrained market.
Head “winds” For Thermal Plants

- Air: Revised Ozone Standard
  Revised SO2 Standard
  Mercury MACT Rule (all HAPS)
  Regional Haze
  CAIR Replacement Rule
  High Electric Demand Days (HEDD)
  EPA Direct GHG Regulation (tailoring rule)
  Federal GHG Legislation

- Water: State Wastewater Regulations (TDS)
  Federal Effluent Guidelines
  Federal/State 316 (b) Implementation

- Solid Waste: Federal Regulations of Coal Combustion Residuals
Wind and AEPS Mandates

- Wind has no NOx, SO2, PM, Hg, or CO2 emissions.
- It uses no water. Its fuel is free.
- It benefits from federal production tax credits of $21/MWH, AEPS/RPS credits, and special purchase agreements which enable it to run at $0/MWH (even negative prices) and still earn revenues.
- Together with environmental challenges for thermal plants, these sum to competitive advantages for wind.
- Given that 55% of planned PJM capacity is currently wind, are higher mandates necessary at this time?
- Are more state mandates for wind and other variable energy resources the best policy tool going forward?
Transmission Challenges of Integrating Wind

- Wind must locate where “fuel” is available, often great distances from where it is needed.
- Substantial investment required to upgrade existing transmission system and build new high voltage lines.
- DOE and other studies estimate transmission investments of $60-$158 billion needed for wind to reach 20% market share in Eastern Interconnection.
- Issue of who will pay is very contentious. Example of problems getting wind from Dakotas to load centers.
- Strong policy leadership + federal siting authority needed to build transmission needed to connect wind to load.
Reliability and Operations Challenges

- Fuel availability does not correlate with electricity demand.
- Limited value as a capacity resource – not available on peak summer days when needed most.
- Higher levels of wind generation greatly increases need for dispatchable ramping capability from other sources on the system.
- Contributes to “overgeneration” events. Baseload generation can be backed off at night to accommodate high winds then not available next day to meet demand.
- Places stresses on existing capacity for which it was not designed.
- Portfolio reconfiguration: longer term, changes desired operating characteristics of non-variable capacity - favors less baseload (especially coal) and more generation that can start up and shut down faster.
Cost and Environmental Challenges

- Due to variability, requires redundant capacity and more ancillary services (e.g., load following reserves, voltage support, etc.) - added costs that are often overlooked.
- Required flexibility means reduced reliance on baseload and increased reliance on thermal peaking units – significant additional cost over time.
- Greater investment in transmission per MW means higher cost of transmission per MWH delivered.
- Much greater amount of land consumed per MW compared to thermal capacity (see slide at end).
- More frequent ramping of thermal generation produces higher fossil fuel emissions per MWH.
The Issue of Wholesale Price Suppression

- Alleged: mandating more renewable resources like wind will lower wholesale energy market prices – partial analysis at best.
- PJM Independent Market Monitor net revenue analysis: new peaking, mid-merit and base load coal plants have covered only 43%, 59% and 59%, respectively, of fixed costs over last 11 years.
- Clearly, total revenues available to generators from energy, capacity and ancillary services markets have not been high enough to support new entry for these capacity resources.
- Q: If there is price suppression in the energy markets by variable energy resources, where will the “missing money” come from to support the capacity resources needed for reliability?
- A: Capacity and ancillary services market prices will have to rise – perhaps significantly, or there would be insufficient capacity.
Meeting the Challenges

- 9 of 13 PJM states and DC have RPS requirements.
- Will require 200 billion KWH by 2025 – most will be wind (cheapest of renewables). For reference, total PA generation = 225 bil KWH.
- Batteries, compressed air systems, flywheels, which can store energy, needed to smooth out production of wind.
- Will need more dependable wind forecasting and demand response.
- Flexible non-variable resources providing a back-up function to wind must be fairly compensated in the market for their opportunity costs (foregone sales) and the value of the service they provide.
- Compensation should reflect increasing risk to equipment from having to ramp up and down or cycle on and off quickly.
- New market constructs may be needed to compensate resources based on their ramping capability or other services provided.
Markets Best at Facilitating Wind Energy

- Approximately 80% of total US wind capacity is located within organized wholesale markets (like PJM).
- Dispatch of generation over large balancing area provides greater ability to accommodate output variations of intermittent resources – larger pool of non-variable resources to rely on.
- If generators perceive fair public policy and price signals, including reasonable ability to recover costs, they will invest efficiently and provide the right balance of renewable and conventional generation.
- Consider relying on “market pull” rather than “government push”. Retailers offering 100% wind products to customers who want it.
- Mandates skew market risks and rewards in favor of some generation sources to detriment of others - do not reduce total electricity costs or increase net employment.
- Costs of AEPS mandates whether socialized (transmission) or assigned to “cost causer” will eventually be paid by customers.
Renewables Footprint Much Larger Than Other Generation Types

Solar: 40 sq. miles of land

Wind: 40 sq. miles of land

Nuclear: 1/3 sq. mile

Renewables Must Be Part of Energy Mix But......for Baseload?
### Levelized Cost of New Generating Technologies, 2010

($2008 per megawatt hour)

<table>
<thead>
<tr>
<th>Plant Type</th>
<th>Capacity Factor (%)</th>
<th>Levelized Capital Cost</th>
<th>Fixed O&amp;M</th>
<th>Variable O&amp;M (including fuel)</th>
<th>Transmission Investment</th>
<th>Total System Levelized Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Coal</td>
<td>85</td>
<td>69.2</td>
<td>3.8</td>
<td>23.9</td>
<td>3.6</td>
<td>100.4</td>
</tr>
<tr>
<td>Advanced Coal</td>
<td>85</td>
<td>81.2</td>
<td>5.3</td>
<td>20.4</td>
<td>3.6</td>
<td>110.5</td>
</tr>
<tr>
<td>Advanced Coal with CCS</td>
<td>85</td>
<td>92.6</td>
<td>6.3</td>
<td>26.4</td>
<td>3.9</td>
<td>129.3</td>
</tr>
<tr>
<td>Natural Gas-fired</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Conventional Combined Cycle</td>
<td>87</td>
<td>22.9</td>
<td>1.7</td>
<td>54.9</td>
<td>3.6</td>
<td>83.1</td>
</tr>
<tr>
<td>- Advanced Combined Cycle</td>
<td>87</td>
<td>22.4</td>
<td>1.6</td>
<td>51.7</td>
<td>3.6</td>
<td>79.3</td>
</tr>
<tr>
<td>- Advanced CC with CCS</td>
<td>87</td>
<td>43.8</td>
<td>2.7</td>
<td>63.0</td>
<td>3.8</td>
<td>113.3</td>
</tr>
<tr>
<td>- Conventional Combustion Turbine</td>
<td>30</td>
<td>41.1</td>
<td>4.7</td>
<td>82.9</td>
<td>10.8</td>
<td>139.5</td>
</tr>
<tr>
<td>- Advanced Combustion Turbine</td>
<td>30</td>
<td>38.5</td>
<td>4.1</td>
<td>70.0</td>
<td>10.8</td>
<td>123.5</td>
</tr>
<tr>
<td>Advanced Nuclear</td>
<td>90</td>
<td>94.9</td>
<td>11.7</td>
<td>9.4</td>
<td>3.0</td>
<td>119.0</td>
</tr>
<tr>
<td>Wind</td>
<td>34.4</td>
<td>130.5</td>
<td>10.4</td>
<td>0.0</td>
<td>8.4</td>
<td>149.3</td>
</tr>
<tr>
<td>Wind-Offshore</td>
<td>39.3</td>
<td>159.9</td>
<td>23.8</td>
<td>0.0</td>
<td>7.4</td>
<td>191.1</td>
</tr>
<tr>
<td>Solar Pv</td>
<td>21.7</td>
<td>376.8</td>
<td>6.4</td>
<td>0.0</td>
<td>13.0</td>
<td>396.1</td>
</tr>
<tr>
<td>Solar Thermal</td>
<td>31.2</td>
<td>224.4</td>
<td>21.8</td>
<td>0.0</td>
<td>10.4</td>
<td>256.6</td>
</tr>
<tr>
<td>Geothermal</td>
<td>90</td>
<td>88.0</td>
<td>22.9</td>
<td>0.0</td>
<td>4.8</td>
<td>115.7</td>
</tr>
<tr>
<td>Biomass</td>
<td>83</td>
<td>73.3</td>
<td>9.1</td>
<td>24.9</td>
<td>3.8</td>
<td>111.0</td>
</tr>
<tr>
<td>Hydro</td>
<td>51.4</td>
<td>103.7</td>
<td>3.5</td>
<td>7.1</td>
<td>5.7</td>
<td>119.9</td>
</tr>
</tbody>
</table>