Output-Based Environmental Regulations

An Effective Policy to Support Clean Energy Supply

Output-based regulations (OBR) can be an important tool for promoting an array of innovative energy technologies that can help achieve national environmental and energy goals by reducing fuel use. OBR encourages energy efficiency and clean energy supply, such as combined heat and power (CHP), by relating emissions to the productive output of the process, rather than the amount of fuel burned.

How Do Output-Based Emission Limits Encourage Clean Energy?

Traditional "input-based" environmental regulations for power generators and boilers establish emission limits based on heat input (e.g., pounds per million British thermal units [lb/MMBtu] heat input) or exhaust concentration (parts per million) in the exhaust stream. These input-based limits do not account for the pollution prevention benefits of increased efficiency in the generation of heat or electricity.

Output-based emission limits, expressed as emissions per unit of useful energy output (e.g., pounds per megawatt-hour [lb/MWh]), on the other hand, promote clean energy by accounting for the air pollution effects of energy efficiency in the compliance computation.

For example, a facility that installs an energy-efficient technology has lower

What Are the Benefits of Using More Efficient Combustion Technologies?

- ***Reduced Fossil Fuel Use***. Encouraging energy efficiency and renewable energy sources will reduce the demand for imported fossil fuels.
- ***Multipollutant Emission Reductions.*** The use of efficiency as a pollution control measure results in multipollutant emission reductions. For example, a source that chooses to comply with NO_X limits by increasing fuel conversion efficiency will also reduce emissions of all other pollutants as well.
- ***Multimedia Environmental Reductions***. By encouraging reduced fuel use, an OBR reduces air, water, and solid waste impacts that result from the production, processing, transportation, and combustion of fossil fuels.
- ***Technology Innovation.*** Encouraging more efficient energy generation can advance the use of innovative technologies, such as CHP.
- ***Compliance Flexibility.*** Allowing the use of energy efficiency as part of an emission control strategy provides regulated sources with an additional compliance option. This flexibility enables the plant operator to determine the most cost-effective way to reduce emissions, while providing an incentive to use less fuel.

emissions because it burns less fuel. However, input-based emission limits do not count the reduced emissions from improved energy efficiency toward compliance. By not accounting for these emission reductions, input-based emission limits can present a missed opportunity for adopting energy-efficiency improvements. Output-based emission limits, which do account for the emission reduction benefits of energy efficiency, make it more attractive for regulated sources to install clean energy technologies because these technologies provide greater compliance flexibility and the opportunity for reduced compliance costs.

Output-based emission limits are particularly important for promoting the energy and environmental benefits of CHP. CHP units produce both electrical and thermal output. Output-based limits can be designed to explicitly account for both types of output in the compliance computation. Traditional input-based limits, on the other hand, do not account for the pollution prevention benefits of CHP (see Figure 1).

Output-based emission limits do not favor any particular technology, nor do they result in increased emissions. They simply level the playing field by allowing energy efficiency and renewable energy to compete on an equal footing economically with any other method of reducing emissions (e.g., combustion controls and add-on controls).

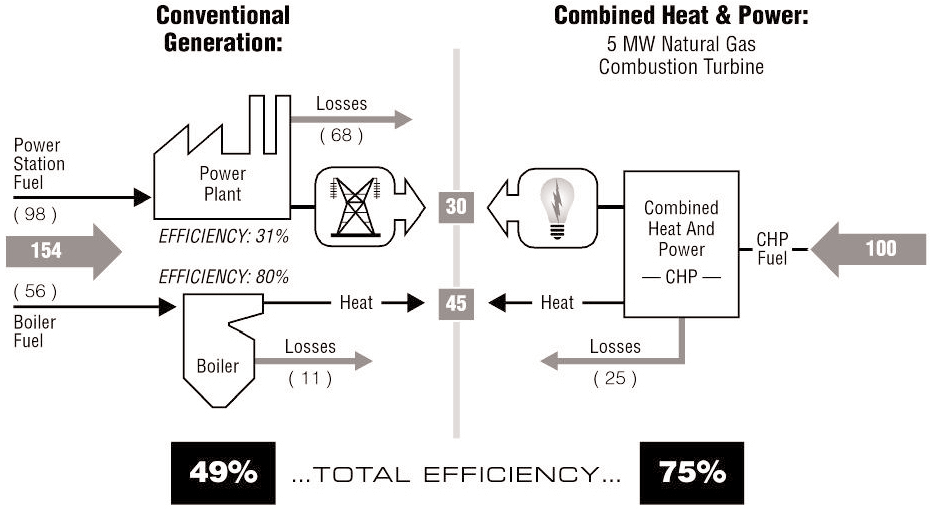
In What Ways Can Output-Based Approaches Be Incorporated Into Air Regulatory Approaches?

Output-based regulatory concepts can be applied to a variety of air regulatory programs, including:

- *Conventional emission limits*, such as emission limits in State Implementation Plans for Reasonably Available Control Technology.[1]
- *Emission limits for small distributed generation (DG) and CHP*. Most states that have recently promulgated emission limits for DG are using OBR.
- *Allowance allocation in emission trading programs.* Emission allowances are most commonly allocated based on either heat input or energy output. Allocation based on heat input gives more allowances to less efficient units. Allocation based on energy output gives more allowances to more efficient units. An updating allocation system (where allowances are reallocated in the future) based on output provides an ongoing incentive for improving energy efficiency.
- *Allowance allocation set-asides for energy efficiency and renewable energy*. In addition to allocating allowances to regulated sources, a cap and trade program can "set aside" a portion of its allowances for allocation to energy efficiency, renewable energy, and CHP projects that are not regulated under the cap and trade program. These unregulated units can sell the allowances to regulated units to generate additional revenue.

[1]EPA has used an output-based approach with recognition of CHP for the new source performance standards (NSPS) for NO_X from utility boilers, NSPS for mercury from coal-fired utility boilers, and National Emission Standards for Hazardous Air Pollutants for combustion turbines.

Figure 1. CHP System Efficiency



Source: EPA 2004.

Which States Have Established Output-Based Environmental Regulations?

Several states have been at the forefront of adopting OBR in general and, in particular, developing rules that account for the efficiency benefits of CHP. Table 1 presents a summary of state OBR programs. Features of several state OBR programs are highlighted below.

Connecticut has promulgated an OBR for NO_X, particulate matter, CO, and CO_2 from small DG (< 15 MW capacity), including CHP. Connecticut's regulation values the efficiency of CHP based on the emissions that are avoided by not having separate electric and thermal generation. Connecticut also allocates allowances based on energy output in their NO_X trading program. For more information, visit *www.ct.gov/dep/lib/dep/air/regulations/mainregs/sec42.pdf*.

Table 1. State Output-Based Regulations

California	Small DG Rule*
Connecitcut	Allowance Allocation/trading Small DG Rule*
Delaware	Small DG Rule*
Indiana	Allowance Allocation/set-asides
Maine	Small DG Rule
Maryland	Allowance Allocation/set-asides
Massachusetts	Allowance Allocation/trading* Small DG Rule Multipollutant Regulation Allowance Allocation/set-asides
New Jersey	Allowance Allocation/trading Allowance Allocation/set-asides
Ohio	Allowance Allocation/set-asides
Texas	Conventional NO_X Limits Small DG Rule*
New Hampshire	Multipollutant Regulation
New York	Small DG Rule Allowance Allocation/set-asides
**Includes recognition of CHP through inclusion of thermal credit.*	

Indiana's NO_X trading program includes a set-aside of allowance allocations for energy efficiency and renewable energy. Indiana allocates 1,103 tons of NO_X allowances each year for projects that reduce the consumption of electricity, reduce the consumption of energy other than electricity, or generate electricity using renewable energy. Eligible projects can involve combined cycle systems, CHP, microturbines, or fuel cells. For more information, visit *www.in.gov/idem/programs/air/sip.*

The **Massachusetts** NO_X cap and trade program employs useful output, including the thermal output of CHP, to allocate emission allowances to affected sources (i.e., generators > 25 MW). This approach provides a significant economic incentive for CHP within the emissions cap. Massachusetts also has a multipollutant emission regulation (i.e, NO_X, SO_2, Hg, CO_2) for existing power plants, which uses an output-based format for conventional emission limits. For more information, visit *www.mass.gov/dep/air/laws/pbsareg.pdf* or *www.mass.gov/dep/air/laws/729final.doc*.

In 2001, **Texas** promulgated a standard permit with output-based emission limits for small electric generators. The permit sets different NO_X limits (lb/MWh) based on facility size, location, and level of utilization. The compliance calculation accounts for the thermal output of CHP units by converting the measured steam output (Btu) to an equivalent electrical output (MWh). For more information, visit *www.tceq.state.tx.us/assets/public/permitting/air/NewSourceReview/Combustion/segu_permitonly.pdf*.

Elements of a Successful Policy

Based on the experiences of state environmental agencies that have developed OBR, a number of best practices have emerged for designing and implementing effective OBR. These best practices include:

- ***Conduct internal education*** to ensure that state environmental regulators understand the benefits, principles, and mechanisms of OBR and CHP.
- ***Evaluate the state's overall air pollution regulatory program.*** Regulatory programs are routinely reviewed and revised, and occasionally new programs are mandated by state or federal legislation. States can take advantage of those opportunities to evaluate their regulatory programs to determine whether their regulations are

structured to encourage energy efficiency, pollution prevention, and renewable resources.

- ***Coordinate with other state agencies that can lend support.*** State energy offices, energy research and development offices, and economic development offices can be important supporters in promoting OBR, efficiency, and CHP. Their perspective on the importance of energy efficiency and pollution prevention can be very valuable when formulating OBR policies.
- ***Determine what types of DG and CHP technologies and applications might be affected*** and whether there are any specific technology issues that the regulation needs to address. Consult with the Public Service Commission, Independent System Operator, and owners or operations of DG and CHP units to inform regulatory determinations.
- ***Gather/review available output-based emission data for regulated sources.*** Alternatively, convert available data to output-based format. Obtain information from equipment providers on technologies and emissions profiles, and capitalize on experience and work already conducted by other states.
- ***Evaluate alternative approaches to account for multiple outputs of CHP units.***
- ***Train permit writers*** on implementation of the new rules, once adopted.

EPA Assistance Available

The EPA CHP Partnership is a voluntary program that seeks to reduce the environmental impact of power generation by promoting the use of cost-effective CHP. The Partnership assists state policy makers and regulators to evaluate opportunities to encourage CHP through the implementation of policies and programs. See *www.epa.gov/chp*.

Additional Resources

EPA has developed *Output-based Regulations: A Handbook for Air Regulators*, which explains the benefits of output-based emission limits, how to develop OBR, and the experience of several states in implementing OBR. This handbook is intended as a resource for air regulators in evaluating opportunities to adopt OBR and writing regulations. The handbook is available at *www.epa.gov/chp/state_resources.htm*.

EPA has created *The Clean Energy-Environment Guide to Action*. The Guide provides an overview of clean energy supply technology options and, in addition to OBR, presents a range of policies that states have adopted to encourage continued growth of clean energy technologies and energy efficiency. *The Guide* is available at *www.epa.gov/cleanenergy/stateandlocal/guidetoaction.htm*.

Developing and Updating Output-Based NO_X Allowance Allocations. This EPA guidance document was the result of a 1999 stakeholder process to develop approaches to output-based allocation of emission trading allowances, including allocation to CHP facilities. See *www.epa.gov/airmarkets/progsregs/nox/docs/finaloutputguidanc.pdf*.

Analysis of Output-Based Allocation of Emission Trading Allowances. This report for the U.S. Combined Heat and Power Association provides background on emission trading programs and the benefits of output-based allocation, with a particular focus on CHP. See *http://uschpa.admgt.com/allocationfinal.pdf*.

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EPA CHP COMBINED HEAT AND POWER PARTNERSHIP

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