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Docket Number:	12-AFC-03
Project Title:	Redondo Beach Energy Project
TN #:	201690
Document Title:	Response Letter to South Coast Air Quality Management District re (RBEP) greenhouse gas (GHG) emissions
Description:	N/A
Filer:	Sarah Madams
Organization:	CH2M HILL
Submitter Role:	Applicant Consultant
Submission Date:	2/10/2014 11:11:51 AM
Docketed Date:	2/10/2014

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February 7, 2014

Vicky Lee
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21865 Copley Drive
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Re: Redondo Beach Energy Project Response
(Facility ID 115536)

Dear Ms. Lee:

This letter provides the information you requested regarding the Redondo Beach Energy Project's (RBEP) greenhouse gas (GHG) emissions.

GHG Best Available Control Technology (BACT) Analysis

Please calculate the emission rate in net megawatt-hours, identifying heat rates at various operating loads, start-up and shutdown periods, and at different configurations (1 on 1, 2 on 1, and 3 on 1), as well as the amount of hours the facility expects to operate at each configuration.

Response: Table 1 presents the gross and net heat rates and the net electrical generation output for RBEP in a 1 on 1, 2 on 1, and a 3 on 1 configuration. Table 2 presents the average electrical production and gross and net heat rates for RBEP based on the expected operating hours for each configuration (1 on 1, 2 on 1, and 3 on 1). Table 3 presents heat rates for the start up and shutdown events along with the expected annual hours for each.

Table 1
RBEP Heat Rates and Electrical Production

Parameter	Turbine Output (%)				
	70	**80**	**90**	**100**	**100 + DB**
Heat Rates for a 1 on 1 Configuration					
Net Plant Electrical Output (kW)	116,977	130,750	144,285	161,150	203,570
Net Plant Heat Rate (Btu/kWh-LHV)	7,969	7,796	7,669	7,578	7,979
Estimated Gross Heat Rate (Btu/kWh-LHV)	7,737	7,569	7,446	7,357	7,747
Estimated Net Heat Rate (Btu/kWh-HHV)	8,766	8,576	8,436	8,336	8,777
Heat Rates for a 2 on 1 Configuration					
Net Plant Electrical Output (kW)	241,081	268,702	295,720	329,459	367,913
Net Plant Heat Rate (Btu/kWh-LHV)	7,733	7,587	7,484	7,413	7,683
Estimated Gross Heat Rate (Btu/kWh-LHV)	7,508	7,366	7,266	7,197	7,459
Estimated Net Heat Rate (Btu/kWh-HHV)	8,506	8,346	8,232	8,154	8,451
Heat Rates for a 3 on 1 Configuration					
Net Plant Electrical Output (kW)	367,918	403,656	443,066	492,265	N/A
Net Plant Heat Rate (Btu/kWh-LHV)	7,681	7,575	7,492	7,440	N/A
Estimated Gross Heat Rate (Btu/kWh-LHV)	7,457	7,354	7,274	7,223	N/A
Estimated Net Heat Rate (Btu/kWh-HHV)	8,449	8,333	8,241	8,184	N/A

Btu/kWh = British thermal unit(s) per kilowatt-hours
DB = duct burner
HHV = higher heating value
kW = kilowatt(s)
LHV = lower heating value
N/A = Not applicable

Table 2
RBEP Heat Rates and Electrical Production

Parameter	Turbine Output (%)				
	70	80	90	100	100 + DB
Heat Rates for a 1 on 1 Configuration					
Hours per Configuration per Year			125		
Net Plant Electrical Output (kW)	116,977	130,750	144,285	161,150	203,570
Net Plant Heat Rate (Btu/kWh-LHV)	7,969	7,796	7,669	7,578	7,979
Estimated Gross Heat Rate (Btu/kWh-LHV)	7,737	7,569	7,446	7,357	7,747
Estimated Net Heat Rate (Btu/kWh-HHV)	8,766	8,576	8,436	8,336	8,777
Average Power Output (kW)			151,346		
Average Net Heat Rate (Btu/kWh-HHV)			8,578		
Average Gross Heat Rate (Btu/kWh-HHV)			8,328		
Heat Rates for a 2 on 1 Configuration					
Hours per Configuration per Year			1,600		
Net Plant Electrical Output (kW)	241,081	268,702	295,720	329,459	367,913
Net Plant Heat Rate (Btu/kWh-LHV)	7,733	7,587	7,484	7,413	7,683
Estimated Gross Heat Rate (Btu/kWh-LHV)	7,508	7,366	7,266	7,197	7,459
Estimated Net Heat Rate (Btu/kWh-HHV)	8,506	8,346	8,232	8,154	8,451
Average Power Output (kW)			300,575		
Average Net Heat Rate (Btu/kWh-HHV)			8,338		
Average Gross Heat Rate (Btu/kWh-HHV)			8,095		
Heat Rates for a 3 on 1 Configuration					
Hours per Configuration per Year			730		
Net Plant Electrical Output (kW)	367,918	403,656	443,066	492,265	N/A
Net Plant Heat Rate (Btu/kWh-LHV)	7,681	7,575	7,492	7,440	N/A
Estimated Gross Heat Rate (Btu/kWh-LHV)	7,457	7,354	7,274	7,223	N/A
Estimated Net Heat Rate (Btu/kWh-HHV)	8,449	8,333	8,241	8,184	N/A
Average Power Output (kW)			414,031		
Average Net Heat Rate (Btu/kWh-HHV)			8,335		
Average Gross Heat Rate (Btu/kWh-HHV)			8,092		

Table 3
Start-up and Shutdown Heat Rates and Hours

Start-up (9 Minutes) Heat Rate (Btu/kWh-HHV, Net)	20,094
Shutdown (9 Minutes) Heat Rate (Btu/kWh-HHV, Net)	18,172
Start-up (Balance of Start) Heat Rate (Btu/kWh-HHV, Net)	8,766
Shutdown (Balance of Shutdown) Heat Rate (Btu/kWh-HHV, Net)	8,766
Start-up Hours (9 Minutes)	93.6
Shutdown Hours (9 Minutes)	98.8
Start-up Hours (Balance of Start-up)[1]	267.4
Shutdown Hours (Balance of Shutdown Down)[1]	5.2

[1] Balance for a cold start-up is 81 minutes (81 min / 60 min * 24 starts), warm/hot start-ups are 23.5, and a shutdown is 0.5 minutes.

Table 4 presents RBEP's GHG efficiency estimates based on the annual average gross and net heat rate data presented in Tables 1 through 4 and generally using the SCAQMD's overall methodology, as presented in the HBEP Preliminary Determination of Compliance, issued on January 24, 2014.[1] The only deviation from the SCAQMD's approach was to use the start-up heat rates for the first 9 minutes of the event (shutdown is the first 9.5 minutes), then use a 70 percent load heat rate (from Table 2 for a 1 on 1 configuration) for the balance of the start-up/shutdown period.

Based on these calculations, RBEP's expected operating profile GHG efficiency is 1,064 pounds of carbon dioxide per megawatt-hour (lb CO_2/MWh) on a net basis, assuming the equipment is new and clean. Over time, the overall performance will degrade; as a result, incorporating a degradation of 8 percent results in a GHG efficiency of 1,149 lb CO_2/MWh on a net basis.

Assuming RBEP operates at the maximum electrical output of 546 megawatts (MW) gross for 2,920 hours per year (2,455 operating hours, 361 start-up hours, and 104 shutdown hours), the expected plant capacity factor would be 33 percent.[2]

Table 4
RBEP GHG Efficiency

Overall Average Net Heat Rate (Btu/kWh-HHV)	9,097
Overall Average Gross Heat Rate (Btu/kWh-HHV)	8,832
Net Heat Rate Basis (lb CO_2/MWh)	1,064
Gross Heat Rate Basis (lb CO_2/MWh)	1,033
Net Heat Rate Basis with 8% degradation (lb CO_2/MWh)	1,149
Gross Heat Rate Basis with 8% degradation (lb CO_2/MWh)	1,115

CO_2 = carbon dioxide
lb/MWh = pound(s) per megawatt-hour

[1] See Appendix F - http://docketpublic.energy.ca.gov/PublicDocuments/12-AFC-02/TN201595_20140127T104536_SCAQMD_PDOC_for_AES_HB.pdf
[2] (546 MW * 2,920 hours) / (546 MW * 8,760 hours) * 100 = 33 Percent

BACT Analysis Table 3-2

Table 3-2, Comparison of Heat Rates and GHG Performance Values of Recently Permitted Projects, of the BACT analysis presents RBEP's GHG efficiency as 0.398 metric tons CO_2/MWh, which converts to 877 lbs CO_2/MWh. Please provide supporting emissions calculations.

Response: The 0.398 metric tons (MT) CO_2/MWh presented in Table 3-2 of the BACT analysis was calculated for a single combustion turbine (at a heat input of 1,220.6 million British thermal units per hour, lower heating value [MMBtu/hr-LHV]) at 63 degrees Fahrenheit (°F) and 100 percent load, with a combined electrical output of 162.2 MW gross (for both the combustion turbine and steam turbine). The calculation is presented below.

0.398 MT CO_2/MWh = (52.91 kilograms [kg] CO_2/MMBtu * 1,220.6 MMBtu/hr-LHV * 0.001 MT/kg) / 162.2 MW

Converting the heat input in the previous equation to a higher heating value basis results in a GHG efficiency of 0.439 MT CO_2/MWh.

If you have any additional questions, please contact either me or Jerry Salamy (916-286-0207).

Sincerely,

Stephen O'Kane
Vice-President
AES Southland Development, LLC

cc: J. Didlo/AES
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