Regulatory Assistance Project
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Output-Based Emissions Standards for Distributed Generation

Innovations in technology, changes in the economics of the electric industry, and a variety of regulatory reforms have combined to create new opportunities for small-scale, distributed generation (DG). Microturbines, diesel gen-sets, fuel cells, solar panels, gas reciprocating engines, wind turbines, and other DG can further transform the nature of the electric network, offering additional ways to capture production cost savings and benefits.

With these opportunities come challenges. Extensive deployment of DG could, if unregulated, have significant environmental impacts. Yet if DG is *over*regulated, valuable, efficient, and clean technologies could be stifled. For air regulators, DG raises particular concerns, because diesel and natural gas combustion technologies make up the lion's share of installations. If DG is to benefit electric systems across the country, states will need to tackle the emissions question head on.[1]

Although developers may rankle at the idea of regulation, far more frustrating to them would be a hodgepodge of inconsistent and even incompatible rules, each state setting its own standards, timing, and compliance requirements. In the long run, the industry, the electric system, and the environment will be better served by a set of like rules across states and regions.

1 Other issues need to be dealt with, too, such as interconnection, stand-by rates, demand response, and the role of DG among other distributed resources (e.g., end-use efficiency). Emissions regulations are only one component of an integrated package of policies needed to support cost-effective, environmentally sustainable distributed resources.

Seeing the value in uniformity and the avoidance of duplicative effort, the Regulatory Assistance Project convened a working group of state utility regulators, state air pollution regulators, representatives of the distributed resources industry, environmental advocates, and federal officials to develop model DG emissions regulations. Approximately thirty people came together over a two-year period to develop a rule designed to foster the deployment of distributed generation and other resources in ways that are both environmentally sustainable and economically efficient. In October 2002 the group came to a broad consensus on the rule, which is printed in its entirety as an insert to this *Issuesletter*.

The Emissions Challenge: A Basis for Standards

Distributed generation, like central generation, comes in many different technologies, sizes, and fuel types. Each has particular strengths and weaknesses: some, such as diesel reciprocating engines, have quick start capabilities that make them ideal for emergency service; others, such as gas turbines, perform well in more extended operations. Each has its

Figure 1: NO_X (lb/MWh)

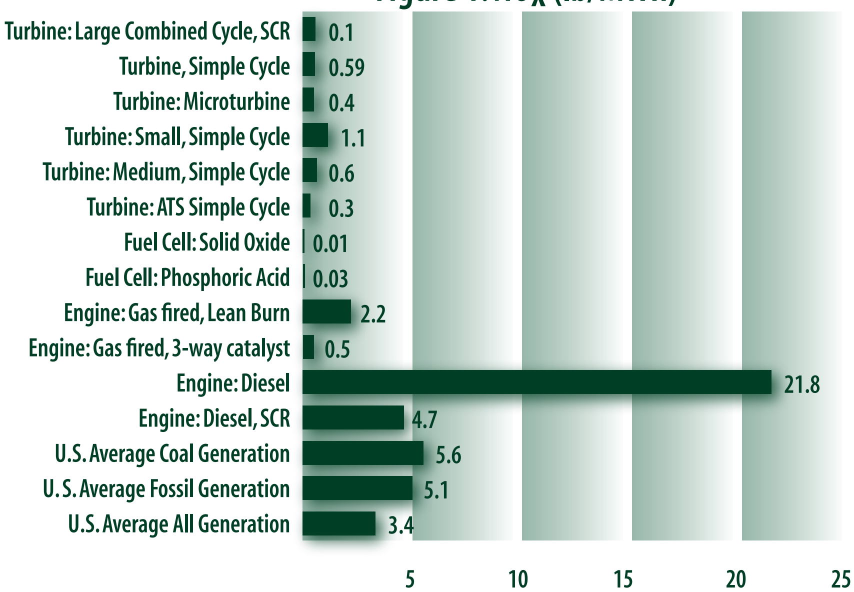
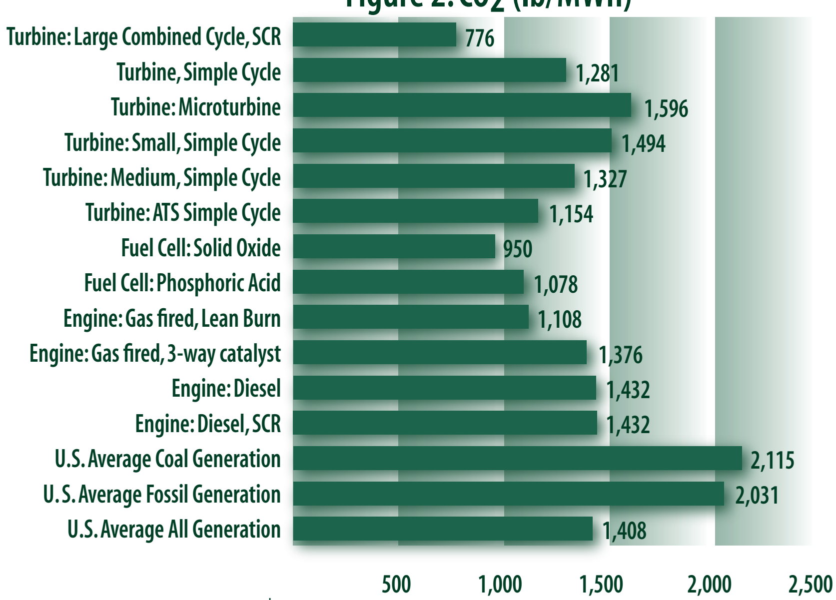


Figure 2: CO_2 (lb/MWh)



own emissions characteristics. Figures 1 and 2 compare the emissions outputs of various types of DG and central generating facilities in the United States.

The rule focuses primarily on the emissions standards DG should be required to meet. In certain cases new distributed generation will displace higher-emitting central generation, including coal-fired facilities whose emissions output is in many instances greater than that of the new DG. Some would argue that policymakers should simply adopt standards that encourage the deployment of DG because doing so would improve air quality overall. Yet emissions regulation under the Clean Air Act is intended not merely to achieve marginal improvements over existing air quality but to meet public-health-based ambient air standards. And it is difficult to establish with a sufficient degree of confidence what emissions are actually being displaced by new distributed generation. From an environmental analyst's point of view, it is impractical to model the operations of thousands of dispersed DG units, operating at very different times and in very different places within the electric system. Each could be displacing a different set of power plants with different emission characteristics. DG operating in some hours may even displace less polluting resources. Moreover, emissions from central generating facilities that are exhausted through tall stacks in remote areas are not directly comparable to DG emissions, which are likely to be near ground level in populated areas.

The rule does not attempt to reconcile these contending positions. Instead, it considers the practical implications of emissions limits on distributed generation and approaches the problem of setting emission standards with an eye to technological capabilities and reasonable expectations for improvements over time.

Features of the Rule

The rule is intended to regulate the emissions of a class of generators that are not covered, or not covered consistently, under existing state or federal regulations. In this sense, it is meant to close the gap in a state's existing air regulations. It applies only to new installations, which many expect to proliferate rapidly in the coming years.

The model rule regulates five air pollutants: nitrogen oxides (NO_X), particulate matter (PM), carbon monoxide (CO), sulfur dioxide, and carbon dioxide (CO_2).[2] It takes an output-based, fuel- and technology-neutral approach to controlling the emissions (except in the case of sulfur dioxide, which is readily addressed through a fuel sulfur-content requirement). This approach recognizes and rewards efficiency and promotes innovation. The rule also allows for compliance through manufacturer certification and is compatible with competitive markets and other regulatory schemes, such as generation performance standards and tradable emissions allowances.

But not all distributed generation is the same. Given the range of technologies, uses, and environmental profiles, single-point emissions standards applicable to all DG would not be practical. Depending on how such standards might be set, they would be either ineffective (not stringent enough) or a barrier to DG deployment and its benefits (too stringent). Consequently, the rule differentiates not by technology but by the needs served, which in turn are defined by the circumstances of operation (duty-cycles): emergency (no more than 300 hours per year) and non-emergency. In addition, the rule calls for phasing in the standards in three steps over an eight-year period.

The general premise of the rule is that the more a generator operates, the lower its emissions per megawatt-hour (MWh) must be. This is consistent with the historic approach to permitting larger sources, which relates compliance requirements to the cost per ton of reduction. The compliance costs for sources that run very few hours (such as peaking facilities) will be more likely to exceed the cost-per-ton thresholds (as set by the state environmental regulators). When the compliance cost is spread out over a greater number of hours of operation, the requirement can be more stringent. This premise goes for emergency generation as well, although it is complicated by public health and safety imperatives during blackouts. Emergency units will run to provide electricity, particularly for essential services such as hospitals, until grid power is restored. These events are unpredictable and usually of limited duration, given the extremely high reliability of the U.S. power system.

The rule recognizes that certain technologies are better suited to particular needs, for example, diesels for emergency operations and microturbines and gas reciprocating engines for extended use. The emissions limits in the two categories (emergency and non-emergency)

2 Many, but not all, members of the working group thought that CO_2 should be included in the final draft rule. It is the only element of the rule that was not supported by a unanimous consensus. RAP, however, believes, that CO_2 warrants the attention of policymakers and recommends that it be addressed in the rules that states adopt.

State Activity on DG Emissions Standards

In June 2001 the Texas Natural Resource Conservation Commission adopted the "Air Quality Permit for Electric Generating Units," which established output-based standards for nitrogen oxides from generating facilities of less than 10 MW. The standards differ between east Texas and west Texas, are phased in over four years, and give emissions credits for combined heat and power systems. Around the same time, the staff of the California Air Resources Board (CARB) issued a proposed rule that set output-based standards not only for NO_X but also for carbon monoxide, volatile organic compounds, and particulate matter. Like the Texas rule, the CARB rule has a two-step phase-in (the second phase begins in 2007) and gives credit for CHP savings. It also calls for a technology review, to be completed a year and a half before the 2007 standards go into effect. The CARB adopted the rule in November 2001 (with minor amendments in early 2002). Other states that are currently considering the adoption of emissions regulations for distributed generation include Connecticut, Delaware, New Jersey, New York, and Massachusetts.

are based on the levels of emissions that current technologies can achieve or are expected to achieve over the next decade. There are three phase-in periods, during which the limits are ratcheted down. In this sense, the approach resembles the BACT (best available control technology) approach historically used in U.S. air regulation (i.e., the standards tighten as cost-effective improvements in technology are made). But BACT has traditionally been interpreted to mean that a new project has to be only as clean as the cleanest current model of the particular technology in question (i.e., diesel, gas combined cycle, oil, atmospheric fluidized bed coal, etc.). The model rule instead requires that all technologies meet the same, tighter standards; the emissions limits push for the cleanest applicable technologies. The model rule also differs from BACT in that it sets standards for technology that have not yet been achieved; BACT, in contrast, calls for compliance with performance standards that have already been demonstrated, and it is determined on a case-by-case basis.

The timing of the phase-in periods is designed to accommodate manufacturers' research and development cycles. Phase One begins in 2004, Phase Two in 2008, and Phase Three in 2012. For emergency generators, the rule adopts the EPA standards for off-road engines (converted to lbs/MWh).[3] In the case of NO_X produced by non-emergency generators, the Phase One and Phase Two limits differ for attainment and non-attainment areas. This will enable a state with attainment areas to give more flexibility to suppliers if it concludes, for instance, that the air-quality benefits of the stricter emissions standards are not great enough to justify the higher technology costs in the early years. As technology develops, driven in part by increased deployment of distributed resources and stricter standards for on-road engines, the justification for areal differentiation will diminish. With Phase Three, both attainment and non-attainment areas will face the same NO_X limits.

The model rule's Phase Three standards are "stretch" goals intended to push technology improvements. Although aggressive, the limits are based in large measure on the predicted trajectories of technology performance over the next decade.[4] Given uncertainties about the state of

3 These standards are differentiated by engine size and are likewise ratcheted down over time. Tier 3 standards will go into effect between 2006 and 2008. In April 2003 USEPA announced its proposal for Tier 4 standards, which would go into effect, depending on engine size, between 2008 and 2014. See http://www.epa.gov/nonroad/reg041503.pdf.

4 Technology-forcing regulation has often been both effective and cost-effective (e.g., automobile mileage and emissions standards), and in certain instances the improvements

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The Model Rule's Proposed Emission Standards for Non-Emergency Generators

	Nitrogen Oxides: Ozone Attainment Areas	Nitrogen Oxides: Ozone Non-Attainment Areas
Phase One: (installed on or after 1/1/04)	4.0 lbs/MWh	0.6 lbs/MWh
Phase Two: (installed on or after 1/1/08)	1.5 lbs/MWh	0.3 lbs/MWh
Phase Three: (installed on or after 1/1/12)	0.15 lbs/MWh	0.15 lbs/MWh

	Particulate Matter: liquid fuel reciprocating engines	Particulate Matter: liquid-fuel only non-reciprocating engines	Carbon Monoxide	Carbon Dioxide*
Phase One: (installed on or after 1/1/04)	0.7 lbs/MWh	TBD	10 lb/MWh	1,900 lbs/MWh
Phase Two: (installed on or after 1/1/08)	0.07 lbs/MWh	TBD	2 lbs/MWh	1,900 lbs/MWh
Technology review to be completed by December 31, 2010				
Phase Three: (installed on or after 1/1/12)	0.03 lbs/MWh	TBD	1 lb/MWh	1,650 lbs/MWh

*The carbon dioxide standards apply also to emergency generators.

both DG technology and environmental regulations in ten years, the rule calls for a technology review to be completed a year before the Phase Three standards go into effect. The review will require the state to evaluate whether the Phase Three limits are still apt and, if not, how they should be changed. To the extent that states can conduct this review jointly or with federal agencies, its costs can be significantly reduced and national consistency of standards promoted.

Conclusion

This is a model rule that states may adopt or adapt as they see fit. Even so, the rule is intended to promote national consistency across the states, thereby reducing the costs of compliance for suppliers and easing administrative burdens for regulators. For that hope to be realized, several states will need to adopt the model rule or its essential provisions and thus begin the process that will make distributed generation a vital part of a more reliable – and more environmentally sustainable – electric system.

4 (particularly emissions reductions) have been attained at lower cost and with less disruption than the affected industry initially feared. For such standards to work, they must be related in some way to industry research and development, the expectations for technological progress, and the market for the technologies under consideration. The distributed resources market differs significantly from, say, the automobile market – it is much smaller – and this influences whether and at what rate changes in technology can be brought about.

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