Output-Based Emission Regulation and Allowance Allocation

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March 9, 2006
Overview of the Issues

- What is an output-based regulation?
- Why adopt output-based regulation?
  - To recognize efficiency: CHP
  - To recognize renewables
- How do I develop output-based regulations?
- Who else has developed output-based regulations?
What is an Output-based Regulation?

- Output-based regulation relates emissions to the productive output of the process.
- Output-based emission standards
  - Conventional emission standards that account for the emissions benefit of efficiency.
- Output-basis for allowance allocation in emission trading programs.
  - Provides more allowances to more efficient plants. Can also allocate to renewable generators and efficiency projects.
### Output-based Units of Measure

<table>
<thead>
<tr>
<th>For this type of energy production...</th>
<th>Using...</th>
<th>An output-based measure is...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity generation</td>
<td>Boilers/steam turbines, Reciprocating engines, Combustion turbines</td>
<td>pounds per megawatt hour (lbs/MWh)</td>
</tr>
<tr>
<td>Steam or hot water generation</td>
<td>Industrial boilers, Commercial boilers</td>
<td>pounds per million British Thermal Units (lbs/MBtu)</td>
</tr>
<tr>
<td>Mechanical power</td>
<td>Reciprocating engines</td>
<td>grams/brake horsepower-hour (g/bhp-hr)</td>
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</tbody>
</table>

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Output-based Measurement is Not New

- Recip engines use g/bhp-hr
- Many industrial processes measured in lb emissions/unit of product (cement clinker, melted glass or metal)
- Auto CAFÉ standards in g/mi

But the common power generation and steam boiler sources have not used this format.
Why Adopt Output-based Regulation?

- Recognizes/ incentivizes:
  - Efficiency
  - Renewables
  - Pollution prevention
- More accurate/consistent emission measurement.
Emission Reduction Benefits of Efficiency

- Creates multi-pollutant emission reductions
- No start-up/shut-down emissions
- Reduced fuel use
- Avoids upstream and secondary pollutants
- Lower compliance costs
How Have Output-Based Regulations Been Applied?

- Conventional Rate Limits
- DG Regulations
- Emission Trading Programs
- State Multi-pollutant Programs
- Federal Multi-pollutant Programs
- Generation Performance Standards
- Greenhouse Gas Registry
- New Source Review
Output-based Emission Standards

- Relate emissions to productive output, i.e., lb/MWh, lb/MMBtu_{out}.
- Account for increased process efficiency such as combustion efficiency, heat recovery, reduced parasitic losses.
  - Not related to efficiency of energy end use, (i.e., the light bulb).
- Allow efficiency and renewables to be used as part of the emission control strategy.
Issues for Output-based Regulation

- Output-measurement – both electricity and thermal output can be reliably and accurately measured.
- Set standards – can be based on new data or conversion from input-based standards.
- Transaction costs – cost of documentation, application and administration can be a deterrent for smaller renewable, efficiency and CHP projects.
Allowance Trading Programs

- Establish emissions tonnage cap for group of affected sources.
- Distribute emission allowances equal to the cap.
- Each plant must hold allowances equal to its emissions at the compliance point.
- Plants can buy or sell allowances.
The Role of Allocation

- Emission allowances must be distributed at the beginning of the program - distributing the “chips” in the trading system.
- Allocation does not determine the near-term compliance strategy but does affect profitability of individual plants or companies.
  - Can encourage the development of new, clean technologies.
Allocation Options

- Emission-based – based on historic emissions – rewards historic high emitters.
- Input-based – based on historic fuel consumption – rewards less efficient plants.
- Output-based – based on historic generation – rewards more efficient plants.
  - Can include renewables and thermal output of CHP facilities.
Allocation Example: CAIR

◆ Clean Air Interstate Rule - regulates NO\textsubscript{x}, SO\textsubscript{2} in 28 eastern states.
  – NO\textsubscript{x} is the primary target for allocation.

◆ Allocation process left to the states. EPA has provided model language.
  – Can be easily extended to include CHP and renewables.
CAIR Coverage
CAIR Model Rule

- Thermal output included for new CHP generators.
- Easily expanded to include renewables.
- Treatment of CHP can be improved.
STAPPA/ALAPCO Model

- Provides model rule language for direct allocation and renewable energy setasides as well as other $\text{NO}_x$ allowance allocation options.

- *Alternative $\text{NO}_x$ Allowance Allocation Language for the Clean Air Interstate Rule* (August 2005)
  
Summary

- Output-based regulation can be used in many regulatory programs to encourage renewables and various forms of energy efficiency, including CHP.
- Many states have already implemented such programs and there is a variety of resources available to assist in future program development.