Industrial Energy Efficiency and CHP and the Clean Power Plan

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Energy Efficiency as a CO$_2$ reduction strategy

Under section 111(d) of the Clean Air Act, EPA intends to regulate carbon emissions from power plants. The proposed rule includes the use of energy efficiency gains by customers as a compliance mechanism to meet state implementation plans. Conceivably, utilities could pay customers for electricity savings that result in power plant CO$_2$ reductions.
Clean Power Plan proposed rule

- Clean Air Act provides legal authority – requires a federal-state approach. The proposed rule is called the “Clean Power Plan”
  - EPA set state-specific emission rate goals
  - State are to submit compliance plans
  - Section 111(b) new power plants
  - Section 111(d) all other generators
- Reduce power sector CO2 emissions by 30% by 2030 from 2005 levels
  - Corresponds to ~17% reduction from 2013 levels
Timeline

June 2, 2014: EPA proposed the Clean Power Plan
June 2015: Final Rule due
2016-18: State plans due
2020-2029: Compliance with initial goal
2030+ Compliance with final goal
Each state has a target rate

Rate = \frac{\text{Pounds of CO}_2}{\text{MegaWatts/hour}}

The rate is based on the existing mix of electric generating units (EGUs) and the potential for improvement.
Rate improves if:

\[
\text{Rate} = \frac{\text{Pounds of CO}_2}{\text{MegaWatts/hour}}
\]

The numerator decreases, or; the denominator increases.
The Blocks

1. Improve efficiency of generator
2. Change dispatch order
3. Source low-carbon energy
   • RE, Biomass, WHP, Nuclear
4. End-use energy efficiency
   • Large customer EE
   • CHP and WHP
EE as Emission Reduction

How it might work

Documented Energy Reduction

Power Plant Emissions

Before

After

Factory Energy Consumption

Before

After

Electricity only

$
## Types of CHP Units

<table>
<thead>
<tr>
<th>Covered Existing</th>
<th>Non-Covered Existing</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Lower emission rates than conventional generation</td>
<td>• Bio-mass (#3)</td>
</tr>
<tr>
<td>• #1 and #2</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Covered New</th>
<th>Non-Covered New</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Sec. 111(b) NSPS</td>
<td>• Treated as end-use energy efficiency resource (#4)</td>
</tr>
<tr>
<td>• Lower emission rate than conventional generation (#2)</td>
<td></td>
</tr>
<tr>
<td>• Bio-mass #3</td>
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</table>
CHP as Emission Reduction

How it might work

Power Plant Emissions
Energy sales to customer

Documented Energy Reduction

Factory Electricity Consumption

Before

After

Electricity only

$
CHP as Emission Reduction

The collective emissions of power plant and factory are reduced with CHP
Ways to determine CO₂ Reduction

1. Reduced generation at EGU
   • EGU emission rate x MWh not produced
   • (No credit for thermal)

2. Equivalence approach
   • CHP generation & % of thermal converted to MWh not produced by covered EGUs
   • MWh converted to CO₂ emissions*

3. Avoided emissions approach
   • Before emissions* – after emissions

(* based on regional grid average)
CHP as Emission Reduction

In Summary, it looks like this:

Power Plant Emissions
Factory Emissions
Combined Emissions

Documented Energy Reduction

Power Plant Generation
Before After

Electricity only

$
Implementation Possibilities

- Up to each state whether or not to include efficiency as a compliance method
- Two possible approaches:
  - Mass-based (cap in #tons/year)
  - Rate-based (#tons/MWh)
- Up to each state whether or not to include CHP as a compliance method
  - Many, many possible approaches
  - However, none can include offsets because…
Concluding Thoughts

• EPA is attempting to use market forces to reduce the amount of CO$_2$ released by electricity generation
• Each state must develop its own implementation plan
• Demand side efficiency and CHP should be part of such plans
• If they are, customers could monetize such investments
Thank you!

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Appendix: A
ACEEE report on 111(d) and EE:

Change Is in the Air: How States Can Harness Energy Efficiency to Strengthen the Economy and Reduce Pollution

Sara Hayes, Garrett Herndon, James P. Barrett, Joanna Mauer, Maggie Molina, Max Neubauer, Daniel Trombley, Lowell Ungar
A Snapshot of the U.S. in 2030

Following the current energy path will have devastating economic, environmental, and health impacts. Enacting energy efficiency policies would avoid 600 million tons of carbon dioxide emissions.

**Current Energy Path**

- NOx: 527,000 tons* of additional nitrogen oxide pollution
- SO2: 980,000 tons* of additional sulfur dioxide pollution
- CO2: 600 million tons* of additional carbon dioxide pollution
- Transmission and distribution cost increases
- Erosion of energy grid reliability

*$i.e., the amount of pollution that would be avoided by choosing the energy efficiency scenario

**95 billion in electricity generation costs**

**Energy Efficiency Scenario**

- **Environmental impacts:**
  - Energy efficiency policies would save 925 million MWh of electricity

- **Economic impacts:**
  - 26% reduction in carbon emissions relative to 2012
  - 25% reduction in power demand relative to 2012
  - 611,000 new jobs created
  - $17.2 billion increase in GDP in 2030

**47 billion in energy efficiency investments**

ACEEE
American Council for an Energy-Efficient Economy
High-end range of advanced pulverized coal includes 90% carbon capture and compression. Source: Molina 2014.
Savings relative to costs of energy efficiency policies

<table>
<thead>
<tr>
<th></th>
<th>High and low range for all states</th>
</tr>
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<tbody>
<tr>
<td>Energy savings target</td>
<td>1.1 - 4.9</td>
</tr>
<tr>
<td>Building codes</td>
<td>1.8 - 3.0</td>
</tr>
<tr>
<td>CHP</td>
<td>1.0 - 4.1</td>
</tr>
<tr>
<td>Equipment standards</td>
<td>1.8 - 9.4</td>
</tr>
</tbody>
</table>
### 2030 electricity savings if all four policies adopted

<table>
<thead>
<tr>
<th>Policy</th>
<th>Annual electricity savings (MWh)</th>
<th>Cumulative electricity savings (MWh)</th>
<th>Avoided capacity (GW)</th>
<th>Percent avoided electricity consumption relative to 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy savings target</td>
<td>692,200,000</td>
<td>5,470,500,000</td>
<td>185</td>
<td>18.8%</td>
</tr>
<tr>
<td>Building codes</td>
<td>155,400,000</td>
<td>1,100,100,000</td>
<td>41</td>
<td>4.2%</td>
</tr>
<tr>
<td>Combined heat and power</td>
<td>68,300,000</td>
<td>564,500,000</td>
<td>18</td>
<td>1.9%</td>
</tr>
<tr>
<td>Equipment standards</td>
<td>9,400,000</td>
<td>112,100,000</td>
<td>3</td>
<td>0.3%</td>
</tr>
<tr>
<td>National total for all four policies</td>
<td>925,400,000</td>
<td>7,247,200,000</td>
<td>247</td>
<td>25.1%</td>
</tr>
</tbody>
</table>

Table 3. 2030 electricity savings if all four policies adopted
Building CHP instead of Central Generation

18 GW of central generation not built
20 GW of CHP built by 2030

Where will it go?