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|---|---|
| **Docket Number:** | 99-AFC-08C |
| **Project Title:** | Blythe Energy Project Compliance & Blythe Transmission Line Modification |
| **TN #:** | 203374 |
| **Document Title:** | Project Modification for the Blythe Energy Project |
| **Description:** | N/A |
| **Filer:** | Sarah Madams |
| **Organization:** | Sierra Research |
| **Submitter Role:** | Applicant Consultant |
| **Submission Date:** | 11/25/2014 1:28:46 PM |
| **Docketed Date:** | 11/25/2014 |

sierra research

# Project Modification for the Blythe Energy Project (99-AFC-08C)

prepared for:

## Blythe Energy Inc.

submitted to:

## California Energy Commission

November 2014

prepared by:

Sierra Research
1801 J Street
Sacramento, California 95811
(916) 444-6666

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# for the Blythe Energy Project

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# Project Modification for the Blythe Energy Project

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# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| AFC | Application for Certification |
| CEC | California Energy Commission |
| CO | Carbon Monoxide |
| FAA | Federal Aviation Administration |
| GHG | Greenhouse Gases |
| LORS | Laws, Ordinances, Regulations, and Standards |
| MW | megawatt |

###

# 1. INTRODUCTION

## 1.1 Background

The California Energy Commission (CEC) issued a license for Blythe Energy Inc.'s (Blythe Energy) Blythe Energy Project (BEP or Project) on March 21, 2001. Commercial operations for the plant began in July 2003. The BEP is a nominal 520-megawatt (MW) combined-cycle power plant located in the City of Blythe, north of Interstate 10 and approximately 7 miles west of the California and Arizona border.

The purpose of this proposed project modification is to request a staff approved modification for the BEP. Blythe Energy is proposing to add a turndown upgrade package to the two existing gas turbines at BEP. The current license for BEP was approved based on specific gas turbine operating characteristics that included a minimum operating load of approximately 60%. The proposed modification provides a more efficient way to operate the turbines by enabling them to operate at a lower minimum load (below 45%), which is below the current minimum operating load capability. With the lowered load capability, the turbines would use less fuel and emit less pollutants during minimum load operation. No increase in annual fuel consumption will result from this modification, and therefore there would be no increase in GHG emissions as a result of the proposed project modification.

The proposed modification would not require the modification of any Conditions of Certification nor would it result in any environmental impacts or inconsistency with any Laws, Ordinances, Regulations, or Standards (LORS).

A letter request for approval of this change has been submitted to the Mojave Desert Air Quality Management District, a copy of which is provided as Appendix A.

## 1.2 Description of Proposed Modification

BEP is composed of two Siemens F Class V84.3A(2) gas turbines with duct-fired heat recovery steam generators (HRSG), a single condensing steam turbine, two wet cooling towers, and associated plant equipment. Since the BEP commenced commercial operation in 2003, Siemens has developed performance improvements for these gas turbines in the form of a turndown upgrade that will allow the gas turbines to be operated down to minimum loads below 45%, compared with the minimum load of 60% evaluated during the original permitting process. As currently designed, the turbines are unable to operate at a minimum load lower than 60%. With the lowered load capability the turbines would use less fuel and emit less pollutants during minimum load operation.

The turndown upgrade includes minor hardware and software changes,[1] and will therefore constitute a change to the gas turbines as licensed. However, since the minimum gas turbine load is not limited by any conditions of certification, and no increases in emissions or other environmental impacts will result from this modification, the proposed change will not require any changes to any conditions. In fact, implementation of the upgrade will improve plant efficiency and lower overall plant emissions, and will have no additional impacts beyond those identified in the Commission Decision for the BEP. Blythe Energy is requesting that staff approve the implementation of the turndown upgrade for the gas turbines as soon as practicable for the upgrade to be installed during the next scheduled maintenance outage in April 2015.

## 1.3 Necessity of Proposed Changes

Sections 1769 (a)(1)(A), (B) and (C) of the CEC Siting Regulations (20 Cal. Code Reg. §§ 1701 et seq.) require a discussion of the necessity for the proposed changes to the Project and a discussion of whether this modification is based on information that was known by the petitioner during the certification proceeding.

Blythe Energy is requesting this change as the current license for BEP was approved based on specific gas turbine operating characteristics that included a minimum operating load of approximately 60%. The project modification provides a more efficient way to operate the turbines by enabling them to operate at a lower minimum load (45%) which is below the current minimum load capability. With the lowered load capability, the turbines have the ability to use less fuel and emit fewer pollutants under minimum load operating conditions. If system demand was so low that one or both of the gas turbines would have been shut down rather than operated at 60% load, the turndown upgrade may allow BEP to keep one or both turbines online at a reduced load, thereby eliminating the elevated emissions associated with a shutdown-startup cycle.

Blythe Energy was not aware of the turndown upgrade, nor was the upgrade available, during the certification proceeding. The upgrade was only recently made available by Siemens, the gas turbine manufacturer.

## 1.4 Summary of Environmental Impacts

Section 1769 (a)(1)(E) of the CEC Siting Regulations requires that an analysis be conducted to address impacts that the proposed revision may have on the environment and proposed measures to mitigate significant adverse impacts. Section 1769 (a)(1)(F) requires a discussion of the impacts of proposed revisions on the facility's ability to comply with applicable LORS.

The proposed change referenced in this Petition will not result in any additional impacts beyond those already analyzed in the Commission Decision or the Final Determination of Compliance, nor will the proposed modification require changes to any Conditions of Certification. Section 3.0 discusses the potential impacts of the proposed changes on the environment, as well as the consistency of the proposed revision with LORS.

[1] The scope of the upgrade includes replacement parts related to the inlet guide vane and implementation of instrumentation and controls modifications for the gas turbine.

## 1.5 Consistency of Amendment with License

Section 1769 (a)(1)(D) of the CEC Siting Regulations requires a discussion of the consistency of each proposed project revision with the assumptions, rationale, findings, or other basis of the Commission Decision and whether the revision is based on new information that changes or undermines the bases of the Commission Decision. Also required is an explanation of why the changes should be permitted. The proposed modification does not undermine the assumptions, rationale, findings, or other basis of the Commission Decision for the Project. In addition the proposed modification should be permitted as it will improve plant efficiency and lower overall plant emissions, and will have no additional impacts beyond those analyzed in the Commission Decision for the BEP. Lastly, the proposed modification will not require changes to any Conditions of Certification.

###

# 2. DESCRIPTION OF PROJECT CHANGES

Consistent with Sections 1769(a)(1)(A) and (B) of the Siting Regulations, this section includes a complete description of the proposed change as well as the necessity for the change.

## 2.1 Proposed Changes

As originally designed, the gas turbines at BEP had an effective minimum operating load of approximately 60% of rated full load due to the difficulty in maintaining low turbine-out carbon monoxide (CO) emission concentrations below that load point.

Blythe Energy is requesting a project modification to install and operate Siemens' turndown upgrade on the existing gas turbines. This upgrade was recently made available by Siemens. The turndown upgrade includes software changes and some new hardware that will allow the gas turbines to be operated down to minimum loads below 45%, compared with the minimum load of 60% previously evaluated. The upgrade will enable the turbines to utilize less fuel and emit fewer pollutants than they are currently capable of doing when operating under minimum load conditions. If system demand was so low that one or both of the gas turbines would have been shut down, the turndown upgrade may allow BEP to keep one or both turbines online at a reduced load, thereby eliminating the elevated emissions associated with a shutdown-startup cycle.

BEP is not proposing any changes to emissions/operational limits as a result of the proposed amendment. The gas turbines will continue to operate in compliance with their permitted hourly, daily and annual emission limits. No increase in annual fuel consumption will result from this modification, and therefore there would be no increase in GHG emission as a result of the proposed project modification. No changes in Conditions of Certification are required.

###

# 3. ENVIRONMENTAL ANALYSIS OF THE PROJECT CHANGES

Blythe Energy has reviewed the modification proposed herein to determine whether the change will result in any environmental impacts that were not originally analyzed by the CEC when it previously approved the Project.

The following disciplines will not be affected by the proposed change in this amendment and are not addressed below: Facility Design, Efficiency, Reliability, Transmission System Engineering, Transmission Line Safety and Nuisance, Biological Resources, Cultural Resources, Geologic Hazards and Resources, Hazardous Materials Handling, Land Use, Noise, Paleontological Resource, Socioeconomics, Soils, Visual Resources, Waste Management, Water Resources, Worker Safety and Fire Protection. The only disciplines that could be affected by the proposed modification are Air Quality, Public Health, and Traffic and Transportation. As such, those disciplines are discussed in detail below.

As discussed below, the proposed modification does not cause significant impacts in any disciplines beyond those analyzed in the Commission Decision and will not require changes to any Conditions of Certification.

## 3.1 Affected Environment

BEP is a combined-cycle turbine electrical generating facility with a total nominal base load net power output of 520 MW. BEP consists of two power blocks that are made up of Siemens F Class Model V84.3A (2) gas turbines with duct-fired heat recovery steam generators that share a single condensing steam turbine. The natural gas fired combustion turbine generators are equipped with dry low-NOx combustors, selective catalytic reduction systems, and oxidation catalyst systems. The rated heat input of each gas turbine is 1776 million British thermal units per hour (MMBtu/hr[2]) per turbine; each duct burner is rated at 120 MMBtu/hr. The facility includes two wet cooling towers, two emergency diesel fire pumps, and a propane-fired emergency engine.

As originally designed, the gas turbines had an effective minimum operating load of approximately 60% of full rated load due to the difficulty in maintaining low turbine-out carbon monoxide (CO) emission concentrations below that load point. Recently, Siemens has made available a turndown upgrade that allows the gas turbines to operate efficiently and in compliance with all permitted emission limits at lower minimum loads. This expanded operating range may allow BEP to keep operating the gas turbines at lower loads during standby periods, reducing fuel use and emissions. No increase in annual fuel consumption will result from this modification,

[2] All heat inputs are expressed as higher heating values, or HHV.

and therefore there would be no increase in GHG emission as a result of the proposed project modification.

## 3.2 Air Quality

The proposed modification is the implementation of a turndown upgrade to allow operation of the gas turbines at a lower minimum load, with no change in permitted annual fuel use, hourly or annual criteria pollutant emission rates, or other operating limitations. The BEP gas turbines are currently able to achieve a level of production equal to their full rated capacity, as limited by permitted annual emission limits. The gas turbines historically operate below their maximum capacity because electric demand varies over time and is often met with other existing generating resources. The turndown upgrade will not increase the utilization of the gas turbines by changing their overall efficiency or increasing their output. Rather, the upgrade will allow the turbines to be operated at a lower load, with correspondingly lower emissions, when they would have been operated anyway.[3] When gas turbine load is reduced, heat input will be lower. When emissions concentrations are held constant but heat input is reduced, the mass emissions are reduced as well. No increase in annual fuel consumption will result from this modification, and therefore there would be no increase in GHG emission as a result of the proposed project modification.

However, while there will be no increase in emissions, the proposed operation at lower minimum load conditions will affect the mass flow through the turbines at the minimum load point, resulting in slight changes in the exhaust characteristics. The minimum load exhaust characteristics as licensed are compared with the exhaust characteristics provided for the new lower load operation in Table 1. As shown in Table 1, heat input will be up to 20% lower while the minimum exhaust velocity will actually be slightly higher: approximately 45.4 feet per second (ft/s) as compared with the exhaust velocity previously evaluated for minimum load operating conditions (approximately 45.1 ft/s). However, the exhaust velocity is significantly lower than the full-load operating conditions that were analyzed at 65.8 ft/s during BEP licensing. Therefore, the new minimum-load conditions will be within the range previously analyzed in the original permit evaluation and the proposed change will not result in ambient air quality impacts higher than those previously evaluated. A letter to the Mojave Desert Air Quality Management District regarding the proposed modification is provided as Appendix A.

### 3.2.1 Mitigation

No significant impacts beyond those previously described in the Commission Decision for the BEP would result from the approval of this amendment. Therefore, additional mitigation measures beyond those found in the Commission Decision are not necessary.

[3] If system demand was so low that the gas turbines would have been shut down, the turndown upgrade might allow BEP to keep one or both turbines online at a reduced load, thereby eliminating a shutdown-startup cycle and associated elevated emissions.

### 3.2.2 Consistency with Laws, Ordinances, Regulations, and Standards

The Commission Decision for BEP found the facility to be in compliance with all applicable LORS. As amended, the BEP will continue to comply with all applicable LORS and does not alter the conclusions or assumptions in the Commission Decision.

**Table 1**
**Blythe Energy Project**
**Gas Turbine Turndown Upgrade**
**Comparison of Turbine Exhaust Characteristics at Minimum Load**

| | | Minimum Load, by Ambient Condition | | | | | |
|---|---|---|---|---|---|---|---|
| | Full Load | Low Temperature | | Average Temperature | | High Temperature | |
| Parameter | As Licensed (1) | As Licensed (1) | With Upgrade | As Licensed (1) | With Upgrade | As Licensed (1) | With Upgrade |
| Gas Turbine Rated Output, MW | 186.5 | 186.5 | -- | 164.5 | -- | 146.4 | -- |
| Minimum Load, MW | -- | 121.7 | 75.8 | 98.1 | 68.9 | 87.3 | 62.4 |
| Min. Load, % of rated load (1) | -- | 65% | 41% | 60% | 42% | 60% | 43% |
| Heat Input, MMBtu/hr (HHV) | 1,776 | 1,259 | 1,007 | 1,123 | 944 | 1,068 | 889 |
| Exhaust Gas Temp, deg F | 199 | 199 | 180 | 199 | 183 | 199 | 186 |
| Exhaust Velocity, ft/sec | 65.8 | 49.3 | 48.7 | 47.0 | 46.8 | 45.1 | 45.4 |
| NOx, lb/hr | 19.8 | 12 | 9.14 | 11 | 8.57 | 11 | 8.08 |
| CO, lb/hr (2) | 17.5 | 11.1 | 8.9 | 9.9 | 8.3 | 9.4 | 7.8 |

Note:
1. Stack parameters from Siemens performance and emissions estimates, Appendix 7.7, Feb. 2000. Full load case is low temperature condition.
2. CO emissions calculated from heat input and permitted limit of 4 ppmvd @ 15% O2.

### 3.2.3 Conditions of Certification

Consistent with the requirements of the CEC Siting Regulations Section 1769 (a)(1)(A), this section addresses the proposed modifications to the Project's Conditions of Certification. No modifications to the Project's Conditions of Certification are required.

## 3.3 Public Health

As described in Section 3.2, the proposed modification will result in no increase in emissions, but will slightly affect the exhaust characteristics of the turbines. However, the exhaust characteristics are only impacted at the minimum load, and are still well below the maximum limits previously evaluated during licensing of the BEP. As the emissions have not changed and the exhaust characteristics are within the range previously analyzed, an updated health risk assessment was not necessary. Therefore, the effects of the turndown upgrade would not cause significant impacts beyond those considered in the Commission Decision.

### 3.3.1 Mitigation

No significant impacts beyond those previously described in the Commission Decision for the BEP would result from the approval of this amendment. Therefore, additional mitigation measures beyond those found in the Commission Decision are not necessary.

### 3.3.2 Consistency with Laws, Ordinances, Regulations, and Standards

The Commission Decision for BEP found the facility to be in compliance with all applicable LORS. As amended, the BEP will continue to comply with all applicable LORS; the proposed modification does not alter the conclusions or assumptions in the Commission Decision.

### 3.3.3 Conditions of Certification

Consistent with the requirements of the CEC Siting Regulations Section 1769 (a)(1)(A), this section addresses the proposed modifications to the Project's Conditions of Certification. No modifications to the Project's Conditions of Certification are required.

## 3.4 Traffic & Transportation

### 3.4.1 Affected Environment

The Blythe Airport is a public airport located six miles west of the city of Blythe and approximately one mile west of the BEP. During the first fourteen months of BEP operation (June 2003 through August 2004) complaints regarding turbulence and vertical shear were received from area pilots due to the thermal plumes from the exhaust stacks at BEP. An investigation regarding these complaints was conducted by the CEC, and in October 2004 a public workshop was held to develop safety measures to address the potential impact on aviation safety due to the thermal plumes at BEP. The workshop resulted in an agreement to add an advisory to the existing Automated Surface Observing System owned and operated by the Federal Aviation Administration (FAA) that would warn pilots of the potential hazard of the thermal plumes, and direct pilots to avoid overflight of the power plant.

In July 2005, an additional meeting was held between the CEC, the City of Blythe, and all interested agencies and resulted in additional mitigation measures requiring a Notice to Airmen be published in the Los Angeles and Phoenix section aeronautical charts. In addition, the Project Owner agreed to the purchase, installation, and maintenance of a Super Automated Weather Observing System to ensure appropriate advisories regarding the power plant would be broadcast to pilots. All of these mitigation measures are currently in place. [4]

[4] The July 2005 meeting was held well after the BEP license was issued; it was held, in part, as a result of the proposed Blythe II project. Although the mitigation measure was implemented through the Blythe II conditions of certification, the Super AWOS was installed and began operating to provide warning to avoid overflight of BEP.

### 3.4.2 Environmental Impacts

As the proposed modification slightly changes the gas turbine exhaust plume characteristics, an evaluation of the thermal plume velocity based on the new exhaust characteristics was conducted. The detailed analysis is provided as Appendix B and is summarized below.

CEC staff currently uses a 4.3 meters per second (m/s) vertical velocity threshold for determining whether a plume may pose a hazard to aircraft. This threshold was established based on staff's review of a safety circular prepared by the Australian Government Civil Aviation Safety Authority in 2004 and updated in 2012,[5] which cites the need to "assess the potential hazard to aviation posed by vertical exhaust plumes in excess of 4.3 metres per second (m/s) velocity." The FAA performed its own safety risk analysis of thermal plumes in 2006, and concludes that while "[t]he FAA does not necessarily approve/disapprove or warrant the data contained in the CASA AC 139-05…[the FAA] accepts the information and data contained in AC 139-05 as a valid representation of hazardous exhaust velocities."[6]

At the time the BEP was licensed, CEC staff had no standard procedure for evaluating thermal plume impacts or significance. Therefore, no qualitative assessment of thermal plume impacts was performed for the original BEP licensing proceeding. Following staff's current plume velocity analysis procedure,[7] the Spillane Approach has been used to estimate worst-case plume vertical velocities for the proposed new low-load operating cases as well as for full-load operating conditions, which will not be affected by the proposed modification. The analysis shows that the average vertical velocity for a single plume would be 4.2 meters per second (m/s) or below at elevations above 600 feet under existing full load conditions, while velocities for low-load operation would be 4.2 m/s or below at elevations above 400 feet. Therefore, the implementation of the proposed turndown upgrade and resulting lower minimum load operation will not create any new thermal plume hazards for aircraft, and will not result in impacts greater than those addressed previously.

### 3.4.3 Mitigation

No significant impacts beyond those previously addressed for the BEP would result from the approval of this amendment. Therefore, additional mitigation measures beyond those already implemented are not necessary.

### 3.4.4 Consistency with Laws, Ordinances, Regulations, and Standards

The Commission Decision for BEP found the facility to be in compliance with all applicable LORS. As amended, the BEP will continue to comply with all applicable LORS; the proposed modification does not alter the conclusions or assumptions in the Commission Decision.

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[5] CASA Advisory Circular AC 139-5(1), "Plume Rise Assessments," November 2012; available at http://www.casa.gov.au/wcmswr/_assets/main/rules/1998casr/139/139c05.pdf

[6] Federal Aviation Administration, "Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes," DOT-FAA-AFS-420-06-1, January 2006. Available at http://www.ctcombustion.com/oxc/sources/20-safetyriskanalysis.pdf.

[7] See, for example, Appendix TT-1 to the Final Staff Assessment for the Pio Pico Energy Center, May 2012.

### 3.4.5 Conditions of Certification

Consistent with the requirements of the CEC Siting Regulations Section 1769 (a)(1)(A), this section addresses the proposed modifications to the Project's Conditions of Certification. No modifications to the Project's Conditions of Certification are required.

###

# 4. POTENTIAL EFFECTS ON THE PUBLIC AND PROPERTY OWNERS

This section addresses potential effects of the proposed project modification on nearby property owners, the public, and parties in the application proceeding, pursuant to CEC Siting Regulations (Title 20, CCR, Section 1769 [a][1][I]).

Nearby property owners, the Public, and Parties to the Application Proceeding will not be affected by the proposed modification as it will not result in impacts different from those identified in the Commission Decision.

###

# 5. LIST OF PROPERTY OWNERS

As required by CEC Siting Regulations Section 1769(a)(1)(H), a list of property owners potentially affected by this modification is to be provided with this Petition. However, nearby property owners will not be affected by the proposed modification since it will not require a change to any of the emission limits or conditions of certification specified in the Commission Decision.

###

# APPENDIX A

Letter to the
Mojave Desert Air Quality Management District
Requesting Approval to Install the Turndown Upgrade
at the Blythe Energy Project

Blythe Energy Inc.

1411 Third Street, Suite A main (810) 887-4726
Port Huron, MI 48060 fax (810) 887-4756

November 25, 2014

Eldon Heaston, Executive Officer
Mojave Desert Air Quality Management District
14306 Park Avenue
Victorville, CA 92392-2310

Subject: Blythe Energy Project
MDAQMD Federal Operating Permit 130202262

Dear Mr. Heaston:

Blythe Energy Inc. is requesting the District's approval to install turndown upgrades on the two Siemens V84.3A gas turbines at the Blythe Energy Project (BEP). Since the BEP commenced commercial operation in 2003, Siemens has developed performance improvements for these gas turbines in the form of a turndown upgrade that will allow the gas turbines to be operated down to minimum loads below 45%, compared with the minimum load of 60% evaluated during the original permitting process. The turndown upgrade includes minor hardware and software changes,[1] and will therefore constitute a physical change to and a change in the method of operation of the gas turbines. However, since the minimum gas turbine load is not limited by any permit conditions, and no increases in emissions will result from this modification, the proposed change will not require any changes to any permit conditions. Implementation of the upgrade will improve plant efficiency and lower overall plant emissions. BEP is requesting that the District approve the implementation of the turndown upgrade for the gas turbines as soon as practicable to allow for the upgrades to be installed during the next scheduled maintenance outage in April 2015.

The only proposed change is the implementation of the turndown upgrade to allow operation of the gas turbines at a lower minimum load, with no change in permitted annual fuel use, hourly or annual criteria pollutant emission rates, or other operating limitations. The turndown upgrade will reduce emissions from the gas turbines when they are operating at minimum load because there will be less fuel used while the emissions concentrations will not increase.

While there will be no increases in emissions, the proposed operation at lower minimum load will affect the mass flow through the turbines at the minimum load point, resulting in slight changes in the exhaust characteristics. The exhaust characteristics evaluated in the FDOC are compared with the exhaust characteristics provided by Siemens for the new lower load operation in Attachment 1 to this letter. This comparison shows that although heat input will be up to 20% lower, the minimum exhaust velocity will actually be slightly higher than the minimum velocity previously evaluated for minimum load operating conditions (although significantly lower than under full-load operating conditions). Therefore,

[1] The scope of the upgrade includes replacement parts related to the inlet guide vane, and implementation of instrumentation and controls modifications for the gas turbine.

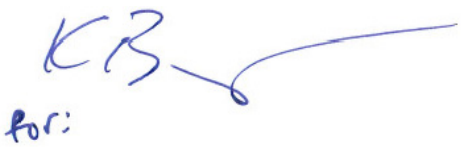
the dispersion for the new minimum-load conditions will be within the range of conditions analyzed in the original permit evaluation and the proposed change will not result in ambient air quality impacts higher than those evaluated in the FDOC.

We are also providing a demonstration that the proposed turndown upgrade will not subject the gas turbines to any additional regulatory requirements. That demonstration is included as Attachment 2 to this letter.

The District determined in the FDOC that BEP as permitted would be in compliance with District regulations, including offset requirements. The proposed turndown upgrade will not result in any emission increases, so no new offsets will be required for the proposed upgrade. The District also determined in the FDOC that BEP as permitted would be in compliance with applicable District prohibitory rules. BEP is not proposing any changes to the project that would change this determination. Therefore, continued compliance with all applicable District rules and regulations is expected.

We appreciate your consideration of our request. If you have any questions or require additional information regarding the proposed turbine upgrades, please do not hesitate to contact Gary Rubenstein of Sierra Research at (916) 273-5126.

Sincerely,



for:

Christopher J. Doyle
Vice President
Blythe Energy Inc.

Attachments

cc: Mary Dyas, California Energy Commission
Gerardo Rios, EPA Region IX
Kyle Banbury, AltaGas Ltd.
Melissa Foster, Stoel Rives LLP
Gary Rubenstein, Sierra Research

**Attachment 1**

Comparison of Turbine Exhaust Characteristics at Minimum Load

**Blythe I Energy Project**
**Gas Turbine Turndown Upgrade**
**Comparison of Turbine Exhaust Characteristics at Minimum Load**

| Parameter | Full Load | Minimum Load, by Ambient Condition | | | | | |
|---|---|---|---|---|---|---|---|
| | | Low Temperature | | Average Temperature | | High Temperature | |
| | As Licensed (1) | As Licensed (1) | With Upgrade | As Licensed (1) | With Upgrade | As Licensed (1) | With Upgrade |
| Gas Turbine Rated Output, MW | 186.5 | 186.5 | -- | 164.5 | -- | 146.4 | -- |
| Minimum Load, MW | -- | 121.7 | 75.8 | 98.1 | 68.9 | 87.3 | 62.4 |
| Min. Load, % of rated load (1) | -- | 65% | 41% | 60% | 42% | 60% | 43% |
| Heat Input, MMBtu/hr (HHV) | 1,776 | 1,259 | 1,007 | 1,123 | 944 | 1,068 | 889 |
| Exhaust Gas Temp, deg F | 199 | 199 | 180 | 199 | 183 | 199 | 186 |
| Exhaust Velocity, ft/sec | 65.8 | 49.3 | 48.7 | 47.0 | 46.8 | 45.1 | 45.4 |
| NOx, lb/hr | 19.8 | 12 | 9.14 | 11 | 8.57 | 11 | 8.08 |
| CO, lb/hr (2) | 17.5 | 11.1 | 8.9 | 9.9 | 8.3 | 9.4 | 7.8 |

Note:

1. Stack parameters from Siemens performance and emissions estimates, Appendix 7.7, Feb. 2000. Full load case is low temperature condition.
2. CO emissions calculated from heat input and permitted limit of 4 ppmvd @ 15% O2.

## Attachment 2

Assessment of Compliance with LORS

This section evaluates the applicability to the proposed turndown upgrade of the rules and regulations listed below, and shows that the proposed turn down upgrade will not trigger any requirements that were not previously applicable.

- Federal Prevention of Significant Deterioration
- New Source Performance Standards
- National Emission Standards for Hazardous Air Pollutants
- New Source Review Offset Requirements
- District Prohibitory Rules

A. Prevention of Significant Deterioration

Prevention of Significant Deterioration (PSD) is the federal preconstruction review program. It applies to *significant modifications* at *major stationary sources*. It also applies to *new major stationary sources*. A major source is a listed facility (one of 28 PSD source categories listed in Rule 20.1, NSR General Provisions) that emits at least 100 tons/year of an attainment pollutant, or any other facility that emits at least 250 tons/year of an attainment pollutant. The PSD threshold for greenhouse gases (GHGs) is currently 100,000 tons/year for sources that trigger PSD review for other pollutants.

At present, the District does not have authority to implement its own PSD program. PSD permits for facilities in the District are issued by EPA Region 9.

BEP was determined to be a major stationary source for PSD purposes, and was required to undergo PSD review for NOx, CO and $PM_{10}$. Because no changes are being proposed to any emission limits or other conditions of the permit, no amendments to the PSD permit are being requested.

40 CFR 52.21(b)(2)(i) defines "major modification" as:

> *…any physical change in or change in the method of operation of a major stationary source that would result in: a significant emissions increase (as defined in paragraph (b)(40) of this section) of a regulated NSR pollutant (as defined in paragraph (b)(50) of this section); and a significant net emissions increase of that pollutant from the major stationary source.*

Therefore, the proposed change must be evaluated to determine whether it will result in a significant emissions increase, as defined in §52.21 (b)(40).

In accordance with §52.21 (a)(2)(iv)(c), the "actual-to-projected-actual applicability test" is used to evaluate potential emissions increases for the existing gas turbines. Under this procedure, the emissions increases for modifications to existing units are calculated as the difference between projected actual emissions and baseline actual emissions.

Projected actual emissions are calculated from

> *(1) The hourly emissions rate, which is based on the emissions unit's operational capabilities following the change(s), taking into account legally enforceable restrictions that could affect the hourly emissions rate following the change(s); and (2) the projected level of utilization, which is based on both the emissions unit's historical annual utilization rate and available information regarding the emissions unit's likely post-change capacity utilization…**From the initial calculation, you may then make the appropriate adjustment to subtract out any portion of the emissions increase that could have been accommodated during the unit's 24-month baseline period and is unrelated to the change**.* [67 FR 80196, emphasis added]

"Baseline actual emissions" are defined in §52.21(b)(48)(ii) as:

> *… the average rate, in tons per year, at which the emissions unit actually emitted the pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding either the date the owner or operator begins actual construction of the project, or the date a complete permit application is received by the Administrator for a permit required under this section….*

"Baseline actual emissions" are the highest actual emissions for each pollutant of any two-year period during the previous 10 years.

Per 40 CFR §52.21(b)(41)(ii)(c), the calculated emissions increase:

> *Shall exclude, in calculating any increase in emissions that results from the particular project, that portion of the unit's emissions following the project that an existing unit **could have accommodated** during the consecutive 24-month period used to establish the baseline actual emissions under subparagraph (2)(aa) of this rule and that are not resulting from the particular project, including any increased utilization due to product demand growth*… [emphasis added]

This provision is commonly called the "demand growth exclusion."

The BEP gas turbines are currently able to achieve a level of production equal to their full rated capacity, as limited by permitted annual emission limits. The gas turbines historically operate below their maximum capacity because electric demand varies over time and is often met with other existing generating resources. The turn down upgrade will not increase the utilization of the gas turbines by changing their overall efficiency or increasing their output. Rather, the upgrade will allow the turbines to be operated at a lower load, with correspondingly lower emissions, *when they would have been operated anyway*.[2] When gas turbine load is reduced, heat input will be lower. When emissions concentrations are held constant but heat input is reduced, the mass emissions are reduced as well.

For example, the minimum gas turbine load evaluated during the original permit evaluation was 60% of rated load. At an ambient temperature of 59$^{o}$F, the minimum heat input to the gas turbine was 1,163 MMBtu/hr, and the corresponding CO emissions at 4 ppmvd @ 15% $O_2$ were 10.2 lb/hr. As shown in Attachment 1, when the minimum gas turbine load and corresponding minimum heat input are reduced, the minimum heat input at the corresponding ambient condition would be approximately 944 MMBtu/hr and the corresponding CO emissions would be 8.3 lb/hr.

Projected actual emissions after the upgrade will therefore be lower than projected actual emissions before the upgrade, and any difference between baseline emissions and projected actual emissions

[2] If system demand was so low that the gas turbines would have been shut down, the turn down upgrade might allow BEP to keep one or both turbines online at a reduced load, thereby eliminating a shutdown-startup cycle and associated elevated emissions.

would be attributed to the demand growth exclusion. Therefore the proposed upgrade will not result in any increase in annual emissions.

B. New Source Performance Standards (NSPS)

Regulations in 40 CFR Part 60 establish standards of performance to limit emissions from new or modified facilities in specific source categories. These standards are implemented at the local level with federal oversight. The applicability of these regulations depends on the equipment size, process rate, and/or the date of construction, modification, or reconstruction of the affected facility.

For the purposes of NSPS applicability, 40 CFR 60.14 (a) defines "modification" as "any physical or operational change to an existing facility which results in an increase in the emission rate to the atmosphere of any pollutant to which a standard applies…." 40 CFR 60.14(b) states "Emission rate shall be expressed as kg/hr of any pollutant discharged to the atmosphere for which a standard is applicable." Taken together, this means that NSPS applicability is determined based on an increase in the hourly potential to emit a pollutant to which the NSPS applies. The applicable NSPS (40 CFR 60 Subpart KKKK) regulates only NOx and $SO_2$ emissions from gas turbines.

The proposed modification will not result in an increase in the allowable hourly NOx or $SO_2$ emission rates of any of the affected emission units. Therefore, the change requested in this application is not a modification under any NSPS currently in effect. EPA has proposed, but has not yet adopted, a new NSPS that would limit GHG emissions from existing electric utility generating units. Once a final rule has been promulgated, its applicability to BEP will be assessed and a demonstration of compliance will be provided.

C. National Emission Standards for Hazardous Air Pollutants (NESHAP)

NESHAP Subpart YYYY (40 CFR 63.6080 et seq.) is the federal standard that regulates hazardous air pollutants (HAPs) emitted by gas turbines at facilities that are major sources for HAPs. A facility is a major source for HAPs if it emits more than 10 tons/year of any individual HAP, or 25 tons/year of all HAPs combined. BEP is not a major facility for HAPs, so the NESHAP is not applicable to these gas-fired turbines. In addition, the proposed upgrade will not increase BEP's emissions of HAPs; therefore, the NESHAP will not become applicable to BEP as a result of the upgrade.

D. New Source Review (NSR) Offset Requirements

District Rule 20.3(d)(5) requires offsets for projects that result in an emission increase of any federal nonattainment criteria pollutant, or its precursors, which exceed new major source or major modification thresholds. All required offsets were provided for BEP at the time of licensing. Because the proposed turndown upgrade will not result in any emission increases, no additional offsets will be required for the proposed upgrade project.

E. District Prohibitory Rules

The District determined in the FDOC that BEP as permitted would be in compliance with applicable District prohibitory rules. BEP is not proposing any changes to the project that would change this determination. Therefore, continued compliance with all applicable District LORS is expected.

# APPENDIX B

Thermal Plume Analysis

# BEP Thermal Plume Analysis

The following analysis uses the Spillane approach[8] to calculate worst-case plume vertical velocities for the BEP exhaust stacks. This calculation approach is limited to calm wind conditions (wind speed = 0), which are the worst-case conditions. The gas turbine/HRSG plume velocities are calculated for the two gas turbine/HRSG exhaust stacks, which are approximately 91 feet (30 meters) apart, both before and after merging. Based on the CASA-established threshold of 4.3 meters/second (m/s) for potentially hazardous vertical plume velocities, the analysis demonstrates that the proposed low-load operation of the gas turbines will not result in any new hazardous conditions for aircraft and, therefore, thermal plume impacts on aircraft are less than significant.

Blythe Energy Project Turndown Upgrade
BEP Predicted Calm Wind Plume Velocities
BEP Stack Parameters

| Case | Cold Peak | Cold Low | Average Peak | Average Low | Hot Peak | Hot Low |
|---|---|---|---|---|---|---|
| Original/New Condition* | Original | New | Original | New | Original | New |
| Ambient Temperature (F) | 20 | 20 | 59 | 59 | 95 | 95 |
| Ambient Temperature (k) | 266.0 | 266.0 | 288.0 | 288.2 | 308.0 | 308.150 |
| Stack Height (m) | 39.62 | 39.62 | 39.62 | 39.62 | 39.62 | 39.62 |
| Stack diameter (m) | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 | 5.63 |
| Stack Velocity (m/s) | 20.04 | 14.84 | 19.93 | 14.26 | 19.26 | 13.84 |
| Exhaust Temperature (K) | 366 | 355.2 | 366 | 356.9 | 366 | 358.6 |
| Zv Virtual source Height (m) | 5.19 | 4.74 | 3.97 | 3.57 | 2.91 | 2.57 |
| $F^0$ initial stack buoyancy ($m^4/s^3$) | 425.21 | 289.53 | 329.84 | 213.36 | 237.02 | 151.07 |
| $(V*a)_0$ | 48.09 | 36.16 | 49.77 | 36.08 | 49.74 | 36.11 |

* "Original" indicates stack conditions from original licensing proceeding; "New" indicates stack conditions from new low-load operating conditions.

| Height above AGL (ft) | Height above AGL (m) | BEP Plume Velocity (m/s) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Cold Peak | Cold Low | Average Peak | Average Low | Hot Peak | Hot Low | Maximum |
| 200 | 61.0 | 6.8 | 5.6 | 6.6 | 5.1 | 6.2 | 4.8 | 6.8 |
| 300 | 91.4 | 5.5 | 4.7 | 5.2 | 4.3 | 4.8 | 3.9 | 5.5 |
| 350 | 106.7 | 5.2 | 4.4 | 4.8 | 4.0 | 4.4 | 3.6 | 5.2 |
| 400 | 121.9 | 4.9 | 4.2 | 4.6 | 3.8 | 4.2 | 3.5 | 4.9 |
| 450 | 137.2 | 4.7 | 4.0 | 4.3 | 3.7 | 3.9 | 3.3 | 4.7 |
| 500 | 152.4 | 4.5 | 3.9 | 4.1 | 3.5 | 3.8 | 3.2 | 4.5 |
| 600 | 182.9 | 4.2 | 3.6 | 3.9 | 3.3 | 3.5 | 3.0 | 4.2 |
| 700 | 213.4 | 3.9 | 3.5 | 3.6 | 3.1 | 3.3 | 2.8 | 3.9 |
| 800 | 243.8 | 3.8 | 3.3 | 3.5 | 3.0 | 3.1 | 2.7 | 3.8 |
| 900 | 274.3 | 3.6 | 3.2 | 3.3 | 2.9 | 3.0 | 2.6 | 3.6 |
| 1000 | 304.8 | 3.5 | 3.1 | 3.2 | 2.8 | 2.9 | 2.5 | 3.5 |
| 1100 | 335.3 | 3.4 | 3.0 | 3.1 | 2.7 | 2.8 | 2.4 | 3.4 |
| 1200 | 365.8 | 3.3 | 2.9 | 3.0 | 2.6 | 2.7 | 2.3 | 3.3 |
| 1300 | 396.2 | 3.2 | 2.8 | 2.9 | 2.5 | 2.6 | 2.2 | 3.2 |
| 1400 | 426.7 | 3.1 | 2.7 | 2.8 | 2.5 | 2.6 | 2.2 | 3.1 |
| 1500 | 457.2 | 3.0 | 2.7 | 2.8 | 2.4 | 2.5 | 2.1 | 3.0 |
| 1600 | 487.7 | 3.0 | 2.6 | 2.7 | 2.3 | 2.4 | 2.1 | 3.0 |
| 1700 | 518.2 | 2.9 | 2.5 | 2.7 | 2.3 | 2.4 | 2.1 | 2.9 |
| 1800 | 548.6 | 2.8 | 2.5 | 2.6 | 2.3 | 2.3 | 2.0 | 2.8 |

[8] Best, P. et al. 2003. Aviation Safety and Buoyant Plumes. Presented at the Clean Air Conference, Newcastle, New South Wales, Australia. By Peter Best, Lena Jackson, Mark Kanowski of Katestone Environmental, Toowong, Queensland, Australia, and Kevin Spillane of Bendigo, Victoria, Australia.

| Ht above AGL (ft) | Height above stacktop (m) | BEP plume top-hat radius (m) | | | | | |
|---|---|---|---|---|---|---|---|
| | | Cold Base | Cold Low | Average Base | Average Low | Hot Base | Hot Low |
| 350 | 106.7 | 16.2 | 16.3 | 16.4 | 16.5 | 16.6 | 16.7 |
| 450 | 137.2 | 21.1 | 21.2 | 21.3 | 21.4 | 21.5 | 21.5 |
| 500 | 152.4 | 23.6 | 23.6 | 23.7 | 23.8 | 23.9 | 24.0 |
| 600 | 182.9 | 28.4 | 28.5 | 28.6 | 28.7 | 28.8 | 28.9 |
| 700 | 213.4 | 33.3 | 33.4 | 33.5 | 33.6 | 33.7 | 33.7 |
| 800 | 243.8 | 38.2 | 38.3 | 38.4 | 38.4 | 38.5 | 38.6 |
| 900 | 274.3 | 43.1 | 43.1 | 43.3 | 43.3 | 43.4 | 43.5 |
| 1000 | 304.8 | 47.9 | 48.0 | 48.1 | 48.2 | 48.3 | 48.4 |
| 1100 | 335.3 | 52.8 | 52.9 | 53.0 | 53.1 | 53.2 | 53.2 |
| 1200 | 365.8 | 57.7 | 57.8 | 57.9 | 58.0 | 58.1 | 58.1 |
| 1300 | 396.2 | 62.6 | 62.6 | 62.8 | 62.8 | 62.9 | 63.0 |
| 1400 | 426.7 | 67.4 | 67.5 | 67.6 | 67.7 | 67.8 | 67.9 |
| 1500 | 457.2 | 72.3 | 72.4 | 72.5 | 72.6 | 72.7 | 72.7 |
| 1600 | 487.7 | 77.2 | 77.3 | 77.4 | 77.5 | 77.6 | 77.6 |
| 1700 | 518.2 | 82.1 | 82.1 | 82.3 | 82.3 | 82.4 | 82.5 |
| 1800 | 548.6 | 87.0 | 87.0 | 87.1 | 87.2 | 87.3 | 87.4 |

Distance between stacks: 30 m

| AGL | Height above stacktop (m) | BEP Plume Velocity Two Stack Merged Exit Velocity, m/s) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Cold Base | Cold Low | Base | Low | Hot Base | Hot Low | Maximum |
| 350 | 106.7 | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | n/a |
| 450 | 137.2 | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | n/a |
| 500 | 152.4 | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | n/a |
| 600 | 182.9 | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | Not Merge | n/a |
| 700 | 213.4 | 4.7 | 4.1 | 4.3 | 3.7 | 3.9 | 3.3 | 4.7 |
| 800 | 243.8 | 4.5 | 3.9 | 4.1 | 3.5 | 3.7 | 3.2 | 4.5 |
| 900 | 274.3 | 4.3 | 3.8 | 4.0 | 3.4 | 3.6 | 3.0 | 4.3 |
| 1000 | 304.8 | 4.1 | 3.6 | 3.8 | 3.3 | 3.4 | 2.9 | 4.1 |
| 1100 | 335.3 | 4.0 | 3.5 | 3.7 | 3.2 | 3.3 | 2.8 | 4.0 |
| 1200 | 365.8 | 3.9 | 3.4 | 3.6 | 3.1 | 3.2 | 2.7 | 3.9 |
| 1300 | 396.2 | 3.8 | 3.3 | 3.5 | 3.0 | 3.1 | 2.7 | 3.8 |
| 1400 | 426.7 | 3.7 | 3.2 | 3.4 | 2.9 | 3.0 | 2.6 | 3.7 |
| 1500 | 457.2 | 3.6 | 3.2 | 3.3 | 2.9 | 3.0 | 2.5 | 3.6 |
| 1600 | 487.7 | 3.5 | 3.1 | 3.2 | 2.8 | 2.9 | 2.5 | 3.5 |
| 1700 | 518.2 | 3.4 | 3.0 | 3.2 | 2.7 | 2.8 | 2.4 | 3.4 |
| 1800 | 548.6 | 3.4 | 3.0 | 3.1 | 2.7 | 2.8 | 2.4 | 3.4 |