Brian Lusher

From: John_Lague@URSCorp.com
Sent: Monday, February 22, 2010 11:32 AM
To: Brian Lusher
Cc: peter.landreth@mirant.com; chuck.hicklin@mirant.com; Nathalia_Prasetyo_Jo@URSCorp.com
Subject: Greenhouse gas emissions

Hi, Brian

Following your requests on Thursday and Friday, I am attaching a recalculation of ghg emissions for the MLGS. The two attachments are a text description of the methods and assumptions used to estimate SF6 fugitive emissions and an excel spreadsheet with the emissions calculations for all ghgs according to the CARB reporting protocol.

Let me know if you have any questions regarding these materials.

Regards - jsl

(See attached file: SF6 writeup.doc)(See attached file: MLGS_GHG_CARB_021910.xls)

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GHG Operational Emissions

Per California Code of Regulations Subchapter 10, Article 2, Section 95101(b)(4), title 17, the MLGS will be subject to the mandatory Greenhouse gas reporting as operators of electricity generating facilities that are located in California that individually have a nameplate generating capacity greater than or equal to 1 megawatt (MW), and that emit greater than or equal to 2,500 metric tons of CO_2 in any calendar year after 2007 from electricity generating activities. According to the reporting criteria in Section 95111 (Data Requirements and Calculation Methods for Electricity Generating Facilities, Retail Providers and Marketers), MLGS is subject to reporting of GHG emissions from stationary sources (four Combustion Turbines and two fuel gas preheaters) and fugitive SF6 emissions (six circuit breakers).

A detailed description of the greenhouse gas emission calculations is provided below.

Stationary Sources

Operators of generating facilities shall prepare GHG emission calculations from stationary combustion combusting natural gas based on Sections 95125(c)-(d) or (g) if the high heat value (HHV) is > 975 and < 1100 Btu per scf .MLGS proposed four Combustion Turbines (CTGs) and two fuel gas preheaters that combust natural gas with HHV fuel heating value within the range. Therefore, the annual GHG emissions for these stationary sources are calculated as follows:

Table 1- Stationary Source GHG Emissions

Stationary Combustion Source	Unit	Total Annual Fuel Usage - HHV (MMBtu/year)	Emission (Metric Ton/year)			Emission CO_2e (metric ton/year)
			CO_2	CH_4	N_2O	
SSC6-5000F Combustion Turbine	4	14,001,984	740,284.89	12.60	1.40	740,983.59
Fuel Gas Preheater	2	17,520	926.28	0.02	0.00	927.16
		Total :	741,211.18	12.62	1.40	741,910.75

Note: Greenhouse gas emission calculation is based on recommended methodology for stationary sources at Subchapter 10, Article 2, sections 95125 (c), title 17 of the California Code of Regulations - Method for Calculating CO2 Emissions from Fuel Combustion Using Measured Heat Content

GWP for CH_4 and N_2O is based on Appendix A Table 2 of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions

Fugitive SF_6

There will be a total of six SF_6 circuit breakers (1200A) for the 4 simple cycle units design. Each CTG of the Marsh Landing Generating Station (MLGS) will have one circuit breaker on the low-voltage side of the generator step-up transformer. In addition to the four breakers for the CTGs, the project also includes tie-ins at two additional existing circuit breakers located in the switchyard). Each circuit breaker would contain

approximately 85 lbs of SF6 gas in an enclosed-pressure system, based on available specification from other similar breakers[1].

Circuit breakers do not directly emit the SF_6 gas. However, circuit breakers have the potential to release fugitive SF_6 emissions from potential leakages[2]. SF_6 is a highly potent greenhouse gas with a global warming potential (GWP) that is 23,900 times greater than carbon dioxide (CO_2)[3]. However, any expected leakage would be minimal and would occur only as a result of circuit interruption and at extremely low temperatures, which is not anticipated in the Bay Area.

Based on the top-down BACT analyses performed for other power project in the Bay Area, the Bay Area Air Quality Management District concluded that using state-of-the-art enclosed-pressure SF_6 circuit breakers with leak detection is the BACT control technology option for this ghg source category[4]. Implementation of this BACT specification should be able to maintain fugitive SF_6 emissions below 0.5% (by weight)[5] Breakers using oil or compressed air as a dielectric material are considered not to be technically feasible because of their greatly increased size. And, even if they were feasible, the Air District stated that the offsetting ancillary impacts would not preclude the choice of SF_6.

MLGS will require 6 circuit breakers with a total dielectric gas storage capacity of 510 lbs SF_6. Therefore, at a leak rate of 0.5%, the potential annual SF_6 emissions would be at a maximum rate of 2.55 lbs/year, which would equal approximately 27.7 metric tons CO_2e per year when the high global warming potential for this substance is applied.

In the ARB mandatory reporting rules, the methodology for calculating emissions from SF_6 and other gases with high global warming potential is based on a mass-balance method. The methodology looks at (1) changes in SF_6 inventory, (2) purchase and acquisitions of SF_6; (3) sales and disbursements of SF_6 and (4) any difference between SF_6 recovered from retiring equipment and the total nameplate capacity of the equipment. The ARB methodology notes that if new equipment is purchased, the SF_6 that is used to charge the new equipment should not be counted as an emission. There is no methodology for estimating fugitive SF_6 emissions from the equipment during operation – the only time fugitive SF_6 emissions are accounted for is when the equipment is being retired. For emission estimation purposes, the emission rate (emission/capacity %) is assumed to be 0.5%. Therefore, the potential GHG emission from this source can be calculated as follows:

[1] To: Chuck Hicklin, Mirant. Fw: Marsh Landing, 02/18/2010.
[2] U.S. EPA, J. Blackman (U.S. EPA, Program Manager, SF6 Emission Reduction Partnership for Electric Power Systems), M. Averyt (ICF Consulting), and Z. Taylor (ICF Consulting), SF6 Leak Rates from High Voltage Circuit Breakers – U.S. EPA Investigates Potential Greenhouse
[3] SAR (1996) GWP factor from CCAR General Reporting Protocol Version 3.1 January, 2009.
[4] BAAQMD. August 3, 2009. Additional Statement of Basis Draft Federal "Prevention of Significant Deterioration" Permit Russell City Energy Center.
[5] IEC Standard 62271-1, 2004; email message from Tony Conte, Sr. Account Manager, ABB, 4/28/09; email message from Jason Cunningham, Regional Sales Manager, HVB AE Power Systems, Inc., 4/27/09.

Table 2- Fugitive SF_6 GHG Emissions

Fugitive SF_6 Emissions	Annual Leak/Unit (lb SF_6/year-unit)	Unit	Emission CO_2e (metric ton/year)
Circuit Breakers	0.425	6	27.7

Note: Global Warming Potential is based on Appendix A Table 2 of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions. Subchapter 10, Article 2, sections 95100 to 95133, title 17, California Code of Regulations. Greenhouse gas emission calculation is based on SF6 Emissions Reduction Partnership for Electric Power Systems methodology provided in Appendix A Subchapter 10, Article 2, sections 95100 to 95133, title 17, CCR, assuming the expected maximum emission rate (emission/capacity %) of 0.05%.

Summary

Based on the source specific calculations presented in Table 1 and Table 2, the total potential annual GHG emissions from the MLGS project is approximately 741,938 metric tons of CO_2e/year.

Yearly Average (60°F / 64% RH) Per Turbine		
CTG Load Level	%	100%
Heat Input, LHV	MMBtu/hr	1800
hhv/lhv ratio:	ratio	1.11
Annual Operation Schedule		
Total Hours of Operation	hr	1,752
Total Number of Cold Starts		167
Cold Start Duration	hr/Start	0.18
Total Number of Shutdowns		167
Shutdown Duration	hr/Shutdown	0.10
Average Operation	hr	1,705

Source: Revised Appendix J3. AFC Amendment for Marsh Landing Generating Station, September 2009.

Fuel Gas Preheater		
Fuel Gas Preheater Quantity	Unit	2
Hours of Operation	hr/year/unit	1,752
Fuel Heat Content - HHV	Btu/scf	1,020
Max Heat Input Capacity	MMBtu/hr	5

Source: Revised Appendix J3. AFC Amendment for Marsh Landing Generating Station, September 2009.

Circuit Breaker		
Circuit Quantity	Unit	6
SF_6 Gas Capacity	lb/unit	85
Expected Leak Rate	%	0.50%

Source: Email message from Robert Smith, P.E, CH2M Hill. To: Chuck Hicklin, Mirant. Fw: Marsh Landing, 02/18/2010.

Greenhouse Gas	Emission Factor	
CO_2	kg/Mmbtu	52.87
CH_4	g/MMBtu	0.9
N_2O	g/MMBtu	0.1

Source: Appendix A Table 4 & Table 6 of the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions. Subchapter 10, Article 2, sections 95100 to 95133, title 17, California Code of Regulations

GHG Emission Calculation

Stationary Combustion Source	Annual Fuel Usage/Unit - HHV (MMbtu/year-unit)	Unit	Total Annual Fuel Usage - HHV (MMbtu/year)	Emission (Metric Ton/year)			Emission CO_2e (metric ton/year)
				CO_2	CH_4	N_2O	
SSC6-5000F Combustion Turbine	3,500,496	4	14,001,984	740,284.89	12.60	1.40	740,983.59
Fuel Gas Preheater	8760	2	17,520	926.28	0.02	1.75E-03	927.16
			Total :	741,211.18	12.62	1.40	741,910.75

Note: Greenhouse gas emission calculation is based on recommended methodology for stationary sources at Subchapter 10, Article 2, sections 95125 (c), title 17 of the California Code of Regulations - Method for Calculating CO2 Emissions from Fuel Combustion Using Measured Heat Content
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Fugitive SF_6 Emissions	Annual Leak/Unit (lb SF_6/year-unit)	Unit	Emission CO_2e (metric ton/year)
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