
Improving Regulations for Biomass-Based Electrical Generating Facilities

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As state and regional greenhouse gas reduction programs and renewable portfolio standards increasingly require utilities to satisfy at least some portion of their customers' electricity needs through carbon-neutral, renewable forms of electric power generation, utilities and other power producers are likely to propose many new biomass-based electrical generating facilities during the next several years. Such a trend would improve the nation's energy diversity and independence while helping to mitigate greenhouse gas emissions resulting from the generation of electricity. Unfortunately, biomass-based facilities face discouraging regulatory uncertainty and unnecessarily burdensome environmental regulatory programs. This article addresses that dilemma. After providing some background on biomass and biomass-based electrical generating facilities, this article reviews the practical aspects of various environmental regulations that could apply to modern biomass technologies and suggests ways to improve the regulatory approval process for these facilities.

"Biomass" is a broad term that generally encompasses the various forms of organic matter from plants and animals, including agricultural and forestry residues, mill residues, urban wood waste such as yard trimmings and construction and demolition debris, and "energy" crops grown for use in biomass-based facilities. Biomass is a renewable resource that can be replenished relatively quickly on a sustainable basis. While some amount of waste biomass is already being used for energy production, a significant amount remains as an available, untapped resource. To meet the expected demand for renewable energy sources, however, agricultural crops will be needed. Some of the fast-growing and short-rotation woody and herbaceous types being grown or developed for energy feedstock purposes include eucalyptus, locust, sycamore, poplar, willow, switchgrass, miscanthus, giant reed, tall fescue, and big bluestem. The appropriateness of a particular plant can vary by region, based on the area's climate and soil conditions. With a number of federal and state grants available for biomass feedstock-related developments, scientists inevitably will continue to improve the variety, yields, and effectiveness of these and other forms of "energy" crops, thus helping to ensure high-quality and high-volume supplies of energy-rich biomass.

Biomass-based electrical generating facilities use biomass

either directly as a fuel to generate electricity or as a feedstock to produce a synthesis fuel that is in turn used to generate electricity. For example, biomass can be used as a fuel in a conventional boiler, either as the primary fuel or cofired with fossil fuels. There are a variety of boiler types appropriate for biomass fuel, including pile burners, circulating fluidized bed combustors, and stationary or traveling grate combustors. Alternatively, gasification technology has been developed to process and convert biomass from a solid form into a gaseous form (referred to as synthesis gas or syngas, which is composed primarily of hydrogen and carbon monoxide). The syngas can then be fired in a conventional boiler or in a simple cycle or combined cycle gas turbine (known as integrated gasification combined cycle or IGCC). Biomass can also be decomposed through anaerobic digestion, resulting in a usable methane gas that can be fired in a gas turbine. This article focuses on IGCC units using biomass as a dedicated feedstock to produce syngas that is subsequently fired in a combined cycle combustion turbine system, as well as modern boilers using biomass or syngas as a primary fuel.

Considering the entire nation as a whole, biomass is the largest form of renewable energy being used today, outpacing the country's reliance on hydroelectric, wind, solar, or geothermal resources. But the use of renewable sources remains marginal. According to U.S. Department of Energy (DOE) statistics, all of the renewable sources combined accounted for only 7 percent of total energy consumed in the United States in 2006, and only 1 percent of all electricity generated that year came from biomass. These statistics are, however, expected to change.

Both DOE and the U.S. Department of Agriculture (USDA), as well as many states, are strongly committed to expanding the role of biomass as a sustainable energy source to strengthen the nation's energy security and diversity, lessen environmental impacts, and stimulate economic growth. To determine whether sufficient amounts of biomass could be available to support a significant increase in biomass-based energy, DOE and the USDA studied potential sources within the United States, considering both the quantities of biomass currently available and also the quantities of crops that could be specifically grown for energy purposes. They estimated that with only modest changes in land use and agricultural and forestry practices, the United States could achieve a seven-fold increase in the amount of biomass currently consumed for commercial and industrial products and energy. Specifi-

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cally, they found that 1.3 billion dry tons of biomass could be produced annually from agricultural and forest lands in this country on a sustainable basis, while maintaining forests and meeting food, feed, and export demands. *Biomass as Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Study*, DOE, USDA (2005). Based on their initial goals and the feedstock study results, these federal agencies are encouraging an increase in biomass-based energy including electric power generation.

In addition, more and more states concerned about sustainable and diverse energy supplies are establishing renewable portfolio standards for electric utilities, requiring that a minimum percentage of a utility's overall power generation come from renewable sources such as biomass. Some states are mandating that 20 or even 25 percent of future electricity generation come from renewable sources—an impressive surge considering the small percentage of total electrical generating capacity that renewable sources currently occupy. Congress also has considered establishing a national renewable portfolio standard, perhaps as high as 15 percent.

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Another driver of increased electricity generation from renewable biomass is the potential for curbing greenhouse gas emissions. The Intergovernmental Panel on Climate Change (IPCC) has recommended an increased reliance on renewable sources of energy, including biomass, as a significant element in the overall strategy for mitigating greenhouse gas emissions. *Fourth Assessment Report of the IPCC, Summary for Policy-makers* (2007). Supportive of this recommendation, several

life-cycle analyses performed during the past decade have indicated that electric power generation from biomass-based facilities is carbon neutral or would have minimal greenhouse gas emissions, assuming that sustainable, environmentally friendly biomass production practices are implemented. These studies analyzed the environmental impacts of entire systems, including crop cultivation, transportation, construction and operation of the generating facility, emissions and discharges, and disposal. Because trees and plants absorb carbon dioxide emissions as they grow, and because some of the carbon remains in the root systems and in the soil, the net amount of carbon dioxide added to the atmosphere from the combustion of biomass is neutralized, or at least minimized, assuming a continuous biomass cultivation cycle. The use of waste biomass is even more beneficial due to avoided emissions of methane (another greenhouse gas) that would otherwise occur if the waste were left to decompose, as well as lower energy requirements compared to cultivated energy crops.

Given these carbon-friendly attributes and the abundance of biomass resources, considering both current and future supplies, and because some areas of the country are not well-suited for other forms of renewable energy, biomass-based facilities are certain to be a greater part of the overall mix of electrical generating facilities developed in the United States. Notwithstanding these benefits and the urgings (even mandates) of federal and state agencies to expand the nation's use of biomass-based electrical generating facilities, environmental permitting requirements could nevertheless be unnecessarily burdensome and ultimately hinder the timely and efficient regulatory approval of these facilities.

Environmental Requirements

Biomass-based facilities seem to fall within a variety of established regulatory programs because some amount of fossil fuel might be used (e.g., during startup), because electricity or steam is generated, or because some amount of "waste" biomass is used (e.g., yard trimmings, which are considered municipal waste), often without apparent deliberate consideration of biomass as the primary fuel or feedstock. Whether a particular standard applies is not always clear, and the standards are sometimes overly burdensome, especially given the relatively low emissions from biomass-based facilities. The following are some examples of regulatory programs under the federal Clean Air Act that may apply to biomass-based IGCC units or boilers, even though the agency likely did not consider these types of facilities when the regulations were established.

When determining the potentially applicable air quality requirements for a facility, one of the first issues considered is whether the New Source Review (NSR) program applies, triggering the need for a control technology determination, ambient air quality modeling, and additional impact analyses. Under section 169 of the Clean Air Act, the major source threshold tied to NSR applicability is the potential to emit 100 tons per year or more of a regulated air pollutant for twen-

ty-eight listed source categories, compared to the major source threshold of 250 tons per year for nonlisted categories. The U.S. Environmental Protection Agency (EPA) recently clarified that biomass-based *ethanol* plants were subject to a major source threshold of 250 tons per year and that these plants were not “chemical process plants” (a listed source category). 72 Fed. Reg. 24,060 (May 1, 2007). Similarly, EPA recently determined that a gasifier converting biomass to synthetic gas was not a “fuel conversion plant” (another listed category) because EPA always intended for that source category to apply to units converting coal or other fossil fuels into other fuels. EPA had come to the opposite conclusion in a prior determination, however, leading to some regulatory uncertainty.

Another potentially applicable source category within the list of twenty-eight is “fossil fuel-fired steam electric plants.” A boiler that used primarily biomass should not fall within a category focused on fossil fuel-firing, even if it uses a small amount of fossil fuel. EPA agreed with this general premise when it determined that a boiler using fossil fuel only during startup for proper operation of the unit and not for the purpose of producing steam is not a “fossil fuel steam generator” under New Source Performance Standard (NSPS) Subpart D. Guidance from EPA to confirm that steam electric plants using primarily biomass or biomass-based fuels do not fall within the list of twenty-eight source categories would help improve regulatory certainty for these plants.

Contrary to EPA’s NSPS determination regarding fossil-fuel steam generators, the Acid Rain Program and the Clean Air Interstate Rule (CAIR, applicable in twenty-eight eastern states and the District of Columbia) appear applicable to electrical generating facilities using primarily biomass if any amount of fossil fuel is ever used for any purpose (e.g., even if only for startup). These programs require allowances to cover sulfur dioxide and nitrogen oxides omissions as well as continuous monitoring and additional recordkeeping and reporting, all of which result in a financial burden. When asked to exempt biomass-fired units from CAIR, EPA stated that because biomass-fired units are designed and operated *for the purpose of generating electricity for sale*, they are considered to be part of the power generating sector, the target of the CAIR program, and should not be exempt regardless of their emission levels. 71 Fed. Reg. 25,328 (April 28, 2006).

The Acid Rain Program and CAIR do, however, exempt very small units and also solid waste incineration units that fire more than 80 percent nonfossil fuels (such as biomass). The term “solid waste incineration unit” is broadly defined as a unit that combusts any solid waste material from commercial or industrial establishments or the general public, which could include various forms of waste biomass. The exemption is unfortunately not available for qualifying small power production facilities (or QF facilities, as defined under section 3(17)(c) of the Federal Power Act), and many biomass-based units are likely to have that status. The primary benefits of QF status include the right to sell energy to a host utility at the host utility’s avoided cost rate, exemption from the Public Utility Holding Company Act of 2005, and exemption from certain

state laws regulating rates and finances. Facilities wishing to take advantage of such benefits are then forced to choose between electing QF status and eligibility for exemption from the Acid Rain Program and CAIR.

In addition to those two programs, biomass-based generating facilities also face regulatory controls under NSPS. Specifically, Subpart Da applies to larger combustion turbines and duct burners associated with IGCC systems that employ “gasified biomass” as their fuel. Subpart Da is one of the few regulations that mention the use of “gasified biomass.” This subpart may also apply to larger boilers if they are “capable” of firing fossil fuel with a heat input rate exceeding 250 MMBtu/hour. Smaller boilers, and possibly biomass gasifiers that produce steam, would be subject to Subpart Db or Dc, and smaller turbines (and the associated duct burners) would be subject to Subpart KKKK. Subparts Db and Dc include emission limits applicable to wood firing in a boiler or duct burner, and Subpart KKKK includes emission limits applicable to fuels “other than natural gas,” although syngas and gasified biomass are not specifically mentioned.

Another NSPS, Subpart RRR, is potentially applicable to the gasifier used in a biomass-based IGCC facility. This NSPS applies to unit operations in which one or more chemicals, or reactants other than air, are combined or decomposed in such a way that their molecular structures are altered and one or more new, listed organic compounds are formed. The biomass gasifier could fall within this broadly worded definition, although the quantities of individual chemicals produced as part of the syngas may fall below the applicability thresholds. When EPA promulgated the rule more than fifteen years ago, it focused on fossil fuels and not natural feedstocks such as biomass. Accordingly, EPA often grants case-by-case exemptions for biomass facilities, including those producing liquid fuels generated from biomass feedstock; EPA should extend a comparable exemption practice to biomass gasifiers.

Depending on the size of the unit and the extent to which “municipal waste” biomass (e.g., yard trimmings) is used in a boiler or gasifier, NSPS Subparts Eb and AAAA for new municipal waste combustors could apply. Exemptions from these subparts are available for QF facilities and when a federally enforceable limit is established to severely restrict the quantity of municipal waste used. Similarly, NSPS Subpart CCCC for commercial and industrial solid waste incineration units could apply to biomass gasifiers—depending on the process and type of biomass used (e.g., clean waste wood). Potentially applicable exemptions include QF facilities and “chemical recovery units” (units burning only hydrocarbon liquids or solids to produce synthesis gas for use in other manufacturing processes). The applicability of this rule to any facility is currently indeterminable, however, because the definition of “commercial and industrial solid waste incineration unit” has been vacated and remanded to EPA. Nevertheless, these various standards were established without apparent consideration of units using primarily biomass fuels and feedstocks, and the emission limits and other requirements established in these rules may not be appropriate for biomass-based units.

Requirements under the National Emissions Standards for Hazardous Air Pollutants program (NESHAP) could also apply to biomass-based units if they are located at a major source of hazardous air pollutants (HAPs). For example, Subpart DDDDD, applicable to boilers and process heaters, could apply, and although currently vacated, it is subject to reinstatement. Subpart YYYY, applicable to combustion turbines, could also apply (although a stay is in effect for certain types of combustion turbine units). Unless these standards were developed with a consideration of potential HAP emissions associated with the combustion of biomass or biomass-based fuels, application of the standards could be inappropriate. Adding to the regulatory uncertainty associated with HAP emissions, a case-by-case control technology determination could be required for a major HAP unit not falling within an established source category or if the established standards are not currently in effect.

The need for more regulatory certainty is true for not only air requirements, however, but wastewater discharge requirements as well. A smaller biomass facility would typically discharge to a publicly owned treatment work (POTW), while a larger facility utilizing biomass may discharge subject to an individual permit issued under the National Pollutant Discharge Elimination System (NPDES) program. Apparently some permit writers had been establishing effluent limits for ethanol facilities based on guidelines applicable to similar industrial categories. EPA subsequently determined that the other source categories were distinguishable from ethanol and other “biofuel” facilities and that the existing guidelines should not be used. EPA ultimately may suggest that the general pretreatment standards apply, at least for POTWs, including a prohibition on discharges that disrupt operations or cause an NPDES permit violation. Unfortunately, EPA has not clarified whether only liquid biofuel production facilities would be affected by this determination, or whether the production of gaseous fuel from biomass might also be affected. Again, regulatory certainty and clarity are needed for these new categories of sources that do not fit neatly into existing categories.

In addition to consideration of environmental regulations associated with biomass-based electrical generating facilities, biomass feedstock production can also face environmental regulatory hurdles. For example, the National Council on Environmental Policy and Technology issued a draft letter to EPA in late 2007 indicating that the expansion of biomass and liquid biofuel production must be done sustainably, recognizing the potential for increased nutrient runoff from fertilizer and increased water usage. At least one state, New York, requires that sustainable practices be used for biomass-based projects for eligibility under its renewable portfolio standard. The state restricts the types of feedstock that qualify as biomass and imposes special rules applicable to the use of those fuels. A biomass-based project seeking designation as a “renewable” energy source must have an approved “forest management plan” describing what sustainable practices will be employed in order to protect biological diversity, productive forest capacity, and forest ecosystem health. *New York*

State Renewable Portfolio Standard, Biomass Guidebook, New York State Energy Research and Development Authority (2006). These requirements could be the first of many, as other states seek to ensure the use of sustainable practices.

Improving the Regulatory Process

Recognizing the need for consistency in evaluating energy projects and associated climate change risks and opportunities, some top Wall Street banks recently developed what they call “The Carbon Principles” to help reduce environmental and economic risks associated with the construction of electric power generation projects. The principles encourage renewable and low carbon energy technologies as well as legislative and regulatory changes to remove barriers to and promote investments in renewable sources. Leading Wall Street Banks Establish the Carbon Principles, Citigroup Inc. (Feb. 4, 2008), www.citigroup.com/citigroup/press/2008/data/080204a.htm. As suggested through these principles, EPA and the states should improve regulatory certainty (especially given the large number of potentially applicable standards), streamline the permitting process, and eliminate unnecessary regulatory burdens for biomass-based boilers and IGCC units. For example, EPA and the states should prioritize issuance of permits and approvals for biomass-based facilities as well as develop model permits to communicate early and directly to applicants (and their lenders) what conditions and requirements to expect. EPA should also issue guidance outlining all of the potentially applicable environmental standards for both construction and operation of biomass-based electrical generating facilities, following an example set by EPA Region 7 for biomass-based ethanol facilities. This guidance should include clarification that the appropriate NSR major source threshold for biomass-based electrical generating facilities is 250 tons per year and confirm any appropriate exemptions on a categorical basis, rather than requiring case-by-case determinations. In addition, EPA should undertake steps necessary to exempt biomass-based electrical generating facilities from the Acid Rain Program and CAIR, or at least minimize the requirements as appropriate for those facilities, such as elimination of unnecessary monitoring due to the relatively low emissions from biomass. Following the example of some existing state programs, each of the CAIR states should establish a generous allowance allocation formula for biomass facilities to minimize any associated financial burdens. States should also do their part by ensuring regulatory certainty associated with state-specific environmental standards and requirements.

These and other similar regulatory improvements would enhance regulatory certainty and minimize unnecessary burdens, which should improve the overall regulatory process and encourage the timely development of biomass-based electrical generating facilities in the United States. These biomass-based electrical generating facilities will in turn help the nation by improving its options for diverse, renewable sources of energy while also minimizing greenhouse gas emissions—a winning combination that should continue to be encouraged. 🌱