The Importance of Recognizing the Multiple Outputs of CHP

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CHP is a Clean, Efficient Method of Providing Energy Services

Source: EPA CHP Partnership - 2012
That Efficiency Generally Results in Lower Emissions

Source: EPA CHP Partnership - 2012
Overall Fuel Savings from CHP

\[ \text{Fuel Savings} = \text{Fuel SHP} - \text{Fuel CHP} \]

+ Fuel use from avoided on-site thermal energy production
+ Fuel use from avoided purchased grid electricity
- Fuel use by the CHP system

Total Fuel Savings

\[ (56 + 91) - 100 = 47 \text{ units} \]
Overall \( \text{CO}_2 \) Savings from CHP

\[ \text{CO}_2 \text{ Savings} = \text{CO}_2 \text{ SHP} - \text{CO}_2 \text{ CHP} \]

+ \( \text{CO}_2 \) emissions from avoided on-site thermal energy production

+ \( \text{CO}_2 \) emissions from avoided purchased grid electricity

- \( \text{CO}_2 \) emissions from the CHP system

Total \( \text{CO}_2 \) Savings

\((13k + 32k) - 23k = 22k \text{ tons } \text{CO}_2\)
Recognizing CHP Savings

• CHP systems produce both power and thermal outputs using a single fuel input

• Fuel and CO$_2$ savings come from displacing on-site boilers/furnaces and central station generation (including T&D losses)

• CHP may result in increased fuel use and/or emissions at the site

• Critical to recognize multiple outputs of CHP, and impacts beyond site, in order to properly credit efficiency and emissions benefits
Approaches to Crediting CHP

• Two common approaches to credit both CHP outputs
  o Equivalence approach
  o Avoided emissions approach

• The two approaches can result in different levels of emissions rates based on CHP system characteristics and emissions rates of avoided separate heat and power

• Which approach to use would be influenced by the overall regulatory structure and objectives
Equivalence Approach

• Directly adds the thermal output to the electric output of the CHP system in consistent or equivalent units
  o Example: Total output = (30 units + 45 units) = 75 units

• The value of the conversion factor depends on the underlying regulatory objectives
  o Can be based on straight unit conversion (i.e., 3412 Btu equals 1 kWh – credit 100% of thermal output)
  o Can incorporate a factor for the relative value of the outputs (credit 75% of thermal output)
    o Example: Total output = (30 units + 0.75*45 units) = 63.75 units

• Results can vary substantially based on the ratio of power and heat output of the CHP system
Avoided Emissions Approach

• Credits the CHP system with the avoided emissions that a conventional separate heat and power system would otherwise emit to provide the same energy services.

• The approach relates the value of the thermal output to the emissions actually avoided by the displacement of the on-site boiler/furnace.

• Results can vary based on thermal unit displaced (e.g., replacing new gas on-site boiler or old coal boiler):
  - CHP electric emissions = (23K – 13K) = 10K tons CO₂
## Regulatory Experience

<table>
<thead>
<tr>
<th>Entity</th>
<th>Equivalence Approach</th>
<th>Avoided Emissions Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>California</td>
<td>DG and conventional emissions limits (100% thermal credit)</td>
<td></td>
</tr>
<tr>
<td>Connecticut</td>
<td></td>
<td>Small DG Rule</td>
</tr>
<tr>
<td>Delaware</td>
<td></td>
<td>Conventional emissions limits</td>
</tr>
<tr>
<td>Massachusetts</td>
<td></td>
<td>Small DG Rule and performance standards</td>
</tr>
<tr>
<td>Rhode Island</td>
<td></td>
<td>Conventional emissions limits</td>
</tr>
<tr>
<td>Texas</td>
<td>DG Permit by Rule and Standard Permit (100% thermal credit)</td>
<td></td>
</tr>
<tr>
<td>US EPA</td>
<td>Electric Utility Steam Generating Unit NSPS, Subpart Da (75% thermal credit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gas Turbine NSPS, Subpart KKK (100% thermal credit)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposed rule for GHG emissions from New Electric Generating Units 11(b) (75% thermal credit)</td>
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</tr>
</tbody>
</table>
Resources

• Crediting CHP
  – *CHP Emissions Calculator* - [http://www.epa.gov/chp/basic/calculator.html](http://www.epa.gov/chp/basic/calculator.html)

• Calculating Avoided Emissions
  – *Emissions & Generation Resource Integrated Database (eGRID)* - [http://www.epa.gov/cleanenergy/energy-resources/egrid/](http://www.epa.gov/cleanenergy/energy-resources/egrid/)