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Docket Number:	16-AFC-01
Project Title:	Stanton Energy Reliability Center
TN #:	221722
Document Title:	Stanton Energy Reliability Center, LLC Response to SCAQMD October 16, 2017
Description:	N/A
Filer:	Marie Fleming
Organization:	DayZen LLC
Submitter Role:	Applicant Representative
Submission Date:	11/13/2017 10:21:02 AM
Docketed Date:	11/13/2017

ATMOSPHERIC DYNAMICS, INC
Meteorological & Air Quality Modeling

October 31, 2017

Ms. Vicky Lee
South Coast Air Quality Management District
21865 E. Copley Drive
Diamond Bar, CA 91765

Subject: Stanton Energy Reliability Center (Facility ID# 183501) Response Package to the SCAQMD October 6th, 2017 Comment Letter

Dear Ms. Lee;

Stanton Energy Reliability Center, LLC (SERC) has provided the attached response package to your October 6th, 2017 information request. As summarized below, we have responded to all of the questions with the exception of the requested guarantees, which will be provided under separate cover by the end of the first full week in November 2017. Additionally, the attachments and modeling files associated with response number 7 were emailed to you and Melissa Sheffer (and provided on modeling CD via overnight delivery) on October 10th and are not included with this response package.

7. Toxic Emissions Factors
   e. After review of the initial health risk assessment prepared by SERC, the SCAQMD letter, dated 12/2/16, provided the AP-42 toxic/hazardous air pollutants emission factors in terms of lb/MMBtu, with citations for the sources of the emission factors, which are required to be used in the health risk assessment. The SERC letter, dated 12/29/16, indicated the emission factors had been revised to the AP-42 emission factors provided by the SCAQMD but continued to use an unverified control efficiency factor for some toxic compounds for the revised health risk assessment. The SCAQMD letter, dated 2/2/17, requested verification of the assumed control efficiency factor. The SERC letter, dated 2/15/17, indicated the unverified control efficiency factor had been removed for the revised health risk assessment.

      In the SERC submittal, dated 2/15/17, *Table 5.1A-4 Calculation of Hazardous and Toxic Pollutant Emissions from Combustion Turbines* presented the emissions factors in terms of lb/MMSCF.

      i. Please explain the conversion from the lb/MMBtu, provided by the SCAQMD from AP-42, to the lb/MMSCF used by SERC for the following compounds. The conversion factor of 1017 btu/scf is included on *Table 5.1A-4,* and confirmed by the *Design Fuel Gas Analysis* table provided by SERC.

         Response: *The following comments apply to each of the five pollutants noted below:*

         1. *In the initial analysis produced by the applicant, emissions factors for air toxics and/or HAPs were derived from the AP-42 Background Document for Section 3.1 Stationary Gas Turbines, April 2000, Table 3.4-1, All Loads. These values were chosen based upon the Applicant's*

information concerning the operational profiles of the turbines, i.e., frequent mid to low-load operations. The values, as given in the table in units of lbs/mmscf were used directly, with no adjustment for gas heat content in terms of btu/scf. The values used were for a reference value of 1020 btu/scf.

2. *The values, as noted above, were not adjusted for a heat value of 1017 btu/scf because the difference between 1017 and 1020 is approximately 0.3%, which is insignificant. Furthermore, when considering that the heat value provided by the Applicant is based on an annual average, it made little practical sense to adjust the Table 3.4-1 values. This explains why the values noted below were used.*

3. *We note that the SCAQMD uses the values in AP-42 Section 3.1, Table 3.1-3. These values were derived from the Background document cited above for the "High Loads" scenario. But, the values in Table 3.1-3 represent rounded values from Table 3.4-1. Of the 11 substances given in Table 3.1-3, seven represent values that have been rounded up, three represent values that have been rounded down, and one value remains unrounded. Therefore, the values in Table 3.1-3 represent values that are not, in the Applicant's view, as precise as those given in Table 3.4-1.*

4. *We also note that use of the SCAQMD factors, over the last several iterations of the HRA analysis, has driven the risk values lower than the original analysis, and although all of the risk values to date show that the facility risk impacts are insignificant, the Applicant contends that the original analysis is most likely the most health protective.*

aa. Ethylbenzene: (3.2 E-05 lb/MMBtu)(1017 MMBtu/MMSCF) = 0.0326 lb/MMSCF
Please explain why SERC used 0.02630 lb/MMSCF.

Response: *The SERC value of 0.02630 lb/MMSCF was derived from the Background Document, Table 3.4-1, All Loads column labeled lb/MMscf. See comments 1 and 2 above.*

bb. Naphthalene: (1.3 E-06 lb/MMBtu)(1017 MMBtu/MMSCF) = 0.00132 lb/MMSCF
Please explain why SERC used 0.00140 lb/MMSCF.

Response: *The SERC value of 0.00140 lb/MMSCF was derived from the Background Document, Table 3.4-1, All Loads column labeled lb/MMscf. See comments 1 and 2 above.*

cc. Propylene oxide: (2.9 E-05 lb/MMBtu)(1017 MMBtu/MMSCF) = 0.0295 lb/MMSCF
Please explain why SERC used 0.00292 lb/MMSCF.

Response: *The SERC value of 0.00292 lb/MMSCF was derived from the Background Document, Table 3.4-1, All Loads column labeled lb/MMscf. See comments 1 and 2 above.*

dd. Toluene: (l.3 E-04 lb/MMBtu)(1017 MMBtu/MMSCF) = 0.132 lb/MMSCF
Please explain why SERC used 0.09560 lb/MMSCF.

Response: *The SERC value of 0.09560 lb/MMSCF was derived from the Background Document, Table 3.4-1, All Loads column labeled lb/MMscf. See comments 1 and 2 above.*

ee. Xylene: (6.4 E-05 lb/MMBtu)(1017 MMBtu/MMSCF) = 0.0651 lb/MMSCF
Please explain why SERC used 0.05590 lb/MMSCF.

Response: *The SERC value of 0.05590 lb/MMSCF was derived from the Background Document, Table 3.4-1, All Loads column labeled lb/MMscf. See comments 1 and 2 above.*

ff. For aa- ee, please revise your calculations to reflect the SCAQMD approved emission factors.

Response: *The attached spreadsheet now reflects the high load case for all HAPs, adjusted for the gas heat content per the SCAQMD examples.*

ii. The SCAQMD did not provide emission factors for hexane and propylene because emission factors are not provided by AP-42. In a telephone conversation on 12/6/16, it was explained to SERC that the SCAQMD does not accept CATEF emission factors. Please revise your calculations to reflect the SCAQMD approved emission factors for hexane and propylene.

Response: *Hexane and propylene have been removed from the HRA analysis, based on the following:*

The Applicant conducted a search of the SCAQMD website to identify if any emissions factors for hexane or propylene were identified or recommended for use for turbines firing natural gas. The following documents were reviewed.

a. Ventura County APCD, AB2588 Combustion Emissions Factors
http://www.aqmd.gov/docs/default-source/permitting/toxics-emission-factors-from-combustion-process-.pdf?sfvrsn=0

- *No emissions factors for hexane or propylene were found in this resource.*

b. *SCAQMD, Supplemental Instructions, Reporting Procedures for AB2588 Facilities for Reporting their Quadrennial Air Toxics Emissions Inventory, December 2016.*

   - *No emissions factors for hexane or propylene were found in this resource.*

c. *SCAQMD, AB2588 and Rule 1402 Supplemental Guidelines, November 2016.*

   - *No emissions factors for hexane or propylene were found in this resource.*

d. *SCAQMD, Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics "Hot Spots" Information and Assessment Act, June 2015.*

   - *No emissions factors for hexane or propylene were found in this resource.*

Therefore, hexane and propylene were not evaluated in the revised HRA.

iii. The SCAQMD indicated that (1) naphthalene and (2) PAHS (excluding naphthalene) are to be considered separately in the HRA. The PAHS (excluding naphthalene) are the carcinogenic PAHS.

SERC evaluated (1) naphthalene and (2) all PAHS (including naphthalene). Therefore, naphthalene is double counted.

Response: *However, Applicant notes that neither in AP-42 Section 3.1 or in the Background Document for Section 3.1 is it noted anywhere that the PAH emissions factor includes naphthalene.*

From above, the naphthalene emission factor should be 0.00132 lb/MMSCF.

PAHS (excluding naphthalene) emission factor should be 0.000915 lb/MMSCF, instead of the 0.00230 lb/MMSCF used.

[2.2 E-06 lb/MMBtu (all PAHs) - l.3 E-06 lb/MMBtu (naphthalene)]
(1017 MMBtu/MMSCF) = 0.000915 lb/MMSCF

Please revise your calculations to reflect the PAH emissions factor of 0.000915 lb/MMSCF.

Response: *Napthalene was subtracted from the total PAHs and was considered separately in the HRA and is no longer double counted.*

The updated cancer risk HRA results in a MIR of 0.07 in a million risk over a 30 year exposure.

SERC HRA Summary						
Receptor Type	Receptor #	UTM E	UTM N	Cancer Risk*	Chronic HI	Acute HI
MIR (PMI 1)	2617	409000	3741360	7.14E-8	0.0000977	0.00166
PMI 2	2674	409020	3741380	7.11E-8	0.0000973	0.00158
PMI 3	2673	409020	3741360	7.10E-8	0.0000972	0.00162
MEIR	8003	409045	3741578	5,31E-8	0.0000727	0.00122
MEIW[1]	8008	409012	3741221	4.07E-8	0.0000557	0.00144
Nearest School 1	8046	408825	3741680	2.20E-8	0.0000301	0.00128
Nearest School 2	8012	409311	3741517	5.13E-8	0.0000702	0.001
Nearest Health Facility	8051	411233	3744268	2.16E-8	0.0000295	0.00041
Nearest Daycare	8064	407611	3740470	1.45E-8	0.0000198	0.000863
Nearest Convalescent Home	8071	408716	3742848	1.88E-8	0.0000257	0.000617

***30 year risk values.**
[1]MEIW values have not been adjusted for a 25 year exposure due to the insignificance of the 30 year risk values.

f. Please revise the proposed health risk assessment to incorporate the above emission factor changes. Please e-mail the revised health risk assessment to Melissa Sheffer and Vicky Lee as soon as possible.

Response: *The above responses to question 7 were supplied via email to Vicky Lee and the SCAQMD modeler, Melissa Sheffer, on October 10. A compact disk containing the updated modeling data was also sent to Melissa Sheffer via FedEx on October 10th.*

The email transmittal message is provided below for completeness.

> *"Attached is the response to Question 7 (Toxic Emission Factors) and includes a revised HRA which reflects the use AP-42 emission factors. The updated HAP emissions are also provided in the attached spreadsheet and are based on AP-42 Tables 3.1-3 and Table 3.4-1."*

9. Annual Facility-Wide Emissions Limit

Thank you for Scott Galati's memo, dated 5/26/17, regarding Rule Analysis Supporting Annual Facility Wide Emission Limits, Stanton Energy Reliability Center. The issue is under review by our Legal Dept. and the District will address this separately.

Response: *Acknowledged. Please contact Scott Galati at your convenience should you have any questions.*

10. Commissioning

d. The SCAQMD has reviewed the revised Commissioning Emissions (per Turbine), provided as Attachment 5 to the SERC Letter, dated 5/17/17. The total commissioning emissions for NOx, CO, and VOC proposed in the SERC response letter, dated 5/17/17, have decreased significantly from the commissioning emissions proposed in its application, dated 11/10/17. Further, the total commissioning emissions for NOx and CO proposed by SERC for all three of its submittals are significantly lower than the commission emissions for NOx and CO provided for a permitted power plant based on GE estimates.

The SCAQMD requires assurance that the actual commissioning emissions are no greater than the permitted emissions. To demonstrate compliance, SERC is provided with two options, discussed below.

- The first option is that the PDOC will be based on the commissioning emissions provided by SERC in its 5/17/17 submittal. However, a Method 100.1 source test van CEMS will be required to monitor the NOx emissions for the entire commissioning period for both turbines. Commissioning emissions factors provided in the facility permit will be used for all other criteria pollutants (CO, VOC, PM_{10} and SOx). The fuel usage will be used to calculate the corresponding mass emissions of NOx, CO, VOC, PM_{10}, and SOx emissions for commissioning.

- The second option is that the PDOC will be based on the estimated commissioning emissions provided by GE for the SERC project. Since the GE estimated emissions are likely conservative, a source test van CEMS will not be required to monitor the NOx emissions during commissioning. However, the modeling for the commissioning may need to be adjusted to align with the GE emissions.

Please advise the option selected by SERC.

Response: *SERC will select the first option and will utilize a source test van with CEMs to monitor the commissioning emissions from both turbines.*

11. Guarantees

c. In the SCAQMD Letter, dated 2/2/17, item 11.a. requested SERC to forward a copy of the guarantees/warranties for the BACT emission rates for NOx, CO, VOC, PM_{10}, $PM_{2.5}$, and NH_3. Item 13.a. requested manufacturing specifications including a guarantee for the life of the SCR. Item 13.b. requested a guarantee for the life of the oxidation catalyst.

In the meeting with SERC representatives on 2/8/17, SERC clarified they are unable to provide the requested information because they have not entered into a commercial relationship with any control equipment manufacturer. They urged the SCAQMD to deem the application complete because they may enter into a commercial relationship in as little as two months.

In the SERC letter, dated 2/15/17, the response to 11.a. stated: "Data collected via SERC's initial procurement efforts is reported in the District's required application forms, and SERC is confident that the procurement process will be sufficiently advanced in order to allow the guarantees to be supplied to the District prior to the issuance of the Preliminary Determination of Compliance (PDOC)."

In a conference call with SERC representatives on 4/13/17, the SCAQMD followed up regarding the need for the guarantees and manufacturing specifications **prior** to the issuance of the PDOC.

i. Please forward a copy of the guarantees/warranties for the BACT emission rates for NOx, CO, VOC, PM_{10}, $PM_{2.5}$, and NH_3.

ii. If the guarantees/warranties are not available, please provide the date by which they will be provided.

Response: *SERC's technical and commercial team members have continued to diligently move toward finalization of purchase agreements for the gas turbines and Emissions Reduction Units (ERUs). The purchase agreements are in near final form, and will now allow the gas turbine and ERU equipment suppliers to document their guarantees for the BACT emission rates for the criteria pollutants. Additionally, SERC is working with the ERU supplier in order to update the requested SCR and CO catalyst manufacturing specifications as needed. SERC expects to be able to obtain the guarantees/warranties information within the week and we expect to provide this information to the SCAQMD under separate cover by the end of the first full week in November.*

13. <u>SCR and CO Oxidation Catalyst Specifications and Guarantees</u>

a. <u>SCR</u>

The SERC letter, dated 2/15/17, provided responses for items 13.a.i.- a.vi. based on an existing SCR and oxidation catalyst located at a similar facility. As soon as the control equipment is procured for this project, please provide updates to the following prior responses.

i. The dimensions were provided as WIDTH: 23 FT 4.8 IN; HEIGHT: 25 FT; LENGTH: 2 FT 8 IN. Please update.

Response: *These dimensions are still valid preliminary design dimensions and do not require updating as a result of finalizing our equipment procurement activities.*

iii. The ammonia injection rate range was provided as 0 to 200 lb/hr of ammonia solution during normal operation. Normal operation is not intended to include start-ups and shutdowns. Please update and provide the lower operating range, not 0 lb/hr, for normal operation.

Response: *The ERU's low-end ammonia injection rate will be 15 lb/hr of ammonia solution during normal operations. As such, the ammonia injection rate range for each ERU system is 15 to 200 lb/hr of 19% aqueous ammonia solution.*

iv. In response to the question regarding the maximum allowable pressure drop, the maximum expected pressure drop across the catalyst was provided as 2.7 inches water. Please update.

Response: *In further reviewing this item with the ERU manufacturer, SERC's previously provided pressure drop of 2.7 inches water was actually a predicted full-load, nominal value, rather than the maximum allowable pressure drop. The updated, full-load, nominal pressure drop is expected at 4.0 inches water, with the maximum expected pressure drop across the catalyst at 6.0 inches water.*

v. The exhaust temperature range required at the inlet of the SCR for proper operation was provided as 480 to 850 deg F. Please update.

Response: *The updated operating exhaust temperature range at the inlet of the Emissions Reduction Unit (ERU) for typical operation is 460 to 855 deg F. (Note: Although this range is typical, both the NOx Catalyst and CO Catalyst can react outside of these ranges. Permit compliance should be measured via pollutant concentrations, not ERU inlet temperature.)*

vi. <u>Guarantee for Catalyst Life</u>
The SCR catalyst warranty period was provided as expected to be five (5) years, but an actual warranty was unavailable. Please forward the guarantee for the life of the catalyst as soon it is available.

Response: *SERC is working with the ERU manufacturer to finalize the ERU purchase agreement. The SCR catalyst warranty period will be for five (5) years, and SERC expects to receive verification of the warranty within the week, and to provide this information to the SCAQMD under a separate cover by the end of the first full week in November.*

vii. The SERC letter, dated 2/15/17, provided a revised *Form 400-E-5—SCR System, Oxidation Catalyst, and Ammonia Catalyst* based on the existing SCR and oxidation catalyst located at a similar facility. Please provide an updated *Form 400-E-5,* including the area velocity unless proprietary, for the control equipment for this project.

Response: *The 400-E-5 Forms submitted with the SERC letter, dated 2/15/17, were completed utilizing details from a similar facility, which facility's Emissions Reduction Unit (ERU) continues to be the basis for the preliminary design details previously provided in the Forms. The previously provided preliminary area velocity is still valid and does not require updating as a result of finalizing our equipment procurement activities.*

b. <u>CO Oxidation Catalyst</u>

i. <u>Guarantee for Catalyst Life</u>

The CO catalyst warranty period was provided as expected to be three (3) years, but an actual warranty was unavailable. Please forward the guarantee for the life of the catalyst as soon it is available.

Response: *SERC is working with the ERU manufacturer to finalize the ERU purchase agreement. The CO catalyst warranty period will be for five (5) years, and SERC expects to receive verification of the warranty within the week, and to provide this information to the SCAQMD under a separate cover by the end of the first full week in November.*

ii. The SERC response letter, dated 2/15/17, included a revised *Form 400-E-5-SCR System, Oxidation Catalyst, and Ammonia Catalyst.* For the Oxidation Catalyst, the size of each layer or module is 2.1 in. long, 2 ft wide, 2 ft high, with 120 layers or modules, based on the oxidation catalyst located at a similar facility.

Please provide the overall dimensions for the CO oxidation catalyst for this project.

Response: *These overall dimensions are still valid preliminary design dimensions and do not require updating as a result of finalizing our equipment procurement activities.*

Preliminary overall dimensions of the CO oxidation catalyst are: WIDTH: 23 FT 4.8 IN; HEIGHT: 25 FT; LENGTH: 2.1 IN.

16. <u>BACT Levels</u>

a. Revised *Section 5.1-Air Quality* was submitted as part of the SERC response package, dated 5/17/17. Please review the revisions to ascertain that all stated BACT levels are correct.

b. Please review the other sections/appendices of the AFC, including *Section 2-Project Description* and *Appendix 5.1 F-Evaluation of Best Available Control Technology,* to ascertain that all stated BACT levels are correct.

Response: *The referenced BACT levels for NOx and CO at 2.5 ppm and 4.0 ppm (15% O_2) are correct. Applicant's currently proposed VOC BACT level is 2 ppm (15% O_2). Any remaining references to VOCs at 1 ppm as being Applicant's proposed limit are incorrect. Additionally, all VOC mass emissions reported in the Revised Section*

5.1-Air Quality section were calculated using the revised proposed VOC limit of 2 ppm. SERC will work with CEC Staff to docket this VOC BACT level clarification and will ensure the AFC record accurately reflects the change.

17. SO_x Emissions
    a. For the application, dated 11/2/16, the *Maximum Annual & Monthly Emissions - Normal Year* table in *Appendix 5.1A* based the monthly and annual SO_x emissions on 0.25 gr S/100 scf. The SCAQMD letter, dated 12/2/16, indicated the monthly emissions are required to be based on 0.75 gr S/100 scf for normal operation, startup, and shutdown. The annual emissions may be based on 0.25 gr S/100 scf for normal operation, startup, and shutdown, if the facility will accept a permit condition for monthly testing of the natural gas. The SERC response letter, dated 12/29/16, indicated that all hourly, daily, monthly and annual emissions are now based on 0.75 gr S/100 scf. This response was unexpected because other projects have based annual emissions on 0.25 gr S/100 scf. It should be emphasized that applicants are strongly encouraged to minimize the number of offsets for which an applicant is applying for an offset exemption. Therefore, please revise your **annual** SO_x emissions calculations based on 0.25 gr S/100 scf.

    Response: *As the District correctly identifies, the original application for a Preliminary Determination of Compliance (PDOC) calculated all SO_x emissions based on a natural gas sulfur content of 0.25 g S/100 scf, a value that has been historically used to represent long term averages. Since the District's letter dated 12/2/16 indicated that "The **monthly** emissions for CO, VOC, PM_{10}/$PM_{2.5}$, and SOx establish a basis for calculating offset requirements and will be enforced by permit condition.", and recognizing that (1) the gas supplier, SoCal Gas Company, is allowed by tariff to transport gas with sulfur content up to 0.75 g S/100 scf, (2) SERC would have no ability to control the sulfur content of the CPUC regulated pipeline quality natural gas delivered to it by SoCal Gas Company, and (3) mitigation requirements, as indicated by the District, would be based on maximum monthly emissions, all emissions were recalculated using the natural gas tariff allowed level of 0.75 g S/100 scf, with the updated values included in the Revised Section 5.1 Air Quality. Currently, in its letter dated 10/6/17, the District requests that the annual emissions be calculated using the sulfur content level of 0.25 g S/100 scf and infers instead that the **annual** SOx emissions will be used to determine the required number of mitigation.*

    *Generally, except for the compliance enforcement discussion below, SERC is indifferent as to which sulfur levels are utilized in the analysis. Neither a 0.25 or 0.75 grain loading causes a health risk concern, and in both cases the project is still eligible for an offset exemption. As requested, the following table provides predicted **annual** SO_x emissions at a sulfur grain-loading of 0.25 g S/100 scf. Subject to the following compliance enforcement concerns, SERC requests the District to determine the appropriate sulfur grain-loading factor for inclusion in its engineering analysis.*

Annual Emissions			
Case Number	1	2	3
	638 Total Hours – 500 Starts	**805 Total Hours – 100 Starts**	**902 Total Hours – 1 Start**
SO_2 Tons per Year, 0.25 g S/100 scf	0.18	0.27	0.30

*Compliance Enforcement – In its letter dated 10/6/17, the District restates that annual emissions "**may** be based on 0.25 g S/100 scf, **if** the facility will accept a permit condition for monthly testing of natural gas". Whereas SERC had previously attempted to minimize its requirements for the monthly testing of natural gas for sulfur content, with the exception of the requirements under 40 CFR 60 Subpart KKKK , it now is willing to conduct monthly sulfur testing.*

However, again recognizing that SERC has no ability to influence sulfur content in the natural gas supplied by the SoCal Gas Company, SERC is concerned that by accepting an annual SO_x limit determined via sulfur grain-loading of 0.25 g S/100 scf, the facility could become subject to a Notice of Violation if the annual average sulfur content exceeded this limit. As such, SERC is willing to submit monthly test results assuming the permit condition is written in such a way that SERC would not be in violation if the sulfur content of the natural gas provided by SoCal Gas Company is in excess of 0.25 g S/100 scf. With such a condition SERC, LLC supports calculating the annual SO_x emissions based on 0.25 g S/100 scf. Otherwise, SERC, LLC believes that the annual emissions should be based on the tariff level of 0.75 g S/100 scf.

18. Gross and Net MW Ratings

As gross and net MW rating for each case number are not provided in the *Combustion Turbine Operating Emissions and Support Data* table, the *GE Power & Water Estimated Average Engine Performance* table was consulted.

a. Gross kW Ratings per Turbine

i. Please confirm the "kW, Gen Terms" data in the *GE Power & Water Estimated Average Engine Performance* table, as reproduced below, represent the gross MW ratings. According to *Figure 2.1-3 Heat and Mass Balance Diagram,* these values do represent the gross MW ratings.

Case No.	**100**	**101**	**102**	**103**	**104**	**105**	**106**	**107**	**108**
CTG Load Level (%)	100	50	21	100	50	21	100	50	20
CTG Inlet Air Cooling	On	Off	Off	On	Off	Off	Off	Off	Off
Ambient Temperature (°F)	102.7	102.7	102.7	65.0	65.0	65.0	40.0	40.0	40.0
Gross CTG Output, kW (one CTG)	47,252	23,649	10,148	49,058	24,532	10,074	51,049	25,530	10,074

Response: *Yes. The "kW, Gen Terms" data in the GE Power & Water Estimated Average Engine Performance table represents gross MW ratings as measured at the generator terminals.*

b. Net kW Ratings per Turbine

i. *Figure 2.1-3 Heat and Mass Balance Diagram* provides the plant net power output for three cases. Please have GE provide the net kW rating per turbine for each case.

Response: *GE does not provide the net kW ratings for the plant as they are not responsible for all items that contribute to the parasitic loads. SERC is knowledgeable of parasitic loads for its affiliates LM6000 facilities, and derived the estimated net ratings provided for the three cases in Figure 2.1-3. SERC's estimates for all cases, on a per turbine basis, assuming both turbines operating, are as follows:*

Case No.	***100***	***101***	***102***	***103***	***104***	***105***	***106***	***107***	***108***
CTG Load Level (%)	*100*	*50*	*21*	*100*	*50*	*21*	*100*	*50*	*20*
CTG Inlet Air Cooling	*On*	*Off*	*Off*	*On*	*Off*	*Off*	*Off*	*Off*	*Off*
Ambient Temperature (°F)	*102.7*	*102.7*	*102.7*	*65.0*	*65.0*	*65.0*	*40.0*	*40.0*	*40.0*
Gross CTG Output, kW (one CTG)	*47,252*	*23,649*	*10,148*	*49,058*	*24,532*	*10,074*	*51,049*	*25,530*	*10,074*
Net Plant Output, kW (one CTG)	*45,891*	*22,549*	*9,048*	*47,673*	*23,432*	*8,974*	*49,637*	*24,430*	*8,974*

19. Ammonia Tank, A/N 589941

The *Form 400-E-18-Storage Tank* is incomplete and appears to include incorrect information.

a. The *Forms 400-A* and *400-E-18* state the contents are 19.5% aqueous ammonia. However, pp. 2-24, 5.1-2, 5.5-3, 5.5-5, and 5.5-10 of the Application for Certification (AFC) state the concentration is 19%. Please confirm the concentration is 19%.

Response: *SERC's ERU system design and NOx reduction capabilities assumes a nominal ammonia concentration of 19%. SERC indicated an ammonia concentration of 19.5% on Forms 400-A and 400-E-18 to allow for a manufacturing margin for the aqueous ammonia solution in the event the ammonia concentration ended up in a permit condition. In order to evaluate worst-case environmental impact conditions, SERC's Offsite Consequences Analysis (Appendix 5.5A of the Application for Certification) assumed usage of an aqueous ammonia solution with ammonia concentration of 19.5%. In summary, environmental impacts assumed worst-case concentration of 19.5% solution, whereas design engineering and procurement language utilizes a nominal ammonia concentration of 19%.*

b. On *Form 400-E-18,* the pressure setting is stated to be 2.5 psig. This setting will be included in a permit condition.

i. Please explain why the setting is 2.5 psig for an aqueous ammonia tank. Such tanks are normally pressure vessels.

Response: *SERC proposes to store aqueous ammonia in a low-pressure storage tank designed and fabricated in accordance with API 620. Since the vapor pressure of 19% aqueous ammonia (14.4 psia at 120 deg. F) is less than ambient pressure under all anticipated ambient temperatures (ambient pressure = 14.7 psia), it is unnecessary to maintain a high pressure in the storage tank to prevent the offgassing of ammonia vapor. SERC's system design assumes the storage tank will operate with the vapor space effectively at ambient conditions. The breather vent pressure setting of 2.5 psig indicated on Form 400-E-18 is incorrect, and instead should be listed as 2.3 psig. The tank design pressure is 2.5 psig. The respective 2.3 and 2.5 psig ratings are determined by the system design engineers to provide a suitable operating range to maintain the storage tank at a low pressure while still providing sufficient operating margin to prevent the release of ammonia vapor during tank filling. This type of storage system design is approved in practice by the Orange County Fire Authority (the SERC project's CUPA (Certified Unified Program Agency).*

ii. If the 2.5 psig is not correct, please provide the correct pressure setting.

Response: *SERC's aqueous ammonia storage tank system includes a breather vent for proper management of the vapor space pressure. The storage system vapor management is achieved with a pressure setpoint of 2.3 psig and a vacuum setpoint of 1 inch of water column (equivalent to 0.036 psi).*

c. Process Description

i. The *Form 400-E-18* skipped over the "Vapor Control During Loading or Unloading." Please explain the vapor control operation.

Response: *During ammonia deliveries, two hoses will connect the delivery truck to SERC's ammonia unloading station. Aqueous ammonia will be pumped from the truck to the SERC ammonia storage tank through one hose while the displaced vapor from the ammonia storage tank is returned to the delivery truck through a second hose, thus avoiding the release of ammonia vapor during the transfer of ammonia from the truck to the aqueous ammonia storage tank.*

ii. The Form 400-E-18 skipped over the "Turnovers Per Year."

aa. Page 5.5-11 of the AFC indicates: "Ammonia will be delivered five times per year on average, and at a maximum frequency of six deliveries per month for continuous operation." Please explain how deliveries are five times per year on average but a maximum of six deliveries per month. The PDOC will included a discussion of the expected maximum number of annual and monthly deliveries.

Response: *The following table lays out the input assumptions and the logic for calculating estimated deliveries of aqueous ammonia. As the District observes, Section 5.5 provided estimates for*

Maximum Monthly Deliveries and Average Annual Deliveries. In response to the District's question, the table also provides the details and inputs needed to provide an estimate for Maximum Annual Deliveries.

Key variables and estimated deliveries for each of the scenarios are:

Maximum Monthly Deliveries: *743 operating hours (1 hour of start-up/shut-down), both LM6000 units on-line, 100% load, and storage re-order point at 25% of tank's effective capacity. Estimated Maximum Monthly Deliveries = 6.*

Average Annual Deliveries: *722 operating hours (80% of estimated maximum full-load annual hours, i.e. 80% of 902 hours), both LM6000 units on-line, 50% load, and storage re-order point at 50% of tank's effective capacity. Estimated Average Annual Deliveries = 5.*

Maximum Annual Deliveries: *902 operating hours (estimated maximum full-load annual hours), both LM6000 units on-line, 100% load, and storage re-order point at 50% of tank's effective capacity. Estimated Maximum Annual Deliveries = 11.*

Derivation of Delivery Estimates for Each Scenario

	Maximum Monthly Deliveries	**Average Annual Deliveres**	**Maximum Annual Deliveries**
Maximum Emissions Calculations Case *	Monthly Case 3	Annual Case 3	Annual Case 3
Total Annual Operating Hours by Case	743.0	902.0	902.0
% of Total Case Hours, Assumed for NH3 Delivery Estimates	100%	**80%**	100%
Resultant Hours for Each Delivery Case	743.0	721.6	902.0
Plant Load Assumption, %	100%	**50%**	100%
Required Ammonia, lb/hr/unit	18.9	10.8	18.9
LM6000 Units On-line, qty	2	2	2
Total SERC Ammonia Required, lb/hr	37.8	21.6	37.8
Annual Ammonia Consumption, lb/yr	28,085	15,587	34,096
% Ammonia in Aqueous Solution	19%	19%	19%
SERC Annual Aqueous Ammonia Consumption, lb/yr	147,818	82,035	179,451
Aqueous Ammonia Density, lb/cf	57.69	57.69	57.69
SERC Annual Aqueous Ammonia Consumption, cf/yr	2,562	1,422	3,111
Volume Constant, gal/cf	7.48	7.48	7.48
SERC Annual Aqueous Ammonia Consumption, gal/yr	19,166	10,636	23,267
Total Tank Capacity, gal	5,000	5,000	5,000
Administrative Tank Fill Capacity, %	85%	85%	85%
Effective Tank Capacity, gal	4,250	4,250	4,250
Reorder Point, % of Effective Tank Capacity	**25%**	50%	50%
Reorder Point, gal	1,063	2,125	2,125
Predicted Aqueous Ammonia Delivery Qty, gal	3,188	2,125	2,125
Predicted Total Deliveries for Each Scenario	6.0	5.0	10.9
* **See Table 5.1A-1a Rev 3**			

bb. Will the deliveries be approximately 7000 gallons per tanker truck shipment?

Response: *No. SERC has proposed a 5,000-gallon ammonia storage tank, with an administrative control to limit the tank fill to no more than 85% of capacity (or 4,250 gallons). Thus, the maximum delivery would be 4,250 gallons, however, deliveries will typically be requested prior to the tank becoming completely empty. A more typical delivery amount would be in the 2,000 to 3,000-gallon range.*

20. Battery Storage

a. From page 1-2 of the AFC, the battery for each turbine is rated at 10 MW. Please explain why the storage is 5 megawatt-hours.

Response: *Battery Energy Storage Systems (BESSs) are rated both in terms of "power" and "stored energy". In the case of the SERC Hybrid EGT® systems, each associated BESS is capable of producing 10 megawatts (MW) of power, and capable of storing 5 megawatt-hours (MWh) of energy. Both of these ratings were determined by the EGT® Hybrid designers to allow the LM6000 Hybrid EGT® to provide generator characteristics necessary to fully qualify the units for Spinning Reserve status according to the California Independent System Operator's (CAISO's) tariff rules. Simply stated, this amount of power and stored energy allows each unit to instantaneously and immediately begin delivering power to the grid and ramp in a smooth and continuous manner from 0.0 MW to 49 MW (nominal) within 10 minutes of receipt of a Spinning Reserve instruction. The BESS is capable of discharging at any power output (0 to 10 MW) until the BESS's stored energy (5MWh nominal) is discharged. Actual BESS power output levels and durations during ramping are controlled by the Hybrid Control System (HCS). Power output and stored energy levels are optimized by the HCS, and will vary over the course of a run instruction, even if the Gas Turbine remains offline in its GHG-free Spinning Reserve mode.*

b. Please discuss the utilization and flexibility of the battery energy storage portion of the project, both in technical and non-technical language.

Response: *The EGT® Hybrid is similar to a hybrid car, which charges its battery using the gas engine and by regenerative braking, and then discharges the battery when there is a call for increasing speed or power. When the EGT® Hybrid is in operation, its control system is constantly monitoring and adjusting either the output of the LM6000 gas turbine, the battery energy storage system, or both. The primary variables that are co-optimized are energy or power demand (in MW) by the grid operator and State of Charge (SOC) of the battery system. As described in the AFC, the SOC is completely managed by the LM6000 with no charging from external sources. MW demand and SOC are described as follows:*

- *Energy demand is the quantity of MWs that the CAISO, as grid operator, is instructing the EGT® Hybrid to deliver to the grid*
- *SOC is the amount of stored energy left in the batteries at any given time that is available for discharge to the grid. The optimum range of SOC is from 20 to 90 percent for lithium-ion chemistry. The optimum SOC is 50 percent because, at 50 percent SOC, there is room to charge and energy available for discharge.*

The EGT® Hybrid control system can generally be expected to follow the operations described in Table DRA11-1.

Table DRA11-1. EGT® Hybrid battery-turbine operation modes

		Battery State		
		Discharging	***Steady State Output of Zero***	***Charging***
Turbine State	***Decreasing MWs***	*The top of the SOC range has been achieved and battery needs to reduce SOC*	*The SOC is acceptable and total MW Demand has been reduced*	*Optimum SOC has not been achieved and total MW Demand has been reduced*
	Steady State Output	*The top of the SOC range has been met and MW demand is not changing*	*The SOC is acceptable and MW Demand is not changing*	*Optimum SOC has not been achieved and total MW Demand is not changing*
	Increasing MWs	*MW Demand is increasing and Bottom of SOC has not been reached.*	*MW Demand is increasing and Top of SOC has been reached.*	*MW Demand may be increasing or SOC may be low or both*

Similar to a gas-hybrid automobile, the demands of the overall EGT® Hybrid system determine which source of energy provides the motive force. The integration of the gas-fired engine with the battery system is tightly controlled and finely tuned for optimal operations. The control system for the EGT® Hybrid is supplied by General Electric.

Copies of this submittal will be sent to the California Energy Commission. Please feel free to contact me at (831) 620-0481 if you have any questions concerning our response to your October comments.

Regards,
Atmospheric Dynamics, Inc.

Gregory Darvin

Cc
Paul Cummins, SERC
Gary Franzen, SERC
Scott Galati, Dayzen, LLC