

# Invenergy

October 22, 2004

Mr. Bill Storm  
Minnesota Environmental Quality Board  
658 Cedar Street, Room 300  
St. Paul, MN 55155

Re: Response to the Lindquist comment letter

Dear Mr. Storm:

Mark Lindquist, Energy Policy Specialist with The Minnesota Project, has requested the EA to take into account the use of biofuels or fuel oil blended with biofuel in lieu of fuel oil as a backup fuel. In response to Mr. Lindquist's request, Invenergy has briefly investigated the use of biodiesel as a back-up fuel.

Setting aside the technical requirements for a moment, the biggest obstacles to the use of biofuels at the Cannon Falls Energy Center are cost, availability, and long term storage. Currently, according to the National Biodiesel Board's website, the closest biodiesel production facilities are in northwest Iowa and northeast Wisconsin, although several projects are planned for southwest Minnesota. When compared to the project's close proximity to the Flint Hills Resources' refinery and terminal, the transportation cost of Biodiesel will be much higher. The 2004 Biodiesel Handling and Use Guidelines state that the wholesale cost of Biodiesel is typically \$1 to \$2 per gallon greater than diesel fuel. Since federal and state road sales taxes are not assessed on fuel used for power production, renewable fuel tax breaks will not offset the increased cost. Additionally, the energy content of a gallon of biodiesel is 8 percent lower than diesel fuel.<sup>1</sup>

With the Cannon Falls Energy Center's status as a peaking plant and the use of fuel oil as a backup to natural gas, the use of fuel oil will be limited. As a backup fuel, fuel oil will be required to be stored for extended periods of time prior to use, in many instances more than a year. The National Biodiesel Board recommends that B20 and B100 be used within 6 months.<sup>1</sup> Additionally, due to the large amount of fuel stored at the CFEC (750,000 gallons), the most efficient way to ship Biodiesel is to ship it in its neat or B100 form and mix it on site or at a local distributor. According to the 2004 Biodiesel Handling and Use Guidelines, B100 is challenging to ship in the winter. Since natural gas is most frequently curtailed in the winter, the most likely time for the CFEC to consume fuel oil is in the winter. Shipping biodiesel in the winter will require the fuel to be heated prior to loading into trucks and delivery to be "immediate" to avoid the temperature of the fuel dropping below its cloud point.

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<sup>1</sup> U.S. Department of Energy, "2004 Biodiesel Handling and Use Guidelines"

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Properly mixing the biodiesel on site will be difficult. Three processes are available to mix the fuel oil, splash blending, in-tank blending, and inline blending. Splash blending utilizes the motion associated with a vehicle in motion to properly mix the biodiesel and fuel oil. In-tank blending uses two streams entering a fuel oil tank to mix the fuels and inline blending uses the turbulent forces of liquids flowing in a pipe to mix the fuels and metering equipment to control the mix of fuels in the pipe prior to putting the mixed fuel in a tank. Since a large above ground tank does not have any motion, the fuel mixing options are limited to in-tank and inline blending. Both methods require additional equipment and logistical efforts as compared to a standard fuel oil storage facility to properly control fuel consistency. Since a combustion turbine's combustion system is tuned to a particular fuel quality, consistency of the fuel mixture is extremely important.

Nearly all research to date has been completed on compression ignition engines more commonly referred to as diesel engines. Unfortunately this research is not directly applicable to large frame combustion turbines such as the one proposed for Cannon Falls. In combustion turbines, the fuel delivery process is different, the combustion is not compression ignited, fuel atomization is different, water is injected to control NOx emissions, and cooling requirements are completely different. In order to properly address the combustion issues, a large scale testing program would need to be undertaken. In discussions with General Electric (GE), they have not tested any biodiesel fuels nor do they have any current plans to implement a testing program. The funding required to commence the testing program is more appropriately funded on a national or state scale rather than as a project specific requirement. Testing costs are estimated to exceed \$1.6 million and will be much higher when the cost of fuel is included. To properly test the fuel characteristics in a combustion turbine combustor, GE would need to do exhaustive testing in its controlled combustion lab, after which testing would move to a fuel scale combustion turbine.

GE was provided the B100 fuel specification found on the National Biodiesel Board's website. GE's initial conclusions were that the high level of aromatics in the Biodiesel may be problematic. High levels of aromatics can result in higher emission levels of volatile organic compounds, unburned hydrocarbon emissions, and smoke; however, emission levels are difficult to predict without proper combustion testing. Diesel engine testing has shown NOx emissions to increase over 14% with the use of soy based biodiesel; however, it is unclear what the NOx levels would be in combustion turbines.<sup>1</sup> GE is also concerned that the maintenance factors will increase due to the combustion of biodiesel. The combustion of biodiesel may increase the rate at which cooling passages become fouled, thus increasing the thermal stress on gas turbine parts. An increased maintenance factor requires turbine maintenance intervals to be decreased, resulting in additional cost.

In summary, it is ill advised to combust biodiesel until proper testing has been conducted on biodiesel's combustion in combustion turbines and long term storage properties.

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If you have any additional questions, please contact me at 312-224-1417.

Sincerely,

A handwritten signature in black ink that reads "Joel Schroeder". The signature is written in a cursive style with a large, stylized initial "J".

Joel Schroeder  
Project Manager  
Invenergy Cannon Falls LLC

cc: Bryan Schueler – Invenergy  
James Bertrand – Leonard, Street & Deinard