From: Andrew Chartrand
To: Wilson, Aimee
Cc: David.Ayers@cheniere.com
Subject: RE: Corpus Christie Liquefaction Project GHG Application
Date: Tuesday, June 04, 2013 1:56:48 PM

Aimee,

Below are our responses to your two questions regarding the use of electric drive compressors. The responses to the first two questions in your e-mail were e-mailed to you on May 24th.

Comment: I will need more information on the basis for eliminating electric driven compressors in the turbine BACT analysis. Please detail why electric motor drives are not feasible. Is there a concern with power supply to the facility? Is there a concern with the costs? Are gas fired turbines needed to supply heat to other areas of the process, that if not selected would require the installation of additional heaters or other combustion devices that would increase the GHG emissions?

Response: Use of electric motors to drive the refrigerant compressors would "redefine the source," because the use of gas turbines is part of the basic design of the proposed plant. Moreover, even if electric motors were not excluded in Step 1 of the BACT analysis as redefining the source, they would be excluded in Step 4 of the BACT analysis because of the energy and environmental impacts.

As EPA noted in its March 2011 guidance document, PSD and Title V Permitting Guidance for Greenhouse Gases ("GHG Permitting Guidance"), *Step 1 of the top-down BACT analysis need not include inherently lower-polluting processes that would fundamentally redefine the nature of the source proposed by the permit application.* GHG Permitting Guidance at p.26. *Permitting authorities can look at whether design elements can be changed to achieve emission reductions "without disrupting the applicant's basic business purpose for the proposed facility."* Id. *As detailed below, the substitution of electric motors for the proposed gas turbines in this case would interfere with the plant's basic design.*

Most importantly, the gas turbines that CCL plans to use to provide refrigerant compression will provide 100% of the plant heating needs (hot oil and regeneration services) through waste heat recovery units installed on the gas turbine exhausts for the ethylene compressors. If electric motors were substituted for the gas turbines, new and additional direct-fired heaters would be required at the plant to make up for that lost heating service. Gas would be required to fuel those direct-fired heaters, which would create significant emissions of GHG and criteria pollutants. Plant heating needs would not result in additional emissions under CCL's proposed design.

Furthermore, the use of electric motors would also require a variable frequency drive (VFD) system to control the motors, and this would require an additional large building in each LNG train to house the VFD system. Electric motors and the VFD systems might also require water cooling. The layout of the plant and available property do not allow sufficient plot space to add these buildings and the other infrastructure that would be required to support the electric motors.

Even if electric motors were not eliminated in Step 1 of the BACT analysis, other factors would eliminate them from qualifying as BACT during the Step 4 analysis of economic, energy and environmental impacts. As EPA states in the GHG Permitting Guidance, "applicants and permitting authorities should examine whether the energy requirements for each control option

result in any significant or unusual energy penalties or benefits." GHG Permitting Guidance at p.39. *Approximately 780 MW of power would have to be supplied from the regional power transmission grid to run the electric motors, which would constitute a significant and unusual energy penalty. In addition, use of electric motors would result in significant offsite GHG and criteria pollutant emissions by the power generators supplying the power for the motors.*

Experience at other LNG liquefaction facilities around the world – of which there are dozens – supports the conclusion that the use of electric motors to drive refrigerant compressors is not BACT. Electric motors have never been successfully used in LNG liquefaction trains without onsite power generation facilities. Only one LNG plant, Snohvit LNG in Norway, currently uses electric motors to drive refrigeration compressors. The 6-year-old Snohvit LNG plant uses five onsite LM6000 aeroderivative gas turbine-driven generators to produce most of the power needed for the compressors, which produce significant onsite GHG and criteria pollutant emissions. These are precisely the kinds of energy and environmental impacts that preclude electric motors from qualifying as BACT.

Another project under development, Kitimat LNG in British Columbia, Canada, originally proposed to use electric motors with no onsite power generation but has now changed the driver selection to gas turbines. Freeport LNG has proposed to employ electric motors without onsite power generation, but this approach has not been demonstrated to be reliable in practice anywhere in the world.

As for cost, if electric motors were to be substituted for gas turbines for CCL's three LNG trains, the approximately 780 MW of power that would be required from the regional power transmission system would make the facility one of the largest power purchasers in the State of Texas. Significant costly transmission system upgrades would be needed to accommodate this load, a major portion of which CCL likely would have to fund, in addition to the substantial transmission and distribution charges otherwise applicable to such a load.

Comment: The GHG permit application stated that the use of electronic drive compressors would be redefining the source. Please provide further analysis of how this would be redefining the source.

Response: See the response to the previous comment on eliminating electric driven compressors in the turbine BACT analysis.

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From: Wilson, Aimee [mailto:Wilson.Aimee@epa.gov]
Sent: Thursday, May 02, 2013 7:39 AM
To: Andrew Chartrand
Subject: Corpus Christie Liquefaction Project GHG Application

Andrew,

I started working on the draft permit and statement of basis for the Corpus Christi Liquefaction project yesterday. I have a couple of questions.

Are the turbines combined cycle or simple cycle? Does each ethylene gas turbine have a dedicated waste heat recovery unit or does each train share a WHRU?

I will need more information on the basis for eliminating electric driven compressors in the turbine BACT analysis. Please detail why electric motor drives are not feasible. Is there a concern with power supply to the facility? Is there a concern with the costs? Are gas fired turbines needed to supply heat to other areas of the process, that if not selected would require the installation of additional heaters or other combustion devices that would increase the GHG emissions? It will be extremely difficult for us to defend eliminating electric drive compressors for LNG liquefaction when that is what is proposed by Freeport, especially when Freeport will be going to notice before Corpus Christi.

Also please provide a detailed analysis on how selection of electric drive compressors is redefining the source.

Feel free to call me if you have any questions.

Thanks,
Aimee

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