Combined Heat and Power Going Forward: What Can State Utility Commissions Do?

NRRI Report No. 14-06
www.nrri.org

Ken Costello
Principal Researcher – Energy & Environment
National Regulatory Research Institute
kcostello@nrri.org
July 2014
Features of CHP Systems

- Two outputs with a single fuel input
- Two broad categories: topping and bottoming cycle
- Form of distributed generation
- Capacity to use different fuels
- Optimal application dependent upon host’s energy profile
- Site-specific economics
- Economies of scale
- Mature technology
- Energy-efficient and clean energy resource
- Concentration in relatively few areas of the country
Fuel Savings from a CHP System

Potential Benefits from CHP

- Higher overall energy efficiency than production of electricity and steam in separate facilities
- Energy-cost savings for the host
- Reduction in lost electricity from T&D
- Environmental benefits
- Improved power resiliency, reliability and security
- Positive macroeconomic effects
- Economic and environmental advantages over some other generation technologies
Benefits of CHP over Solar and Wind

<table>
<thead>
<tr>
<th>Output</th>
<th>10 MW CHP</th>
<th>10 MW PV</th>
<th>10 MW Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Capacity Factor</td>
<td>85%</td>
<td>25%</td>
<td>34%</td>
</tr>
<tr>
<td>Annual Electricity Production</td>
<td>74,446 MWh</td>
<td>21,900 MWh</td>
<td>29,784 MWh</td>
</tr>
<tr>
<td>Annual Useful Heat</td>
<td>103,417 MWh\text{t}</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Footprint Required</td>
<td>6,000 sq ft</td>
<td>1,740,000 sq ft</td>
<td>76,000 sq ft</td>
</tr>
<tr>
<td>Capital Cost</td>
<td>$20 million</td>
<td>$48 million</td>
<td>$24 million</td>
</tr>
<tr>
<td>Annual National Energy Savings</td>
<td>343,787 MMBtu</td>
<td>225,640 MMBtu</td>
<td>306,871 MMBtu</td>
</tr>
<tr>
<td>Annual National CO₂ Savings</td>
<td>44,114 Tons</td>
<td>20,254 Tons</td>
<td>27,546 Tons</td>
</tr>
</tbody>
</table>

Different Gas-Fired CHP Technologies

- Gas turbines
  - Combined cycle
  - Combustion turbines
- Boiler/steam turbines
- Reciprocating engines
- Microturbines
- Fuel cells
Spotty History of CHP

- Early history of U.S. electricity industry
- Central station era
- PURPA
- Early 21st century
- Last few years and current status
Favorable Prospects for CHP

- Technical potential vs. economic feasibility
- Abundance of natural gas
- Push by the Obama Administration
- Increased recognition at the state level of CHP technology as an energy-efficient and clean-energy resource
- Increased concern about long and costly outages on the central grid
- MACT regulations
Several Factors Affecting the Economics of CHP

- Returns from CHP relative to competing investments
- Payback period
- Electricity and natural gas prices
- Thermal energy requirements of host
- Initial investment costs
- Revenues from electricity sales
- Standby rates
- Interconnection rules
- Environmental regulations
Obstacles to CHP Growth

• What are they?
• How serious are they?
• What should policymakers do, if anything, to mitigate them?
• Distinction between “market/regulatory failures” and “normal market barriers” (Examples)
Market Barriers

- Required short payback period
- Uncertain rate of return
- Inadequate information about CHP technologies
- Inertia
- Myopic behavior by potential investors
- High initial investment costs
- High transaction costs

Which of these require governmental intervention?
Regulatory Practices as Potential Barriers

- Benefit-cost tests for evaluating CHP
- Interconnection rules
- Standby rates
- Existing ratemaking practices
- Characterization of CHP as an energy resource
- Constraints on utility activities

Which of these prevent development of cost-effective CHP investments?
Five Basic Questions for Commissions

- What should society expect from electric utilities in accommodating or supporting CHP?
- How should electric utilities meet those expectations?
- What can commissions do to require or encourage utilities to meet these expectations?
- What role should gas utilities play in support of CHP?
- What can commissions do to change their present policies and practices to assure investments in cost-effective CHP?
Final Thoughts for Commission Consideration

• The market should be the prime driver of CHP investments
• “Leveling the playing field” among generation alternatives should be the major regulatory goal
• Commissions should support subsidies, favorable treatment to CHP only under restrictive conditions; namely, the presence of serious market/regulatory failures for which the benefits of their mitigation exceed the costs