Michigan Air Quality Division

Greenhouse Gas BACT Analysis for Wolverine Power Supply Cooperative Inc.

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Project consists of two 300MW (net) circulating fluidized bed (CFB) coal-fired boilers and auxiliary equipment

Project site is located in Rogers City, Michigan, and would provide base load power in northern lower Michigan

BACT analysis for conventional criteria pollutants completed prior to submittal of GHG BACT analysis

GHG BACT analysis submitted in March 2011 as a supplement to original BACT analysis

Step 1 - Identify control options

Technologies Considered:

- Carbon Capture and Sequestration (CCS)
- Combined Cycle Gas Turbine (CCGT)
- Pulverized Coal (sub-critical, supercritical, ultrasupercritical)
- Circulating Fluidized Bed (supercritical)
- Integrated Coal Gasification Combined Cycle (IGCC)
- Biomass Gasification
- 100% Biomass Combustion
- Energy Efficiency
- Combined Heat and Power (CHP)

Step 2 – Eliminate technically Infeasible Options

Not feasible:

- Combined Cycle Gas Turbine (CCGT)
- Pulverized Coal (sub-critical, supercritical, ultrasupercritical)
- Integrated Coal Gasification Combined Cycle (IGCC)
- Biomass Gasification
- 100% Biomass Combustion
- Combined Heat and Power (CHP)

Most of the these technologies were eliminated is because they redefined the source, were considered to be in developmental state, or in the earlier analysis for criteria pollutants.

Step 3 – Rank Remaining Technologies

Remaining Technologies:

- Circulating Fluidized Bed (supercritical)
- Carbon Capture and Sequestration (CCS)
- Energy Efficiency
- Biomass Fuel Augmentation

Supercritical Circulating Fluidized Bed Boiler

Eliminated from further consideration because:

- Only one supercritical CFB known to exist in world (built in 2009 in Poland)

- Known supercritical CFB burns only eastern european bituminous coals

- Very limited data

Carbon Capture and Sequestration

Carbon Capture technologies reviewed:

- Absorption
- Adsorption
- Physical Separation
- Hybrid technologies
- Biological uptake (algae farms)
- Oxy-firing

Carbon Capture and Sequestration

Carbon Sequestration technologies reviewed:

- Terrestrial - Offsets
- Geological - Sequestration
- Compression & Re-use

Carbon Capture and Sequestration

CCS eliminated based on:

- cost

- increase in plant size to accomodate parasitic load required to operate CCS equipment

Biomass Fuel Augmentation

Michigan PA 295 requires electric service providers to establish renewable energy programs

75-mile radius around site could theoretically support up to 20% biomass

Feedstocks over 5% biomass can negatively affect boiler efficiencies at high moisture contents

5% biomass selected as BACT

Energy Efficiency

Variable speed motors over 100 hp

Thermal efficiencies

Minimize pressure drops across control equipment

Energy Efficiency selected as BACT

Questions?