Burning Biomass in Delaware?

Energy Needs and Environmental Impacts

A Report to the Citizens of Newport, DE
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OVERVIEW

The Ciba Corporation plant in Newport, Delaware, currently has two boilers that are permitted to burn natural gas and kerosene to produce steam. For economic and environmental reasons, Ciba would like to replace these boilers with a boiler that burns logging residue, or clean wood chips, as part of a combined heat-and-power (CHP) cogeneration system. The new boiler would be specified, installed, owned, and operated by Intrinergy, a "renewable energy company" based in Richmond, Virginia, that builds, owns and operates boilers to meet the energy needs of industrial customers.

The Delaware Department of Natural Resources and Environmental Control (DNREC) will have to provide the operating permits for the new boiler. The state of Delaware currently bans incineration of solid waste; however, because the law is vague about the circumstances under which woody biomass is considered "solid waste," it is currently unclear whether logging residue is covered by the ban. If it is, an amendment to the incineration ban would have to be passed in order for the project to be permitted.

In the context of DNREC's pending permitting decision, citizens have raised concerns about increased emissions of particulate matter and the use of more hazardous forms of biomass. This report surveys the environmental benefits and concerns associated with Ciba's switch from natural gas to biomass, and it outlines a series of questions that remain to be answered before the extent of the conversion's environmental impacts can be assessed. The report recommends that if the project is permitted, it should be approached as an experiment, with the resulting impacts on air quality closely monitored.

BACKGROUND

The CHP system proposed by Ciba would produce both steam and electricity, replacing the steam-producing natural gas boilers currently in operation at the plant, and reducing the amount of electricity that Ciba needs to buy from the electric grid. In 2008, Ciba's two boilers burned 509 million cubic feet of natural gas, and Ciba purchased all of its electricity, over 50 million kilowatt-hours, from the power utility.

Environmental Rationale

Using natural gas as a fuel generates carbon dioxide (CO_2) and other greenhouse gases that contribute to global climate change; adds to the pollution associated with natural gas production; and consumes a valuable, non-renewable resource. Purchasing electricity from the grid also has environmental impacts. Delaware's electric grid is supplied in large part by combusting coal and other non-renewable fossil fuels at large-scale power plants, including the Conectiv plant located down the road from Ciba; these plants release both greenhouse gasses and toxic air pollutants, which can cause health problems in nearby communities. Substituting a wood-fired CHP system for natural gas boilers and electricity from the grid would have a number of environmental benefits, including reduced greenhouse gas emissions; reduced pollution from natural gas production and delivery; decreased use of nonrenewable resources; and increased energy efficiency.

Reduced Greenhouse Gas Emissions - Like fossil fuels, biomass releases CO_2 when burned. However, biomass is considered to be "carbon neutral"—to not result in a net increase in overall atmospheric CO_2 levels—as long as the harvesting of the biomass does not represent an underlying change in land use. Biomass can be considered carbon neutral because the CO_2 released during combustion is part of the natural carbon cycle in which CO_2 is absorbed from the atmosphere during the growth of a tree and then re-released after it dies and decays; this carbon cycle occurs even if trees are burned for energy rather than being allowed to decay naturally. In contrast, combusting fossil fuels like natural gas adds to overall levels of CO_2 in the atmosphere because the carbon it releases would remain trapped

underground if it were not for human activity; as a result, fossil fuel CO_2 is the driver behind greenhouse gas emissions and climate change.

Reduced Pollution from Natural Gas Production - Extracting, refining, and delivering natural gas to the end user creates a lot of pollution that impacts the Delaware River watershed. Methane, carbon monoxide, volatile organic compounds (VOCs) are all released to the air in the process of drilling, refining, storing gas in large tank farms, compressing, and piping gas to the end user. The production of natural gas puts toxic chemicals into the water, as well. For example, in the Marcellus Shale, which is now being drilled to produce natural gas used in Delaware and other parts of the region, hydraulic fracturing (commonly known as "fracking") injects millions of gallons of water laced with chemicals, or "slick water," into the shale bed under high pressure to fracture the shale and boost production of natural gas. As many as 278 toxic chemicals can end up in the region's groundwater as a result; many of these, like benzene, naphthalene and chromium, are either carcinogenic or associated with health problems affecting the eyes, skin, lungs, intestines, liver, brain and nervous system. Replacing natural gas with biomass helps reduce these sources of air and water pollution and protect the Delaware River watershed. Switching to biomass helps reduce the air, soil, and water pollution that consumers of natural gas in Delaware are causing.

Reduced Use of Non-renewable Resources - Fossil fuels like natural gas cannot regenerate on human timescales; once used, they are gone. Because fossil fuels are being depleted over time, their use is ultimately unsustainable. In contrast, a tract of forest uses sunlight to regenerate within several years after being logged, creating a renewable cycle of growth-harvest-energy-growth. Using wood instead of natural gas or other fossil fuels thus replaces unsustainable, non-renewable energy sources with sustainable ones. Additionally, when a tract of forest is logged to make paper, furniture, or two-by-fours, much of the smaller trees, branches, tree tops, and broken pieces remain on the job site in large slash piles, causing the biomass to take longer to decay. If done responsibly, collecting and using these "logging residues" for energy can help speed the forest regeneration process; scientists recommend that about 50% of total logging residue remain on logged sites in order to reduce erosion, preserve biodiversity and protect water quality.

Increased Energy Efficiency - Producing electricity generates large amounts of "waste" heat. CHP projects like the one proposed capture this thermal energy and convert it into useful steam energy that can be used in industrial processes. This use of otherwise wasted energy increases energy efficiency—the amount of work done by a given amount of fuel—and therefore decreases the total amount of fuel that needs to be consumed to operate the plant. In addition, the electricity generated in this manner displaces electricity purchased from the grid, which is generated by burning fossil fuels, including highly polluting coal. CHP thus reduces emissions of CO_2 and toxic air pollutants by reducing overall fuel use. Biomass-fueled CHP projects have the additional advantage of further reducing CO_2 emissions as a result of the carbon-neutral nature of the fuel.

Economic Rationale

The price of natural gas and other fossil fuels can fluctuate widely. In January 2009, natural gas cost about $7/GJ (where GJ stands of "gigajoule," a unit of energy equal to nearly one million btu). By June, with crude oil at $60/barrel, natural gas had dropped to only $4. At the same time, fuel oil cost about $10/GJ, and coal varied from $2 to $6/GJ, depending on location and quality.

Switching to biomass would help to put fuel costs on a more stable basis, and might reduce them overall. Wood pellets were quoted at $11/GJ in one source but at only $2 to $5/GJ by other authors. The large difference in estimates may be due to different locations.

ENVIRONMENTAL CONCERNS

Ciba's switch to a biomass boiler will benefit the global environment by reducing the use of non-renewable fossil fuels and decreasing overall CO_2 emissions. It is also likely to benefit the regional environment by reducing demand for electricity and natural gas, thereby decreasing the pollution released in the production processes. Yet there are significant concerns about how the change will affect the *local* environment in the area immediately surrounding the Ciba plant, including concerns about increased emissions of particulate matter and concerns about the toxic chemicals that might be released if biomass fuels other than logging residue are burned.

Particulate Matter

Unlike natural gas, wood fuel produces particulate matter (PM), including black carbon, a product of incomplete combustion. PM is regulated by the U.S. Environmental Protection Agency (EPA) because of concerns about its effects on human health. Because airborne particulates can get deep into the lungs, they can cause serious health effects, including decreased lung function, aggravated asthma, difficulty breathing, chronic bronchitis, irregular heartbeat, and premature death in people with heart or lung disease. The degree to which people are affected by PM, however, depends on what levels they are exposed to.

The total amount of PM emitted by Ciba's proposed biomass burner will depend on (1) the technology used in the boiler's design and (2) the emissions controls installed on the boiler. Intrinergy has not been able to provide the public with information about the specific technology to be used, because technology selection depends on the types of biomass allowed to be used and the specific requirements of the Delaware operating permit, which would be developed using the established regulatory process of public notices, comment periods, and public hearings.

Increases in PM from the Ciba plant have the potential to affect air quality in Newport and the health of Newport residents living near the plant. Without information about boiler

technology or emissions controls, citizens do not have the information necessary to know how great those environmental and health impacts might be.

Fuel Source

"Biomass" can refer to several kinds of fuel, ranging from logging residue to construction materials to yard wastes. The nature of the fuel is important because it determines the products of combustion and, in turn, the chemicals released into the air. For example, when agricultural wastes are used as fuel, they emit more dioxins and chlorophenols than other kinds of biomass; they may also contain agricultural chemicals such as pesticides which create an additional hazard.

Intrinergy currently proposes to power its boiler with wood left behind after tree harvesting, known as "logging residue." This is the cleanest form of biomass and the best option for protecting the health and air quality of Newport residents.

Transportation

Transporting the wood fuel to the Ciba plant will generate additional air emissions that will contribute to overall air quality in the town of Newport. In order to be economical, fuel is usually collected within 50 to 75 miles of the plant and would be delivered to the plant by diesel trucks, which also produce PM, as well as nitrous oxides (NO_x) and sulfur oxides (SO_x). The project would use approximately fifteen (15) trucks of biomass per day. For comparison, 3,030 vehicles (cars and trucks) crossed the James Street Bridge, adjacent to the Ciba plant, each day in 2003, and 67,047 vehicles crossed the Route 141 Bridge, also adjacent to the Ciba plant, each day in 2003 according to Delaware DOT records.

UNANSWERED QUESTIONS

Ciba's plan to replace its natural gas boiler with a biomass boiler comes with environmental benefits, especially at the global and regional levels, as well as environmental concerns, especially at the local level. The change stands to reduce overall greenhouse gas emissions, cut pollution from the production of electricity and natural gas, substitute renewable energy sources for fossil fuels, and improve energy efficiency. However, it would increase the amount of particulate matter (PM) released in Newport and the number of diesel trucks driving through the city on a daily basis. In the context of Delaware's current ban on incineration, it also raises concerns about controlling the kinds of biomass that can be burned in order to avoid those that would release hazardous chemicals to the air.

Although the nature of the environmental benefits and concerns are clear, the extent of the effects—positive or negative—on the local environment impacts are not yet understood. Numerous questions remain to be answered, including:

- How much particulate matter will be released by the new boiler?
- How will the amount of other pollutants (including NO_x) produced by the biomass boiler and new truck traffic compare to that produced by the existing natural gas boiler?
- How much will pollution from the nearby Connectiv power plant be reduced as a result of electricity generated by the new boiler?
- How will changes in air quality affect the health and quality of life of Newport residents?
- What control technologies will be required to reduce emissions from the biomass boiler?
- What will the state legislature, DNREC, Ciba, and Intrinergy do to ensure that only clean logging residues are used in the boiler?

THE WAY FORWARD

Every effort should be made to answer the questions above prior to permitting Ciba's biomass boiler. Some of the questions, however, may not be able to be fully answered until the boiler is in operation. As a result, if the fuel conversion is permitted, it is suggested that it be approached as an experiment. That is, the permit could be written very narrowly to allow the conversion to logging residue in the Intrinergy boiler, contingent on the adoption of "best available control technology" by the plant. DNREC would then closely monitor the resulting emissions and changes in local air quality (having first established a baseline during operations of the natural gas boiler); data from monitoring could be presented to the public and the legislature after one year of operation. Only if the conversion does not adversely affect local air quality should other plants be allowed to consider replacing fossil fuels with biomass.

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ABOUT

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