NORTHERN STAR GENERATION SERVICES COMPANY LLC

Operating Agent for Orlando Cogen Limited, L.P.
8275 Exchange Drive
Orlando, FL 32809
(407) 851-1350 (office)
(407) 851-1686 (fax)

February 22, 2005

Air Permitting South - FDEP
Division of Air Resource Management
Attn: Jeff Koerner
2600 Blair Stone Road MS 5500
Tallahassee, Florida 32399-2400

Re: Orlando CoGen Limited, L.P.
Facility ID: 0950203; ORIS Code: 54466; Title V Permit: 0950203-002-AV
Application for Air Permit – Long Form – Heat Rate Improvement Project

Dear Mr. Koerner:

Northern Star Generation Services is submitting an Air Construction permit application and Title V permit revision long form application for a heat rate improvement project. The application is submitted by Orlando CoGen Limited, L.P. which owns a 129 MW natural gas-fired combined cycle cogeneration facility located at 8275 Exchange Drive, Orlando, Florida 32809. The plant is operated by Northern Star Generation Services.

If you have any questions regarding this submittal, please contact the application contact Scott P. Wesson of PBS&J at (407) 806 – 4106 spwesson@pbsj.com or me at (407)851-1350 todd.shirley@northernstargen.com.

Sincerely,

Todd A. Shirley
Plant Manager
Orlando CoGen Limited, L.P.

Attachment

Cc: David Kellermeyer, NSGS

Department of Environmental Protection

Division of Air Resource Management

RECEIVED
FEB 24 2005
BUREAU OF AIR REGULATION

APPLICATION FOR AIR PERMIT - LONG FORM

I. APPLICATION INFORMATION

Air Construction Permit – Use this form to apply for an air construction permit for a proposed project:
- subject to prevention of significant deterioration (PSD) review, nonattainment area (NAA) new source review, or maximum achievable control technology (MACT) review; or
- where the applicant proposes to assume a restriction on the potential emissions of one or more pollutants to escape a federal program requirement such as PSD review, NAA new source review, Title V, or MACT; or
- at an existing federally enforceable state air operation permit (FESOP) or Title V permitted facility.

Air Operation Permit – Use this form to apply for:
- an initial federally enforceable state air operation permit (FESOP); or
- an initial/revised/renewal Title V air operation permit.

Air Construction Permit & Revised/Renewal Title V Air Operation Permit (Concurrent Processing Option) – Use this form to apply for both an air construction permit and a revised or renewal Title V air operation permit incorporating the proposed project.

To ensure accuracy, please see form instructions.

Identification of Facility

1. Facility Owner/Company Name: Northern Star Generation Services	
2. Site Name: Orlando Cogen Limited, L.P.	
3. Facility Identification Number: 0950203	
4. Facility Location... Street Address or Other Locator: 8275 Exchange Drive City: Orlando County: Orange Zip Code: 32809	
5. Relocatable Facility? ☐ Yes ☒ No	6. Existing Title V Permitted Facility? ☒ Yes ☐ No

Application Contact

1. Application Contact Name: Scott P. Wesson
2. Application Contact Mailing Address. Organization/Firm: PBS&J Street Address: ..482 South Keller Road City: Orlando State: FL Zip Code: 32810-6101
3. Application Contact Telephone Numbers... Telephone: (407) 806 - 4106 ext. Fax: (407) 647 - 4143
4. Application Contact Email Address: spwesson@pbsj.com

Application Processing Information (DEP Use)

1. Date of Receipt of Application:	2-24-05
2. Project Number(s):	0950203-003-AC 0950203-004-AV ✓
3. PSD Number (if applicable):	
4. Siting Number (if applicable):	

APPLICATION INFORMATION

Purpose of Application

This application for air permit is submitted to obtain: (Check one)

Air Construction Permit

☐ Air construction permit.

Air Operation Permit

☐ Initial Title V air operation permit.

☐ Title V air operation permit revision.

☐ Title V air operation permit renewal.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is required.

☐ Initial federally enforceable state air operation permit (FESOP) where professional engineer (PE) certification is not required.

Air Construction Permit and Revised/Renewal Title V Air Operation Permit (Concurrent Processing)

[X] Air construction permit and Title V permit revision, incorporating the proposed project.

☐ Air construction permit and Title V permit renewal, incorporating the proposed project.

Note: By checking one of the above two boxes, you, the applicant, are requesting concurrent processing pursuant to Rule 62-213.405, F.A.C. In such case, you must also check the following box:

[X] I hereby request that the department waive the processing time requirements of the air construction permit to accommodate the processing time frames of the Title V air operation permit.

Application Comment

The proposed project will involve the implementation of either or both of two options for improving plant heat rate: installation of an inlet air fogging system and upgrading the existing gas turbine from an Altsom GT 11N1 to a GT 11NM. The main goal of the upgrade project is to reduce the costs of power generation by increasing turbine efficiency. The cost savings are primarily realized through a reduction in fuel use. There are no changes requested to the emission limits or fuel limits.

APPLICATION INFORMATION

Scope of Application

Emissions Unit ID Number	Description of Emissions Unit	Air Permit Type	Air Permit Proc. Fee
001	Combustion Turbine, Phase II Acid Rain Unit	AC1B	$0
002	HRSG and Duct Burner System, Phase II Acid Rain Unit	AC1B	$0

Application Processing Fee

Check one: ☐ Attached - Amount: $____________ [X] Not Applicable

APPLICATION INFORMATION

Owner/Authorized Representative Statement

Complete if applying for an air construction permit or an initial FESOP.

1. Owner/Authorized Representative Name :
   Todd Shirley – Plant Manager

2. Owner/Authorized Representative Mailing Address...
   Organization/Firm: Orlando Cogen - Northern Star Generation Services
   Street Address: 8275 Exchange Drive
   City: Orlando State: FL Zip Code: 32809

3. Owner/Authorized Representative Telephone Numbers...
   Telephone: (407) 851 - 1350 ext. Fax: (407) 851 - 1686

4. Owner/Authorized Representative Email Address: todd.shirley@northernstargen.com

5. Owner/Authorized Representative Statement:

   I, the undersigned, am the owner or authorized representative of the facility addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other requirements identified in this application to which the facility is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit.

   Todd Shirley
   Signature

   2/21/2005
   Date

APPLICATION INFORMATION

Application Responsible Official Certification

Complete if applying for an initial/revised/renewal Title V permit or concurrent processing of an air construction permit and a revised/renewal Title V permit. If there are multiple responsible officials, the "application responsible official" need not be the "primary responsible official."

1. Application Responsible Official Name:
   Todd Shirley – Plant Manager

2. Application Responsible Official Qualification (Check one or more of the following options, as applicable):

   ☐ For a corporation, the president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit under Chapter 62-213, F.A.C.

   ☐ For a partnership or sole proprietorship, a general partner or the proprietor, respectively.

   ☐ For a municipality, county, state, federal, or other public agency, either a principal executive officer or ranking elected official.

   [X] The designated representative at an Acid Rain source.

3. Application Responsible Official Mailing Address...
   Organization/Firm: Orlando Cogen - Northern Star Generation Services
   Street Address: 8275 Exchange Drive
   City: Orlando State: FL Zip Code: 32809

4. Application Responsible Official Telephone Numbers...
   Telephone: (407) 851 - 1350 ext. Fax: (407) 851 - 1686

5. Application Responsible Official Email Address: todd.shirley@northernstargen.com

6. Application Responsible Official Certification:

   I, the undersigned, am a responsible official of the Title V source addressed in this air permit application. I hereby certify, based on information and belief formed after reasonable inquiry, that the statements made in this application are true, accurate and complete and that, to the best of my knowledge, any estimates of emissions reported in this application are based upon reasonable techniques for calculating emissions. The air pollutant emissions units and air pollution control equipment described in this application will be operated and maintained so as to comply with all applicable standards for control of air pollutant emissions found in the statutes of the State of Florida and rules of the Department of Environmental Protection and revisions thereof and all other applicable requirements identified in this application to which the Title V source is subject. I understand that a permit, if granted by the department, cannot be transferred without authorization from the department, and I will promptly notify the department upon sale or legal transfer of the facility or any permitted emissions unit. Finally, I certify that the facility and each emissions unit are in compliance with all applicable requirements to which they are subject, except as identified in compliance plan(s) submitted with this application.

   Todd Shirley — Signature   2/21/2005 — Date

APPLICATION INFORMATION

Professional Engineer Certification

1. Professional Engineer Name: Scott P. Wesson, P.E. Registration Number: 52801
2. Professional Engineer Mailing Address... Organization/Firm: PBS&J Street Address: 482 South Keller Road City: Orlando State: FL Zip Code: 32810-6101
3. Professional Engineer Telephone Numbers... Telephone: (407) 806 - 4106 ext. Fax: (407) 647 - 4143
4. Professional Engineer Email Address: spwesson@pbsj.com
5. Professional Engineer Statement: *I, the undersigned, hereby certify, except as particularly noted herein*, that:* *(1) To the best of my knowledge, there is reasonable assurance that the air pollutant emissions unit(s) and the air pollution control equipment described in this application for air permit, when properly operated and maintained, will comply with all applicable standards for control of air pollutant emissions found in the Florida Statutes and rules of the Department of Environmental Protection; and* *(2) To the best of my knowledge, any emission estimates reported or relied on in this application are true, accurate, and complete and are either based upon reasonable techniques available for calculating emissions or, for emission estimates of hazardous air pollutants not regulated for an emissions unit addressed in this application, based solely upon the materials, information and calculations submitted with this application.* *(3) If the purpose of this application is to obtain a Title V air operation permit (check here [ ], if so), I further certify that each emissions unit described in this application for air permit, when properly operated and maintained, will comply with the applicable requirements identified in this application to which the unit is subject, except those emissions units for which a compliance plan and schedule is submitted with this application.* *(4) If the purpose of this application is to obtain an air construction permit (check here [X], if so) or concurrently process and obtain an air construction permit and a Title V air operation permit revision or renewal for one or more proposed new or modified emissions units (check here , if so), I further certify that the engineering features of each such emissions unit described in this application have been designed or examined by me or individuals under my direct supervision and found to be in conformity with sound engineering principles applicable to the control of emissions of the air pollutants characterized in this application.* *(5) If the purpose of this application is to obtain an initial air operation permit or operation permit revision or renewal for one or more newly constructed or modified emissions units (check here [ ], if so), I further certify that, with the exception of any changes detailed as part of this application, each such emissions unit has been constructed or modified in substantial accordance with the information given in the corresponding application for air construction permit and with all provisions contained in such permit.* Scott Wesson 2/18/2005 Signature 2/18/2005 Date (seal) PE # 52801

* Attach any exception to certification statement.

II. FACILITY INFORMATION

A. GENERAL FACILITY INFORMATION

Facility Location and Type

1. Facility UTM Coordinates... Zone 17 East (km) 459.5 North (km) 3146.1		2. Facility Latitude/Longitude... Latitude (DD/MM/SS) 28/26/23 Longitude (DD/MM/SS) 81/24/28	
3. Governmental Facility Code: NONE	4. Facility Status Code: A - Active	5. Facility Major Group SIC Code: 49	6. Facility SIC(s):4931Combination Electric & Gas, & Other utility SVCS
7. Facility Comment : 128.9 MW Combined Cycle Gas Turbine with a HRSG and Duct Burner System Cogeneration facility			

Facility Contact

1. Facility Contact Name: Todd Shirley – Plant Manager
2. Facility Contact Mailing Address... Organization/Firm: Orlando Cogen - Northern Star Generation Services Street Address: 8275 Exchange Drive City: Orlando State: FL Zip Code: 32809
3. Facility Contact Telephone Numbers: Telephone: (407) 851 - 1350 ext. Fax: (407) 851 - 1686
4. Facility Contact Email Address: todd.shirley@northernstargen.com

Facility Primary Responsible Official

Complete if an "application responsible official" is identified in Section I. that is not the facility "primary responsible official."

1. Facility Primary Responsible Official Name: NA
2. Facility Primary Responsible Official Mailing Address... Organization/Firm: Street Address: City: State: Zip Code:
3. Facility Primary Responsible Official Telephone Numbers... Telephone: ( ) - ext. Fax: ( ) -
4. Facility Primary Responsible Official Email Address:

Facility Regulatory Classifications

Check all that would apply *following* completion of all projects and implementation of all other changes proposed in this application for air permit. Refer to instructions to distinguish between a "major source" and a "synthetic minor source."

1. ☐ Small Business Stationary Source	☐ Unknown
2. ☐ Synthetic Non-Title V Source	
3. [X] Title V Source	
4. [X] Major Source of Air Pollutants, Other than Hazardous Air Pollutants (HAPs)	
5. ☐ Synthetic Minor Source of Air Pollutants, Other than HAPs	
6. ☐ Major Source of Hazardous Air Pollutants (HAPs)	
7. ☐ Synthetic Minor Source of HAPs	
8. [X] One or More Emissions Units Subject to NSPS (40 CFR Part 60)	
9. ☐ One or More Emissions Units Subject to Emission Guidelines (40 CFR Part 60)	
10. ☐ One or More Emissions Units Subject to NESHAP (40 CFR Part 61 or Part 63)	
11. ☐ Title V Source Solely by EPA Designation (40 CFR 70.3(a)(5))	
12. Facility Regulatory Classifications Comment:	

List of Pollutants Emitted by Facility

1. Pollutant Emitted	2. Pollutant Classification	3. Emissions Cap [Y or N]?
Carbon Monoxide	A	
Acetaldehyde	C	
1,3-Butadiene	C	
Acrolein	C	
Arsenic Compounds (inorganic including arsine)	C	
Benzene (including benzene from gasoline)	C	
Beryllium Compounds	C	
Cadmium Compounds	C	
Chromium Compounds	C	
Cobalt Compounds	C	
Ethyl benzene	C	
Formaldehyde	C	
Hexane	C	
Manganese Compounds	C	
Mercury Compounds	C	
Naphthalene	C	
Nickel Compounds	C	
Polycyclic organic matter	C	
Propylene oxide	C	
Selenium Compounds	C	
Toluene	C	
Xylenes (isomers and mixtures)	C	
Nitrogen Oxides	A	
Particulate Matter - Total	B	
Particulate Matter - PM10	B	
Sulfur Dioxide	B	
Volatile Organic Compounds	B	

B. EMISSIONS CAPS

Facility-Wide or Multi-Unit Emissions Caps

1. Pollutant Subject to Emissions Cap	2. Facility Wide Cap [Y or N]? (all units)	3. Emissions Unit ID No.s Under Cap (if not all units)	4. Hourly Cap (lb/hr)	5. Annual Cap (ton/yr)	6. Basis for Emissions Cap
CO		001	22.3	92.1	AC48-206720
NOx		001	57.4	251.4	AC48-206720
PM		001	9	39.4	AC48-206720
PM10		001	9	39.4	AC48-206720
SO2		001	2.82	12.4	AC48-206720
VOC		001	3	13	AC48-206720
CO		002	12.2	22.5	AC48-206720
NOx		002	12.2	22.5	AC48-206720
PM		002	1.2	2.2	AC48-206720
PM10		002	1.2	2.2	AC48-206720
VOC		002	3.7	6.8	AC48-206720

7. Facility-Wide or Multi-Unit Emissions Cap Comment:

C. FACILITY ADDITIONAL INFORMATION

Additional Requirements for All Applications, Except as Otherwise Stated

1.	Facility Plot Plan: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID:__________ [X] Previously Submitted, Date: 9/2003
2.	Process Flow Diagram(s): (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID:__________ [X] Previously Submitted, Date: 9/2003
3.	Precautions to Prevent Emissions of Unconfined Particulate Matter: (Required for all permit applications, except Title V air operation permit revision applications if this information was submitted to the department within the previous five years and would not be altered as a result of the revision being sought) ☐ Attached, Document ID:__________ [X] Previously Submitted, Date: 9/2003

Additional Requirements for Air Construction Permit Applications

1.	Area Map Showing Facility Location: ☐ Attached, Document ID:__________ [X] Not Applicable (existing permitted facility)
2.	Description of Proposed Construction or Modification: [X] Attached, Document ID: Appendix A
3.	Rule Applicability Analysis: [X] Attached, Document ID: Appendix 5
4.	List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): ☐ Attached, Document ID:__________ [X] Not Applicable (no exempt units at facility)
5.	Fugitive Emissions Identification (Rule 62-212.400(2), F.A.C.): ☐ Attached, Document ID:__________ [X] Not Applicable
6.	Preconstruction Air Quality Monitoring and Analysis (Rule 62-212.400(5)(f), F.A.C.): ☐ Attached, Document ID:__________ [X] Not Applicable
7.	Ambient Impact Analysis (Rule 62-212.400(5)(d), F.A.C.): ☐ Attached, Document ID:__________ [X] Not Applicable
8.	Air Quality Impact since 1977 (Rule 62-212.400(5)(h)5., F.A.C.): ☐ Attached, Document ID:__________ [X] Not Applicable
9.	Additional Impact Analyses (Rules 62-212.400(5)(e)1. and 62-212.500(4)(e), F.A.C.): ☐ Attached, Document ID:__________ [X] Not Applicable
10.	Alternative Analysis Requirement (Rule 62-212.500(4)(g), F.A.C.): ☐ Attached, Document ID:__________ [X] Not Applicable

Additional Requirements for FESOP Applications

1.	List of Exempt Emissions Units (Rule 62-210.300(3)(a) or (b)1., F.A.C.): ☐ Attached, Document ID:________ [X] Not Applicable (no exempt units at facility)

Additional Requirements for Title V Air Operation Permit Applications

1.	List of Insignificant Activities (Required for initial/renewal applications only): ☐ Attached, Document ID:________ [X] Not Applicable (revision application)
2.	Identification of Applicable Requirements (Required for initial/renewal applications, and for revision applications if this information would be changed as a result of the revision being sought): ☐ Attached, Document ID:________ [X] Not Applicable (revision application with no change in applicable requirements)
3.	Compliance Report and Plan (Required for all initial/revision/renewal applications): ☐ Attached, Document ID:________ Note: A compliance plan must be submitted for each emissions unit that is not in compliance with all applicable requirements at the time of application and/or at any time during application processing. The department must be notified of any changes in compliance status during application processing.
4.	List of Equipment/Activities Regulated under Title VI (If applicable, required for initial/renewal applications only): ☐ Attached, Document ID:________ ☐ Equipment/Activities On site but Not Required to be Individually Listed [X] Not Applicable
5.	Verification of Risk Management Plan Submission to EPA (If applicable, required for initial/renewal applications only) : ☐ Attached, Document ID:__________ X☐ Not Applicable
6.	Requested Changes to Current Title V Air Operation Permit: ☐ Attached, Document ID:__________ [X] Not Applicable

Additional Requirements Comment

Appendix A

Heat Rate Improvement Project
Project Description

Orlando CoGen Limited, L.P.

Heat Rate Improvement Project

Project Description

1 INTRODUCTION

Northern Star Generation Services Company LLC is the operating agent for Orlando CoGen Limited, L.P.("Orlando CoGen"), owners of a 123 MW natural gas fired cogeneration power plant in Orlando, Florida. The Orlando facility consists of a single Alstom (ABB) GT 11N1 gas turbine in combined cycle operation. The heat recovery steam generator (HRSG) is equipped with a duct burner. Both the gas turbine and duct burner are single fuel pipeline quality natural gas emission sources. The facility does not have dual fuel capability. Power output from the plant is delivered through the Progress Energy Florida ("PEF") transmission grid along an existing 69 kV transmission line to two customers, PEF and Reedy Creek Improvement District ("RCID"). Power is sold to both customers under existing long-term power purchase agreements. A facility utilizes a steam absorption chiller to produce chilled water for the adjacent Air Products facility and maintain FERC "QF" Qualified Facility status. The power plant is a base load facility that has historically operated at a very high capacity factor, averaging in excess of 87.0% for the period 1999 through 2002.

Orlando CoGen has three main modes of operation: 1) at 97 MW output, 2) at 114 MW output, and 3) at gas turbine base load output without supplemental firing the duct burners. The first mode (97 MW) occurs when the plant is providing PEF with 79 MW and RCID with 18 MW per the base energy provisions of both power purchase agreements ("PPA"). Duct burner firing is not required to produce 97 MW under any ambient conditions. The second mode (114 MW) occurs when RCID exercises their option to purchase an additional 17 MW under the provisions of their PPA. Orlando CoGen generally fires the duct burners during ambient temperatures in excess of 72 F in order to generate a net 114 MW. The third mode occurs when RCID is taking only 18 MW (i.e, the facility is contractually required to produce 97 MW) and the facility exercises a contractual right to sell additional power to PEF at PEF's "As-Available Rate", which is at that time judged to be higher than the facility's cost to produce. Under this base load scenario there is rarely any duct firing, as this is the least economic way to generate power

Orlando CoGen's Alstom GT 11N1 gas turbine has been in service since the start of plant operations in 1993. As this turbine has aged, there has been a gradual decline in performance associated with normal wear and tear. The result of this performance decline is that under high temperature conditions it is increasingly difficult for Orlando CoGen to meet its contractual output of 114 MW. In addition, due to the performance decrease and increasing demand for electricity in general, the plant has had to rely increasingly in recent years on duct firing throughout the year in order to reach its generating requirements. Use of duct firing is the least efficient and least economic means of generating electricity in a combined cycle power plant.

Due to the above considerations, Orlando CoGen has evaluated various options for improving plant performance in order to meet contractual obligations in the future and improve the overall plant heat rate. The two most feasible options for this have been determined to be: 1) the installation of an inlet air fogging system and 2) upgrading the existing Alstom GT 11N1 gas turbine to a GT 11NM gas turbine. Either or both of these options may be implemented by Orlando CoGen.

2 SCHEDULE

The plant is undergoing a major scheduled maintenance outage starting on April 22, 2005. This outage is scheduled to last 25 days and will involve the entire power train (i.e., gas turbine, HRSG, steam turbine). Implementation of one or both of the heat rate improvement options is likely to occur during the spring outage. However, there is a possibility that the spring outage could be delayed to later in 2005, which would delay implementation of the modification. In addition, it is possible that one of the options may be implemented in 2005 and the other at a later date. At this time, Orlando CoGen is requesting an Authorization to Construct either of both of these projects between the time of permit issuance and June 1, 2007.

3 DESCRIPTION OF PROPOSED PROJECT

As indicated above, the proposed project will involve the implementation of either or both options for improving plant heat rate: installation of an inlet air fogging system and upgrading the existing gas turbine from an Altsom GT 11N1 to a GT 11NM.

3.1 Inlet Air Fogging System

Orlando CoGen is considering proposals for an inlet air fogging system from three different vendors: Mee Industries Inc., Caldwell Energy Company, and Vogt. The Mee Industries proposal is provided in Appendix 1 as an example of the scope of the project. All of the proposed inlet air fogging systems are essentially identical in terms of the basic thermodynamic concept of operation.

The purpose behind inlet air fogging is to reduce the temperature in the inlet airflow of combustion turbines. De-ionized water is pumped at high pressure (1000 to 3000 psi) to a water atomizing system. This water is sprayed from nozzles in the inlet air duct to create very small fog droplets (about 10 microns in diameter). As the fog particles evaporate, the air cools adiabatically. The fog output is controlled so that all droplets evaporate before reaching the turbine. The lower inlet air temperatures results in an increase in density which results in an increase in mass flow thru the gas turbine and

HRSG. The increased mass flow results in additional power generation via the most efficient mode of operation for the facility.

At design conditions of 99 °F dry bulb temperature and 77 °F wet bulb temperature, a reduction in the inlet air temperature of up to 22 °F is possible. The estimated benefits from this reduction in temperature are summarized below for an Alstom GT 11 N1 turbine. The expected benefits would be similar for a GT 11 NM turbine.

Conditions	
Ambient Dry Bulb	99 °F
Cooling From Fogging	22 °F
Resulting Temperature to Turbine	77 °F
Water Use for Fogging	23.86 gallons/minute
Turbine Performance (Alstom GT 11 N1)	
Power Without Fogging	70.392 MW
Power With Fogging	75.803 MW
Net Power Increase	5.411 MW
Percent Power Generation Increase	7.69%
Heat Rate Without Fogger	11,092 Btu/KWh
Heat Rate With Fogger	10,897 Btu/KWh
Heat Rate Improvement	195 Btu/KWh
Heat Rate Improvement (%)	1.76%

There are two significant benefits to the use of inlet air fogging. The increase in mass flow at lower inlet air temperatures produces a substantial net power increase from the turbine. Th increased mass flow also results in increased steam generation from the HRSG. The combined increase in power from the gas turbine and steam turbine reduces supplemental firing of the HRSG duct burner, which is the least efficient means of generating power. The overall effect of the use of inlet air fogging will be a reduction in fuel use, which will be most notable in the reduction of duct burner fuel use. The overall impact will be to reduce emissions by reducing the annual fuel use. All of the existing emission and fuel limits in Orlando CoGen's operating permit will be met after implementation of the inlet air fogging system.

3.2 Alstom GT 11NM Turbine Upgrade

The gas turbine upgrade would convert the gas turbine from a GT 11N1 to a GT 11NM. The purpose of this upgrade is to improve the overall efficiency of the gas turbine through increasing the gas channel height, equalizing turbine stage loading, using airfoils with improved aerodynamics, implementing advanced blade cooling technology, and using improved sealing technology to reduce leakage air. All of the upgraded parts are located downstream of the DLN combustor. The improved design provides improved conversion of thermal energy produced by the combustion system to mechanical energy. The overall impact of the GT 11NM upgrade would be to improve thermal efficiency of the gas turbine. This will allow Orlando CoGen to generate the same quantity of electricity that is currently being produced while firing less fuel.

Appendix 2 to this section contains a comparison of the expected turbine performance (at an ambient temperature of 86 F) before and after the upgrade at the three modes of plant operation: 97 MW, 114 MW, and base load. The first case shows that a net plant power production of 97 MW can be achieved by firing approximately 0.9 percent less fuel using the GT 11NM as compared to the GT 11N1. The second case indicates that this fuel savings is approximately 2.5 percent at a net plant output of 114 MW. The third case shows that at base load the NM produces 3.3 percent more plant power than the N1 (113.7 MW versus 110.0 MW) and fires 1.4 percent more fuel. Note that in all three cases the increased efficiency of the NM turbine actually results in a decrease in steam turbine output due to lower exhaust temperatures. However, the increase in gas turbine output is greater than the decrease in steam turbine output and, as a result, produces a net increase in the total plant output after the NM upgrade. Attachment 2 to this letter provides more detailed comparisons of NM and N1 performance under a range of ambient conditions.

The main goal of the upgrade project is to reduce the costs of power generation by increasing turbine efficiency. The cost savings are primarily realized through a reduction in fuel use. Appendix 3 to this letter provides a projection of the potential annual fuel costs, assuming that future plant operations are similar to those that occurred in 2003. The greatest fuel savings occur during the period in which the plant is producing 114 MW for sale to PEF and RCID. As the NM turbine is more efficient, there will be less need to fire the duct burner than with the N1 turbine. Although the NM is theoretically capable of firing more fuel during base load operations than the N1, the maximum firing rate would continue to be limited by the existing permit condition of 856.9 MMBtu/hr (corrected to ISO conditions). Attachment 3 shows that the fuel savings during operations at 97 MW and 114 MW will be of a magnitude sufficient to produce a net annual fuel reduction. Since the combustion portion of the turbine will not be affected by the upgrade, the annual net fuel reduction would also produce an annual net reduction in emissions.

APPENDIX 1

Inlet Air System Proposal
From Mee Industries, Inc.

Mee Industries Inc.
204 West Pomona Ave. Monrovia, CA 91016-4526
tel. 800-732-5364, 626-359-4550 fax 626-359-4660
www.meefog.com

December 27, 2004

MEE FOG SYSTEM PROPOSAL

GAS TURBINE INLET AIR COOLING
For an
ABB GT 11 N 1
AT

ORLANDO COGEN

1.0 DESIGN CONDITIONS:

Ambient Dry Bulb Temperature:	99°F
Wet Bulb Temperature:	77°F
Gas Turbine Type	ABB GT 11N 1
Inlet air flow:	687 LB/SEC @ ISO (59F 60% r.h.)
Elevation:	100' above mean sea level.

2.0 FOG SYSTEM SPECIFICATIONS:

Operating pressure:	2000 psi
Fog droplet size:	8.5 microns @ 2500 fpm (SMD32 Sauter Mean Dia.)
Number of nozzles:	572
Nozzle flow rate:	0.045 gpm per nozzle
Maximum Water Use:	25.74 gpm
Pump skid power requirement:	1 x 5 hp + 5 x 10 hp = 55 hp total
Cooling capacity:	22°F cooling
Cooling stages:	11 stages (2.0s°F per stage).

3.0 SCOPE OF SUPPLY:

Mee Industries standard system will supply:

A. The Fog Pump Skids complete with controller and backup copy of our PLC Operating Software.
B. The stainless steel feed lines and mounting hardware.
C. The Fog Nozzle Manifolds and mounting hardware.

4.0 COOLING AND POWER AUGMENTATION:

The Mee Fog System is designed to produce 22°F of cooling capacity at the 99°F dry bulb and 77°F wet bulb condition. This will allow an estimated 7.69% power augmentation at this ambient condition.

4.1 CLIMATE DATA:

ASHRAE (The American Society of Heating Refrigeration and Air Conditioning Engineers) gives climate data for summer conditions that equaled or exceeded 1% of summer hours as 94°F dry bulb and 76°mean coincident wet bulb of 76°F. To this is added 5°F dry bulb temperature at the same dewpoint rounded to the nearest wet bulb temperature. This number is intended to account for the hotter hours that are not included in the 1% number. (The record high temperature for Orlando is 102°F.)

4.2 INCREMENTAL FOG CONTROL (STAGING):

The Mee Fog System design has eleven (11) stages of fog. The stages are operated according to the capacity of the air to evaporate water. The 2.0°F per stage allows the operator good control of the fogging application.

5.0 PUMP SKID CONTROLLER AND WEATHER STATION

The Fog Pump Skid has an on-board Programmable Logic Controller (PLC) an OIT (Operator Interface Terminal) and a weather station. The weather station is typically mounted on the Fog Pump Skid itself but can also be remotely located.

5.1 PLC, OIT & WEATHER STATION PROVIDE THE FOLLOWING:

A. Control of the various safety devices and interlocks on the pump skids.
B. Measurement and calculation of weather data.
C. Management of the stages of fog cooling.
D. The capability of transmission of data to a host computer via a communication port. (This option must be specified in advance.)
E. The OIT provides operator adjustment capability and information (e.g. temp, flow, r.h. etc)

5.2 PUMP SKID DEVICES:

The Fog Pump Skid has the following devices;

A. A water flow meter for total skid water flow (4 to 20 mA).
B. An inlet pressure switch for each pump unit (on/off).
C. A discharge pressure switch for each pump unit (on/off).
D. A magnetic motor starter for each pump (on/off).

5.3 WEATHER STATION:

The weather station consists of a relative humidity sensor and a temperature sensor. These sensors are both connected to a transmitter (4 to 20 mA) which conditions their signals to be linear and proportional to the sensed values connected in turn to the PLC.

5.4 SKID LOCK-OUT & ENABLE FEATURE:

A remote switch must be closed by the host computer or DCS signifying that all turbine related permissives are met and that the Pump Skid has been cleared for operation. If the signal is lost or open, the skid is automatically shut down. The skid also has an emergency stop button, which can be activated and immediately shuts down the skid.

5.5 PUMP SKID FAULTS & ALARMS:

A. Low Water Flow: If the skid water flow for a given number of stages falls to less than 85% of its rated flow, a fault condition exists. In this case an Alarm is displayed on the PLC interface panel and a fault light and fault signal are activated.

B. Low Inlet Pressure: The PLC checks the state of the inlet pressure switch several seconds after a pump unit is started. If the inlet water pressure is not up to setpoint a fault condition exists. The pump is then shut down and an alarm is displayed on the PLC interface panel and a fault light and fault signal are activated.

C. Low Discharge Pressure: The PLC checks the state of the discharge pressure switch several seconds after the pump is started. If the discharge pressure is less than 90% of the specified pressure a fault condition exists (possibly due to a leak in the high-pressure system). The pump is shut down and an alarm is displayed and a fault light and fault signal are activated. Low discharge pressure would result in larger droplets being produced, which may cause damage to the turbine compressor.

D. Auxiliary Contact on Motor Contactors: The PLC has an input from the auxiliary contact on each of the motor contactors. The main motor control center has fuses, thermal protectors and three phase monitoring fuses. In the event of a fault (due to short Circuit, thermal overload or single-phasing) the pump or pumps are shut down, the auxiliary contact on the motor contactor opens and an alarm is displayed on the PLC interface panel and a fault light and fault signal are activated.

5.6 PLC FOG STAGING FUNCTION:

The Fog Pump Skid has six (6) pump units. The pumps are operated in a sequence that provides eleven (11) stages of fog output. This allows 2.0°F change per stage.

The user inputs the desired amount of overcooling or under-cooling as compared to saturation. Set-points over 100% will result in the fog system over-fogging (i.e. it will inject more water into the air stream than can actually be evaporated at the current ambient conditions, the excess water droplets will be carried by the air stream into the compressor section where the heat of compression will cause them to evaporate and augmenting power output.

The PLC then computes, based on ambient conditions, how may stages of fog can be turned on without exceeding the set-point and turns on that number of stages, turning on one pump at a time at 60 second intervals.

5.7 PLC TYPE, OIT DATA DISPLAYED & INPUT/ OUTPUT TO PLANT:

5.7.1 PLC TYPE

The PLC selected for the skid controls panel is: Allen Bradley SLC 5/03

5.7.2 OIT DISPLAY DATA

The skid Maple OIT (Operator Interface Terminal) display includes the following data (in a scroll-through type display, as the standard).

A. The current ambient relative humidity and dry bulb and wet bulb temperatures.

B. The number of stages currently in operation and its current total output (in gpm, and in °C or °F of cooling potential).

C. The current overcooling or under-cooling set-point.

D. The current water flow of the total skid.

E. All alarm functions as given above.

5.7.3.1 BETWEEN PLC & PLANT - (RELAY CONTACTS ON/ OFF)
The skid PLC is hard wired to the Plant and relays the following information.

1. Inputs: (switch or relay) for "skid enable"
2. Outputs: (switches or relays) for "skid operating" and "skid fault"

6.0 EQUIPMENT AND MATERIAL PROVIDED

Type of Turbine: ABB GT 11N 1 Mass flow : 687 lb/sec at ISO condition

Fogging System Description - 22°F Cooling

1 ea. Fog Pump Skid, model FPS-2750-6-11 with:

5 ea. Fog Pump Units, model FM-500-1051 with capacity for 111 fog nozzles, 5.0 gpm @ 2000 psi, ceramic plunger pump with Stainless Steel head and 10 hp, TEFC electric motor (480 volt, 3 phase). Includes high pressure manifold with pressure regulating valve, high pressure gauge, nitrogen charged pulsation dampener, high pressure discharge hose and high pressure cut-off switch. All fittings are stainless steel.

1 ea. Fog Pump Unit, model FM-250-311 with capacity for 55 fog nozzles, 3.0 gpm @ 2000 psi, ceramic plunger pump with Stainless Steel head and 5hp, TEFC electric motor (480 volt, 3 phase). Includes high pressure manifold with pressure regulating valve, high pressure gauge, nitrogen charged pulsation dampener, high pressure discharge hose and high pressure cut-off switch. All fittings are stainless steel.

1 ea. Inlet water manifold; 1-1/2" stainless steel pipe, solenoid valve, low-pressure switch, flow meter for total skid and low pressure feed hoses.

1 ea. Water Filter; stainless steel housing, model HIF-21, with 21 ea.

sub-micron particle size, (0.35 μm) replaceable water filters.

1 ea. Motor Control Panel; NEMA 4 enclosure with main disconnect (fused), magnetic motor starters and thermal protectors for each pump unit.

1 ea. Weather Station; Relative humidity and temperature sensor with signal transmitter and protective shield

1 ea. Fog Pump Skid Control Panel; NEMA 4 enclosure, Allen Bradley PLC unit and Maple OIT for skid control and fog staging control.

22 ea. Fog Nozzle Manifolds, with 26 fog nozzles each. 1/2" O.D. type 316 stainless steel tube, nozzle adapters with o-ring seals. Fog nozzles are impaction pin, type 316 stainless steel with 0.006" diameter orifice. Fog nozzles are connected by a stainless steel restraining wire to the fog nozzle manifold to avoid any possibility of nozzles detaching from tube. Fittings are double-ferrule, type 316 stainless steel, and compression fittings. Fog Nozzles are installed on fog nozzle lines and shipped with protective plastic caps.

330 ft. Stainless steel feedlines: (0.75" O.D. 0.049 inch thick wall, type 316 stainless steel) with double-ferrule, type 316 stainless steel, compression fittings.

100 ft. Stainless steel feedlines: (0.50" O.D. 0.035 inch thick wall, type 316 stainless steel) with double-ferrule, type 316 stainless steel, compression fittings.

Note: This assumes a 50 linear feet distance between the fog skid location and the inlet duct wall. Further costs will be incurred if the distance is significantly different.

1 set Mounting hardware for fog nozzle manifolds and feedlines. Includes vibration absorbing, uni-strut clamps for feedlines, clamps for fog lines, stainless steel channel strut for holding Fog Nozzle Manifolds

1 set Startup spare parts; including, water filter cartridges (sub-micron), pump oil, fog nozzle filters, fog nozzle o-rings, spare fog nozzles, fittings, etc.

3 sets Drain flapper valves to be installed on the duct and bellmouth floors. Note number may vary depending on design.

3 sets Fog System manuals with drawings (pump unit details with key parts called out, P&ID for entire system, feedline routing drawings, fog nozzle and fitting details, electrical schematic, etc.).

7.0 PRICE

Installed System Price (Including Freight)

Fog System for one ABB GT11N 1 Turbine .... [redacted]
Plus applicable sales taxes

7.1 INSTALLATION:

Mee Industries will install the entire fog system with the following exceptions:

- Labor and Material to connect the demin water supply* from its source to the fog pump skid.
- Labor and Material to connect electrical supply from its source to the fog pump skid.
- Labor and Material to unload and place the fog pump skid on the concrete pad.

MeeFog skid should be supplied the demineralized water supply at 20 to 60 psi g.

7.2 Delivery

Allow four (4) weeks for shipment of Fog Nozzle Manifolds

Allow six (6) weeks for shipment of Fog Pump Skids.

7.3 Payment Terms

10% down payment, with the order
30% upon delivery of equipment
50% upon completion of installation
10% upon completion of all contract obligations

Terms on all payments are 2% 10 days, net 30.

8.0 WARRANTY

8.1 EQUIPMENT, DESIGN & WORKMANSHIP:
Mee Industries warranties all design, equipment and workmanship provided by Mee to be free from defects for a period of one year from the date of final acceptance of the MeeFog system.

9.0 QUALITY ASSURANCE
Mee Industries has implemented a Quality Management System in accordance with ISO 9001:1994. The Certificate Registration Number is: 951 00 0908.

The scope of this Quality Management System governs:

"Design and Manufacture of Fog Systems"

10.0 INDUSTRY EXPERIENCE

Mee Industries is the industry leader with about 85% of all gas turbine compressor fogging systems worldwide, with over 598 installations completed and operating successfully as of December 2004.

Quotation by,

Ross Petersen
Sale Director – Gas Turbine Division, North America
Mee Industries, Inc.

APPENDIX 2

Comparison of "New and Clean" Performance
Alstom GT 11 N1 versus Alstom GT 11 NM
(All Cases Ambient Temperature = 86 °F

Comparison of "New and Clean" Performance
Alstom GT 11 N1 versus Alstom GT 11 NM
(All Cases Ambient Temperature = 86 °F

Case 1: Same Net Power Plant Production – 97 MW

Parameter	Units	GT 11N1	GT 11NM	Percent Difference After Upgrade
Gross Plant Power	kW	100,410	100,369	-0.04%
Balance of Plant Losses	kW	3,052	3,016	-1.2%
Net Plant Power	kW	97,358	97,353	0%
Gross GT Output	kW	63,195	64,891	2.7%
Shaft ST Output	kW	37,215	35,478	-4.7%
GT Heat Rate	Btu/kWh	11,302.4	10,906.3	-3.5%
GT Heat Added	kBtu/hr	714,851	708,312	-0.9%
GT Efficiency	%	30.2%	31.2%	3.3%
Duct Burner Heat Added	kBtu/hr	0	0	0%
Total Plant Heat Added	kBtu/hr	714,851	708,312	-0.9%

Case 2: Same Net Power Plant Production – 114 MW

Parameter	Units	GT 11N1	GT 11NM	Percent Difference After Upgrade
Gross Plant Power	kW	117,674	117,369	-0.05%
Balance of Plant Losses	kW	3,220	3,130	-2.8%
Net Plant Power	kW	114,454	114,482	0.02%
Gross GT Output	kW	72,301	76,576	5.9%
Shaft ST Output	kW	45,373	41,036	-9.6%
GT Heat Rate	Btu/kWh	11,021.1	10,550.5	-4.3%
GT Heat Added	kBtu/hr	797,498	808,595	1.4%
GT Efficiency	%	31.0%	32.3%	4.2%
Duct Burner Heat Added	kBtu/hr	43,039	11,229	-73.9%
Total Plant Heat Added	kBtu/hr	840,537	819,824	-2.5%

Comparison of "New and Clean" Performance
Alstom GT 11 N1 versus Alstom GT 11 NM
(All Cases Ambient Temperature = 86 °F

Case 3: Base Load Operations (no duct firing)

Parameter	Units	GT 11N1	GT 11NM	Percent Difference After Upgrade
Gross Plant Power	kW	113,054	116,680	3.2%
Balance of Plant Losses	kW	3,018	3,010	-0.3%
Net Plant Power	kW	110,036	113,670	3.3%
Gross GT Output	kW	72,301	76,576	6.2%
Shaft ST Output	kW	40,753	40,104	-1.6%
GT Heat Rate	Btu/kWh	11,021.1	10,550.5	-4.3%
GT Heat Added	kBtu/hr	797,498	808,595	1.4%
GT Efficiency	%	31.0%	32.3%	4.2%
Duct Burner Heat Added	kBtu/hr	0	0	0%
Total Plant Heat Added	kBtu/hr	797,498	808,595	1.4%

APPENDIX 3

Detailed Performance Comparisons of N1 and NM Under Various Ambient and Load Conditions

Performance of NM Versus N1 Under Various Ambient Conditions
Operating Scenario: 97 MW Net Plant Output

ORLN-20		NM	NM	NM	NM	NM	NM	NM	NM
		My Input	*My Input*	*My Input*	*My Input*	*My Input*	*My Input*	*My Input*	*My Input*
VIGV	degrees	-20	-20	-20	-20	-20	-20	-20	-20
TIT	deg F	1749.5	1766.75	1785.4	1805.56	1815.03	1827.35	1852.09	1879.335
T amb C	deg C	5.00	10.00	15.00	20.00	22 22	25.00	30.00	35.00
		G / C Input	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*
T amb F	deg F	41.0	50.0	59.0	68.0	72.0	77.0	86.0	95.0
GT Pwr	MW	67.041	66.715	66.339	65.903	65.686	65.395	64.891	64.324
H R	btu/kWh	10,841.1	10,843.7	10,850 7	10,863.3	10,871.1	10,882.7	10,906.3	10,937 9
me2	lb / h	2,228,205	2,196,937	2,163,991	2,129,513	2,113,735	2,093,647	2,056,538	2,018,331
Te2	deg F	888.7	902.8	918.4	935.5	943.7	954.4	975.9	999.9
		G / C Results	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*
Gross CC Pwr	MW	100.340	100.340	100.346	100.350	100.353	100.357	100 369	100.384
Gross GT Pwr	MW	**67.041**	**66.715**	**66.339**	**65.903**	**65.686**	**65.395**	**64.891**	**64.324**
Gross ST Pwr	MW	**33.299**	**33.624**	**34.007**	**34.447**	**34.667**	**34.962**	**35.478**	**36.060**
BOP Losses	MW	**2.983**	**2.987**	**2.992**	**2.997**	**3.000**	**3.004**	**3.016**	**3.032**
Net CC Pwr	MW	97.356	97.352	97.354	97 352	97.353	97.353	97.353	97.352
GT QA	MW	**213.004**	**212.020**	**210.961**	**209.816**	**209.275**	**208.570**	**207.412**	**206.195**
	MMBtu/hr	**727.408**	**724.047**	**720.431**	**716.521**	**714.673**	**712.267**	**708.312**	**704.157**
Gross CC eta	-	0.4711	0.4733	0.4757	0.4783	0.4795	0.4812	0.4839	0.4868
Net CC eta	-	0.4571	0.4592	0.4615	0.4640	0 4652	0.4668	0.4694	0.4721
Gross GT eta	-	0.3147	0.3147	0.3145	0 3141	0.3139	0.3135	0.3129	0.3120
Net ST Pwr	MW	30.316	30.637	31.015	31.450	31.667	31 959	32.462	33 028
Net HRSG QA	MW	**112.869**	**113.924**	**115.120**	**116.501**	**117.177**	**118.085**	**120.086**	**122.449**
Net SC eta	-	0.2686	0.2689	0.2694	0.2700	0.2703	0.2706	0.2703	0.2697
HV Xfmr Loss	MW	0.353	0.353	0.353	0.353	0.353	0.353	0.353	0 353
Net CC Pwr HV	MW	97.004	97.000	97 002	97.000	97.001	97.001	97.000	97.000
Net CC eta HV	MW	0.4554	0.4575	0.4598	0.4623	0.4635	0.4651	0.4677	0 4704

Comparison: Includes HV Xfmr Losses

Net CC Pwr HV	MW	0.001	-0.002	0 002	0.000	0.000	-0.003	-0.005	0.000
Net CC eta HV	% delta	0.197	0 171	0.177	0.224	0.269	0.333	0.425	0.672
	% delta Relative	**0.435**	**0.375**	**0.386**	**0.486**	**0.584**	**0.721**	**0.918**	**1.448**

ORL1-20		N 1	N 1	N 1	N 1	N 1	N 1	N 1	N 1
		My Input	*My Input*	*My Input*	*My Input*	*My Input*	*My Input*	*My Input*	*My Input*
VIGV	degrees	-20	-20	-20	-20	-20	-20	-20	-17.025
TIT	deg F	1782.15	1798.73	1816.44	1835.7	1845	1857	1879.5	1880.6
T amb C	deg C	5.00	10 00	15.00	20.00	22.22	25.00	30.00	35.00
		G / C Input	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*	*G / C Input*
T amb F	deg F	41	50	59	68	72	77	86	95.0
GT Pwr	MW	64.592	64 315	64.018	63.729	63.619	63 477	63.195	63.177
H R	btu/kWh	11,301.0	11,290.8	11,287.2	11,288.5	11,289.7	11,292.7	11,302.4	11,297.8
me2	lb / h	2,228,205	2,196,937	2,163,991	2,129,513	2,113,735	2,093,647	2,056,538	2,071,685
Te2	deg F	920.4	934 1	948.9	965.1	972.8	982.9	1002.0	1003.0
		G / C Results	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*	*G / C Results*
Gross CC Pwr	MW	100.377	100.379	100.380	100.386	100.390	100.399	100 410	100.408
Gross GT Pwr	MW	**64.592**	**64.315**	**64.018**	**63.729**	**63.619**	**63.477**	**63.195**	**63.177**
Gross ST Pwr	MW	**35.785**	**36.063**	**36.362**	**36.657**	**36.771**	**36.922**	**37.215**	**37.231**
BOP Losses	MW	**3.022**	**3.025**	**3.028**	**3.033**	**3.037**	**3.042**	**3.052**	**3.056**
Net CC Pwr	MW	97.355	97.354	97.352	97.353	97 353	97.356	97.358	97.352
GT QA	MW	**213.927**	**212.819**	**211.770**	**210.837**	**210.496**	**210.081**	**209.327**	**209.182**
	MMBtu/hr	**730.562**	**726.777**	**723.196**	**720.008**	**718.844**	**717.426**	**714.851**	**714.356**
Gross CC eta	-	0.4692	0.4717	0.4740	0.4761	0 4769	0 4779	0.4797	0.4800
Net CC eta	-	0.4551	0.4574	0.4597	0.4617	0 4625	0 4634	0.4651	0.4654
Gross GT eta	-	0.3019	0.3022	0.3023	0.3023	0 3022	0.3022	0.3019	0.3020
Net ST Pwr	MW	32.763	33.039	33.334	33.624	33.734	33.879	34.163	34.175
Net HRSG QA	MW	**118.912**	**119.821**	**120.800**	**121.929**	**122.519**	**123.296**	**124.801**	**126.114**
Net SC eta	-	0 2755	0.2757	0.2759	0.2758	0.2753	0.2748	0.2737	0.2710
HV Xfmr Loss	MW	0.353	0.353	0 353	0 353	0.353	0.353	0.353	0.353
Net CC Pwr HV	MW	97.002	97 001	97.000	97.000	97.001	97.004	97.005	97.000
Net CC eta HV	MW	0.4534	0.4558	0 4580	0 4601	0.4608	0.4617	0.4634	0.4637

Performance of NM Versus N1 Under Various Ambient Conditions
Operating Scenario: 114 MW Net Plant Output

ORLN00		NM	NM	NM	NM	NM	NM	NM	NM
		My Input	My Input	My Input	My Input	My Input	My Input	My Input	My Input
VIGV	degrees	-20	-17.8	-14.5	-10.4	-8 2	-4 9	0	0
TIT	deg F	1876.5	1880.6	1880.6	1880.6	1880 6	1880.6	1880 6	1880 6
T amb C	deg C	5.0	10.0	15 0	20.0	22 22	25.0	30.0	35.0
		G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input
T amb F	deg F	41.0	50	59	68	72	77	86	95
GT Pwr	MW	78.114	78.091	78.117	78 058	77 993	77 881	76 576	73 606
H R	btu/kWh	10,403 5	10,396 2	10,394 5	10,409.7	10,424.5	10,453.5	10,550.5	10,665.1
me2	lb / h	2,228,205	2,240,245	2,266,851	2,298,110	2,314,145	2,337,610	2,354,515	2,310,772
Te2	deg F	964.9	966.8	965.2	963.8	963.1	962.3	963.9	971 4
		G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results
Gross CC Pwr	MW	117.546	117 542	117.569	117 580	117.581	117 589	117 612	117.686
Gross GT Pwr	MW	***78.114***	***78.091***	***78.117***	***78.058***	***77.993***	***77.881***	***76.576***	***73.606***
Gross ST Pwr	MW	***39.432***	***39.450***	***39.452***	***39.522***	***39.588***	***39.708***	***41.036***	***44.080***
BOP Losses	MW	***3.084***	***3.086***	***3.089***	***3.093***	***3.095***	***3.100***	***3.130***	***3.199***
Net CC Pwr	MW	114.463	114 455	114.480	114.488	114 485	114.489	114.482	114 488
CC QA	MW	238.166	237 929	237.970	238.138	238 277	238.597	240.066	242.621
	MMBtu/hr	813.339	812.529	812 666	813.240	813 716	814.809	819.824	828.551
NM Duct Burner QA	MW	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***0.000***	***3.288***	***12.555***
	MMBtu/hr	0 000	0 000	0.000	0.000	0.000	0.000	11.229	42.876
GT QA	MW	***238.166***	***237.929***	***237.970***	***238.138***	***238.277***	***238.597***	***236.777***	***230.066***
	MMBtu/hr	813.339	812.529	812 666	813 240	813 716	814.809	808.595	785 675
Gross CC eta	-	0.4935	0.4940	0.4940	0.4938	0.4935	0 4928	0.4899	0.4851
Net CC eta	-	0.4806	0.4810	0 4811	0 4808	0.4805	0.4798	0.4769	0.4719
Gross GT eta	-	0.3280	0.3282	0.3283	0 3278	0.3273	0 3264	0.3234	0.3199
Net ST Pwr	MW	36.349	36.364	36.364	36.430	36.493	36.608	37.906	40 882
Net HRSG QA	MW	***127.915***	***128.822***	***129.879***	***131.245***	***131.991***	***133.121***	***137.917***	***146.926***
Net SC eta	-	0.2842	0.2823	0.2800	0.2776	0.2765	0.2750	0.2748	0 2782
HV Xfmr Loss	MW	0.453	0.453	0.453	0 453	0 453	0.453	0 453	0.453
Net CC Pwr HV	MW	114.010	114.003	114.027	114.035	114.032	114.036	114.029	114.035
Net CC eta HV	MW	0.4787	0.4791	0 4792	0 4789	0.4786	0 4779	0.4750	0 4700

Comparison: Includes HV Xfmr Losses

Net CC Pwr HV	MW	0.009	-0.003	0 025	0.029	0 032	0.034	0.028	0.035
Net CC eta HV	% delta	0 634	0.665	0.711	0.806	0 897	1.063	1.182	1.097
	% delta Relative	***1.343***	***1.407***	***1.507***	***1.712***	***1.911***	***2.275***	***2.551***	***2.391***

ORL100DB		N 1	N 1	N 1	N 1	N 1	N 1	N 1	N 1
		My Input	My Input	My Input	My Input	My Input	My Input	My Input	My Input
VIGV	degrees	-14.94	-11.68	-7.63	-2.175	0	0	0	0
TIT	deg F	1880 6	1880.6	1880.6	1880.6	1880.6	1880.6	1880.6	1880 6
T amb C	deg C	5.0	10.0	15 0	20.0	22.22	25 0	30.0	35.0
		G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input
T amb F	deg F	41	50	59	68	72	77	86	95
GT Pwr	MW	76.088	76.135	76.137	76.053	75.691	74.488	72 301	70.092
H R	btu/kWh	10,823 1	10,813.5	10,823.1	10,864 1	10,898.2	10,940.3	11,021 1	11,107.9
me2	lb / h	2,326,122	2,349,936	2,377,607	2,412,467	2,420,000	2,397,001	2,354,515	2,310,772
Te2	deg F	970 0	968 4	966.7	964.9	965 0	967.9	973.4	979.6
		G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results
Gross CC Pwr	MW	117 576	117.582	117 581	117.590	117.595	117.624	117.674	117.726
Gross GT Pwr	MW	***76.088***	***76.135***	***76.137***	***76.053***	***75.691***	***74.488***	***72.301***	***70.092***
Gross ST Pwr	MW	***41.488***	***41.446***	***41.445***	***41.537***	***41.904***	***43.136***	***45.373***	***47.634***
BOP Losses	MW	***3.122***	***3.124***	***3.127***	***3.132***	***3.141***	***3.169***	***3.220***	***3.274***
Net CC Pwr	MW	114.454	114.458	114.455	114.458	114.454	114.455	114.454	114.453
CC QA	MW	241.346	241 282	241 502	242.151	242.763	243.952	246.131	248.346
	MMBtu/hr	824 196	823.978	824.728	826 947	829 035	833.096	840.537	848 100
N 1 Duct Burner QA	MW	***0.000***	***0.000***	***0.000***	***0.000***	***1.009***	***5.124***	***12.603***	***20.166***
	MMBtu/hr	0.000	0.000	0.000	0 000	3.446	17 497	43.039	68.867
GT QA	MW	***241.346***	***241.282***	***241.502***	***242.151***	***241.754***	***238.828***	***233.528***	***228.180***
	MMBtu/hr	824.196	823.978	824.728	826.947	825.588	815 599	797.498	779.233
Gross CC eta	-	0.4872	0.4873	0 4869	0 4856	0.4844	0.4822	0 4781	0.4740
Net CC eta	-	0.4742	0.4744	0.4739	0.4727	0 4715	0.4692	0.4650	0.4609
Gross GT eta	-	0 3153	0.3155	0.3153	0.3141	0.3131	0 3119	0.3098	0.3072
Net ST Pwr	MW	38.366	38 323	38.318	38.405	38.763	39.967	42.153	44 360
Net HRSG QA	MW	***134.201***	***135.065***	***136.157***	***137.644***	***139.139***	***142.825***	***149.552***	***156.420***
Net SC eta	-	0.2859	0 2837	0.2814	0.2790	0 2786	0 2798	0.2819	0.2836
HV Xfmr Loss	MW	0.453	0 453	0.453	0.453	0.453	0.453	0.453	0.453
Net CC Pwr HV	MW	114.001	114.005	114.002	114.005	114.001	114.002	114 001	114.000
Net CC eta HV	MW	0.4724	0.4725	0 4721	0.4708	0.4696	0.4673	0.4632	0.4590

Performance of NM Versus N1 Under Various Ambient Conditions
Operating Scenario: Base Load (no duct firing)

ORLN00		NM	NM	NM	NM	NM	NM	NM	NM
		My Input	My Input	My Input	My Input	My Input	My Input	My Input	My Input
VIGV	degrees	0	0	0	0	0	0	0	0
TIT	deg F	1880.6	1880.6	1880.6	1880.6	1880.6	1880.6	1880.6	1880.6
T amb C	deg C	5.0	10.0	15.0	20.0	22.22	25.0	30.0	35.0
		G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input
T amb F	deg F	41	50	59	68	72	77	86	95
GT Pwr	MW	89.669	87.275	84.772	82.156	80.957	79.425	76.576	73.606
H R	btu/kWh	10,135.9	10,202.1	10,275.4	10,357.1	10,396.4	10,448.4	10,550.5	10,665.1
me2	lb / h	2,551,056	2,515,257	2,477,538	2,438,064	2,420,000	2,397,001	2,354,515	2,310,772
Te2	deg F	938.2	942.0	946.3	951.4	953.9	957.2	963.9	971.4
		G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results
Gross CC Pwr	MW	131.983	129.114	126.148	123.086	121.693	119.928	116.680	113.286
Gross GT Pwr	MW	***89.669***	***87.275***	***84.772***	***82.156***	***80.957***	***79.425***	***76.576***	***73.606***
Gross ST Pwr	MW	***42.314***	***41.839***	***41.376***	***40.929***	***40.737***	***40.503***	***40.104***	***39.680***
BOP Losses	MW	***3.037***	***3.031***	***3.026***	***3.020***	***3.018***	***3.015***	***3.010***	***3.005***
Net CC Pwr	MW	128.945	126.084	123.122	120.065	118.675	116.912	113.670	110.281
GT QA	MW	***266.365***	***260.947***	***255.285***	***249.375***	***246.666***	***243.209***	***236.777***	***230.066***
	MMBtu/hr	***909.636***	***891.135***	***871.799***	***851.614***	***842.366***	***830.558***	***808.595***	***785.675***
Gross CC eta	-	0.4955	0.4948	0.4941	0.4936	0.4934	0.4931	0.4928	0.4924
Net CC eta	-	0.4841	0.4832	0.4823	0.4815	0.4811	0.4807	0.4801	0.4793
Gross GT eta	-	0.3366	0.3345	0.3321	0.3294	0.3282	0.3266	0.3234	0.3199
Net ST Pwr	MW	39.277	38.808	38.350	37.909	37.718	37.487	37.095	36.675
Net HRSG QA	MW	***140.566***	***139.406***	***138.292***	***137.252***	***136.820***	***136.313***	***135.507***	***134.888***
Net ST eta	-	0.2794	0.2784	0.2773	0.2762	0.2757	0.2750	0.2737	0.2719

Differences and Ratios: Does not include HV Xfmr Losses

GT Power Ratio	-	1.082	1.080	1.076	1.072	1.070	1.066	1.059	1.050
GT eta Ratio	-	1.055	1.053	1.051	1.049	1.048	1.047	1.045	1.042
Gross CC Pwr	MW	5.748	5.383	5.003	4.578	4.371	4.123	3.626	2.990
Gross GT Pwr	MW	6.795	6.428	6.004	5.510	5.266	4.937	4.275	3.514
Gross ST Pwr	MW	-1.047	-1.046	-1.000	-0.932	-0.895	-0.815	-0.649	-0.524
BOP Losses	MW	-0.009	-0.010	-0.009	-0.008	-0.008	-0.008	-0.008	-0.007
Net CC Pwr	MW	5.757	5.392	5.012	4.586	4.379	4.130	3.634	2.997
GT QA	MW	6.730	6.467	5.985	5.291	4.913	4.380	3.250	1.886
Gross CC eta	% Relative delta	***1.911***	***1.764***	***1.689***	***1.659***	***1.660***	***1.695***	***1.791***	***1.868***
Net CC eta	% Relative delta	***2.028***	***1.879***	***1.799***	***1.765***	***1.763***	***1.795***	***1.885***	***1.951***
Gross GT eta	% Relative delta	***5.465***	***5.276***	***5.098***	***4.915***	***4.827***	***4.708***	***4.460***	***4.152***
Net ST Pwr	MW	-1.038	-1.036	-0.992	-0.924	-0.887	-0.807	-0.641	-0.517
Net HRSG QA	MW	-2.529	-2.567	-2.542	-2.461	-2.406	-2.328	-2.142	-1.882
Net ST eta	-	-0.002	-0.002	-0.002	-0.002	-0.002	-0.001	0.000	0.000

ORL100		N 1	N 1	N 1	N 1	N 1	N 1	N 1	N 1
		My Input	My Input	My Input	My Input	My Input	My Input	My Input	My Input
VIGV	degrees	0	0	0	0	0	0	0	0
TIT	deg F	1880.6	1880.6	1880.6	1880.6	1880.6	1880.6	1880.6	1880.6
T amb C	deg C	5.0	10.0	15.0	20.0	22.22	25.0	30.0	35.0
		G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input	G / C Input
T amb F	deg F	41	50	59	68	72	77	86	95
GT Pwr	MW	82.874	80.847	78.769	76.646	75.691	74.488	72.301	70.092
H R	btu/kWh	10,689.9	10,740.3	10,799.3	10,866.1	10,898.2	10,940.3	11,021.1	11,107.9
me2	lb / h	2,551,056	2,515,257	2,477,538	2,438,064	2,420,000	2,397,001	2,354,515	2,310,772
Te2	deg F	950.3	954.1	958.2	962.8	965.0	967.9	973.4	979.6
		G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results	G / C Results
Gross CC Pwr	MW	126.235	123.732	121.145	118.508	117.322	115.805	113.054	110.296
Gross GT Pwr	MW	***82.874***	***80.847***	***78.769***	***76.646***	***75.691***	***74.488***	***72.301***	***70.092***
Gross ST Pwr	MW	***43.361***	***42.885***	***42.376***	***41.862***	***41.631***	***41.318***	***40.753***	***40.204***
BOP Losses	MW	***3.047***	***3.041***	***3.034***	***3.028***	***3.026***	***3.023***	***3.018***	***3.012***
Net CC Pwr	MW	123.188	120.691	118.111	115.480	114.296	112.782	110.036	107.284
GT QA	MW	***259.635***	***254.481***	***249.300***	***244.084***	***241.754***	***238.828***	***233.528***	***228.180***
	MMBtu/hr	***886.652***	***869.052***	***851.358***	***833.547***	***825.588***	***815.599***	***797.498***	***779.233***
Gross CC eta	-	0.4862	0.4862	0.4859	0.4855	0.4853	0.4849	0.4841	0.4834
Net CC eta	-	0.4745	0.4743	0.4738	0.4731	0.4728	0.4722	0.4712	0.4702
Gross GT eta	-	0.3192	0.3177	0.3160	0.3140	0.3131	0.3119	0.3096	0.3072
Net ST Pwr	MW	40.315	39.844	39.342	38.833	38.605	38.295	37.736	37.191
Net HRSG QA	MW	***143.095***	***141.973***	***140.834***	***139.712***	***139.226***	***138.640***	***137.649***	***136.771***
Net ST eta	-	0.2817	0.2806	0.2793	0.2780	0.2773	0.2762	0.2741	0.2719

APPENDIX 4

Estimated Impact of the NM Upgrade on Fuel Use

Appendix 4

Description of the Effect of NM Upgrade on Fuel Use Under Various Plant Dispatch Scenarios

Plant Dispatch Scenario	Plant Output	Projected Annual Frequency of Occurrence[1]	Effect of N1 to NM Upgrade
PEF: 79 MW RCIC: 18 MW	97 MW	35.7%	There is a reduction in fuel needed to produce 97 MW after the NM upgrade. Fuel use reduction is approximately 3%.
PEF: 79 MW RCID: 35 MW	114 MW	54.6%	There is a reduction in fuel needed to produce 114 MW after the NM upgrade. The greatest reduction will be at higher temperatures, where there will be less duct firing after the NM upgrade. Use of the duct burners to achieve 114 MW is the least efficient use of fuel. Overall fuel use reduction will be approximately 6%.
Base Load Case PEF: 79 MW RCID: 18 MW (Additional power to PEF, generally up to unfired base load net output at "As Available Rates")	107 MW to 123 MW depending on ambient conditions	9.7%	The NM is capable of generating additional output from the gas turbine at base load as compared to the N1. The increase in fuel use at base load will be approximately 3% after the NM upgrade.

[1] Estimates based on Orlando CoGen operations in 2003.

Appendix 4

Estimated Annual Fuel Savings
Based on Operations at 86 F

Operating Case	Heat Input (MMBtu/hr)		Heat Input Difference NM - N1 (MMBtu/hr)	Percent Annual Operations By Scenario[1]	Annual Heat Input Difference (MMBtu/year)[2]
	N1	NM			
97	758.055	734.969	-23.186	35.7%	-72,510
114	933.963	873.815	-60.148	54.6%	-287,685
Base	791.268	816.876	25.608	9.7%	21,760

Annual Total: **-338,435**

[1]Based on Orlando CoGen plant operations in 2003.

[2]Based on 8,760 hours/year of operation.

Appendix 5
Netting Analysis of Heat Improvement Modifications and PSD determination

The following tables use the last two years representative of typical plant operations: 2002 and 2003. Based on the average emission factors and fuel use for those two years the baseline emissions can be calculated. The maximum emissions after the modification (be it the NM conversion, fogging, or both) are equal to the baseline emission factors time maximum fuel use for the combustion turbine and duct burner. This assumed 8760 hours of combustion turbine operation and the permit maximum duct firing of 450,000 MMBtu/year. In essence the tables represent a comparison of past actual to future PTE. This analysis shows that regardless of which modification project is implemented, that the PSD significant emission thresholds cannot be exceeded. This analysis is based upon the emission rates not changing by improvements the plant heat rate (only the heat input), then we can identify the maximum possible increase in emissions by comparing historic emissions to the emissions that would occur at maximum fuel usage. This is done since no changes to the permit emission limits or fuel limits and therefore the potential to emit (PTE).

Combustion Turbine and Duct Burner
Actual Versus Maximum Permitted Fuel Usage

Parameter	Maximum Fuel Usage (MMcf/yr)*	Actual Fuel Usage (MMcf/yr) 2002	2003	Baseline 2-Year Average
Combustion Turbine	8,006	7,402	7,518	7,460
Duct Burner	478	178	388	283

* Based on 8760 hours of operation at CT firing rate of 860 MMBtu/hr and maximum permited duct firing of 450,000 MMBtu/year. Heat content = 941 MMBtu/MMcf (the average heat content for 2002 and 2003).

Combustion Turbine and Duct Burner Emission Factors

Pollutant	Combustion Turbine Emission Factors (lb/MMcf)**			Duct Burner Emission Factors (lb/MMcf)**		
	2002	2003	Average	2002	2003	Average
NOx	59.45	61.097	60.2735	59.45	50.76412	55.10706
CO	0.5388	0.5698	0.5543	8.361	2.2582	5.3096
VOC	3.19	3.19	3.19	27.8	27.8	27.8
PM	8.4	8.4	8.4	8.4	8.4	8.4
PM10	8.4	8.4	8.4	8.4	8.4	8.4
SO2	0.6	0.6216	0.6108	0.6	0.6216	0.6108

**Emission factors are from 2002 and 2003 annual operating reports for Orlando CoGen.

Baseline Emissions

Pollutant	CT Emissions		Duct Burner Emissions		Annual Emissions (tons/year)
	Emission Factor lb/MMcf	Fuel Usage MMcf/yr	Emission Factor lb/MMcf	Fuel Usage MMcf/yr	
NOx	60.2735	7,460	55.10706	283	232.62
CO	0.5543	7,460	5.3096	283	2.82
VOC	3.19	7,460	27.8	283	15.83
PM	8.4	7,460	8.4	283	32.52
PM10	8.4	7,460	8.4	283	32.52
SO2	0.6108	7,460	0.6108	283	2.36

Maximum Emissions After Modification

Pollutant	CT Emissions		Duct Burner Emissions		Annual Emissions (tons/year)
	Emission Factor lb/MMcf	Fuel Usage MMcf/yr	Emission Factor lb/MMcf	Fuel Usage MMcf/yr	
NOx	60.2735	8,006	55.10706	478	254.45
CO	0.5543	8,006	5.3096	478	3.49
VOC	3.19	8,006	27.8	478	19.42
PM	8.4	8,006	8.4	478	35.63
PM10	8.4	8,006	8.4	478	35.63
SO2	0.6108	8,006	0.6108	478	2.59

PSD Netting Analysis

Pollutant	Emissions (tons/year) Baseline	After Modification	Net Increase	PSD Major Modification Threshold	PSD Triggered?
NOx	232.62	254.45	21.83	40	No
CO	2.82	3.49	0.67	100	No
VOC	15.83	19.42	3.59	40	No
PM	32.52	35.63	3.11	15	No
PM10	32.52	35.63	3.11	15	No
SO2	2.36	2.59	0.23	40	No